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Science and Transport.

In few if in any departments of civil or industrial life has applied science introduced more revolutionary changes in the last hundred years than in that of transport. It would be difficult, however, to find any other aspect of civil life which has been allowed to develop along more haphazard lines or in which the utilisation of the results of scientific discoveries has been more divorced from scientific organisation and control. One and a half million people, or nearly eight per cent of the employed population of Britain, are directly engaged in one or other of the branches of transport. Regarded solely as an industry, it is, therefore, of the utmost importance that efficient management and wise administration should maintain the highest possible standard of efficiency and economic development of the transport industry. From the wider view of transport as an integral and indispensable part of the national structure, it is impossible to exaggerate the importance of adequate, efficient, and cheap transport facilities, particularly in a country such as Great Britain, in which trade consists so largely in the importation of food and raw materials and the exportation of manufactured goods.

The Royal Commission on Transport alludes in its recently published final report* to the casual and haphazard way in which earlier forms of transport, particularly road transport, have been allowed to develop, and while regarding air transport as outside the scope of its inquiry, expresses the hope that timely guidance will ensure the development of this infant form of transport along sound lines. Many of the main difficulties in the present situation are indeed, as in the case of London, the result of lack of vision on the part of everyone concerned. The continued unchecked or uncontrolled development of road transport in competition with rail transport will undoubtedly have very serious evil results, and, apart from affecting the financial stability of those who provided transport facilities, will also hamper the economic progress of the nation.

The case of the railways provides a classic example of the burden which ignorance and prejudice can place on posterity; and the extremely high prices which in the nineteenth century our railways were compelled to pay for land to buy off influential opposition are an important factor in their present-day difficulties, and one from which other countries are relatively free. It is to be hoped that the lesson has been sufficiently well learnt to ensure general support for the Commissioners' recommendations

* London: H.M. Stationery Office. Cmd. 3751.

regarding compensation in the case of privately owned bridges carrying public highways.

The report by no means holds the railways free from responsibility for some of their present difficulties. To some extent the 'grouping' under the Railway Act of 1921 is unscientific and not sufficiently geographical. To scientific minds the criticism in regard to the speed of railway journeys, particularly long-distance runs, will appear not a little scathing, and the railways are reminded that facilities create traffic.

On the broad issues as between road and rail transport, the report stresses the advantage of rail transport in the case of long distances and heavy loads, and few of the recommendations can be more unquestionable than that which asserts that it is not in the national interest to encourage the diversion of heavy goods traffic from the railways to the roads. Such diversions add greatly to the expenditure on highways, and tend to make the railways unremunerative without conferring any commensurate advantage. As regards long-distance travel, the railways have not made full use of their immense advantage of speed, and there is little doubt that with a little more attention to the amenities of railway travel on the lines recommended, medium- and long-distance passenger road transport would largely disappear as a result of diminished demand.

The report considers that much of the competition between road and railway and other forms of transport is due to the fact that the wages and general conditions of service in the road haulage industry leave much to be desired, and Sir W. G. Lobjoit's reservation on the recommendation for licensing of road hauliers was due not to any doubt as to the unsatisfactory conditions of wages and of labour, but to doubts as to the possibility of imposing conditions upon small firms and owner drivers. The labour aspect of road transport is, indeed, of fundamental importance, not only from the economic aspect in securing fair and satisfactory conditions of wages and hours of work, as well as in eliminating unfair competition and diversion of traffic into channels not to the public advantage, but also from the safety point of view. Insufficient attention has been given to the health and general physical fitness of transport drivers. In particular, the establishment of hostels or rest-houses for long-distance drivers, who form one of the occupational classes most highly infected with venereal disease, is a provision much needed if the efficiency of the driver is to be maintained and this serious factor in the causation of road accidents eliminated.

On the policy adopted by the railways of meeting road competition by themselves developing road transport, the Commission, while welcoming it so far as better co-ordination of rail and road transport is secured, makes the trenchant comment that the large capital sums expended in establishing such services would be better applied to the electrification of suburban lines. It is to such electrification, the improvement of omnibus services, and possibly to tube railways, that the Commissioners obviously look for the handling of the passenger traffic in large cities like London, Glasgow, Liverpool, Manchester, etc., at certain 'rush' hours, in place of the tramway systems, which they condemn as obsolete.

An important feature in transport development to which the report directs attention is that of research on road problems and the ceaseless endeavour to ensure that the highway is adequate not only for the traffic it has to bear at the present time, but also for that which it is likely to carry in the future. Much valuable research is being carried out by the Ministry of Transport, with the collaboration of the National Physical Laboratory, on such matters as the effects of varying certain factors in the design and construction of concrete roads, the conditions which give rise to the skidding of vehicles, and the effect of variations in the wheel diameters in the damage caused to roads. To enable experiments to be carried out under practical conditions without interference from general traffic, and to enable particular road surfaces to be studied under known traffic conditions, a special experimental road has been constructed near an experimental station.

Experiments have been carried out on glare on roads and on other problems of illumination relating to transport under the Illumination Research Committee of the Department of Scientific and Industrial Research. The Bridge Stress Committee, in co-operation with the railway companies, has carried out an investigation on stresses in railway bridges, in which 52 bridges were tested and some forty different types of locomotives used, the work resulting in the withdrawal from service of certain classes of locomotives and in improved locomotive designs to reduce the unbalanced vertical forces responsible for the 'hammer-blow' and the resultant dangerous oscillations in bridges, as well as in the development of practical formulæ for bridge designers. These and similar activities assist the development of modern methods of transport on scientific lines; and the condemnation of steel tyres and the recommendation that all mechanically propelled vehicles using the roads, other than light

and heavy locomotives and steam rollers, should be fitted with pneumatic tyres, are essentially based on scientific investigation and evidence.

The main difficulty, however, is that of securing action along the lines indicated by scientific and impartial examination when a large number of authorities and interests, some of which may be seriously conflicting, are involved. This is possibly illustrated by the failure of the Commission to make any real recommendation in regard to unification, the importance of which is clearly recognised. Beyond the final recommendation for the appointment of a permanent Advisory Council on Transport, the discussion of co-ordination leads to no unanimous conclusion. In this respect the report differs from the two earlier reports on "The Control of Traffic on Roads" and on "The Licensing and Regulation of Public Service Vehicles", the unanimous recommendations of which were practically all incorporated in the Road Traffic Bill which received Royal Assent on Aug. 1, 1930. As the report makes clear, however, the question of co-ordination and unification is of fundamental importance. It must ultimately be determined largely on scientific principles; and the modern traffic problem is essentially one of those problems set by scientific developments the solution and control of which rests with scientific workers themselves.

The Theory of Geological Thermal Cycles.

The Surface-History of the Earth. By Dr. John Joly. Second edition. Pp. xxi + 211 + 13 plates. (Oxford: Clarendon Press; London: Oxford University Press, 1930.) 8*s*. 6*d*. net.

A BOOK which has for its chief object the exposition of a group of geological hypotheses of a highly speculative character is likely soon to become out-of-date as geophysical evidence accumulates and as quantitative criticism is applied to processes envisaged in the light of incomplete knowledge. This fate rapidly befell the first edition of Prof. Joly's well-known book. It is therefore of special interest to consider how the author has dealt with recent advances bearing on his theory of thermal cycles and with the various criticisms, adverse or constructive, that represent the reactions towards it of other workers in the same field. Judged in this way, the second edition can only be regarded as disappointing.

Any discussion of the distribution of the radioactive elements in the earth must be based on the nature of the rock-types entering into the layers of the crust and of the underlying substratum. The xenoliths brought up from the depths by the kimberlite magma of the diamond pipes of Africa suggest that the downward distribution is from granitic and gneissic rocks through amphibolite and granulite to eclogite and peridotite. Seismic evidence is consistent with such a sequence, but it fails to support Joly's new suggestion that the granite layer may be underlain by an anorthosite layer (p. 64). Moreover, the diamond pipes have provided no samples that would lend support to this assumption. Joly's view that eclogite is an important constituent of the upper part of the substratum is less hypothetical, but it is far from safe to assume that the radioactivity of such a layer is necessarily the same as that of the eclogites tested in the laboratory, since these occur for the most part in mountain belts where they owe their origin to exceptionally high pressure. If the plateau basalts have been derived from the complete fusion of an eclogite layer, then the radioactivity of the latter is more likely to be represented by that of the former, as assumed in the first edition. By regarding the radioactivity of the substratum as thermally equivalent to about one-third that of the plateau basalts, Joly now considers the period of liquefaction to be about three times as long as his original estimate. Unfortunately, even this admission fails to make the consequences of the hypothesis consistent with the duration of geological time as estimated from lead ratios.

Much more serious, however, is the fact that Joly's mechanism of alternating accumulation and discharge of heat seems to be physically unacceptable. Jeffreys has vigorously attacked the hypothesis of thermal cycles, on the grounds that on the postulated conditions the substratum would remain permanently fluid, and that tidal drift of the crust would not occur at the required rate. But even though the proposed mechanism for bringing about the discharge of excess heat is unsatisfactory, Joly has nevertheless rendered a most important service to geology by facing the probability that there *is* an excess of heat to be discharged, and that some form of crustal drift is necessary to avoid the *impasse* of a thermally expanding globe. Possibly the underlying flaw in Joly's preliminary assumptions is his belief that because the substratum is now solid in the sense of being rigid and highly viscous, it is therefore necessarily crystalline. It may not be, at least below a certain level; quite as probably it is in a glassy state. Granting the latter assumption, which is difficult to resist from the thermal point of view, there is no difficulty in discharging heat

by convective circulation in the substratum combined with continental drift in the crust, the currents themselves providing the motive force for 'engineering' the drift. Such a process has been already suggested (*Geol. Mag.*, May 1928, p. 236), and it has apparently been overlooked by Joly when he says on p. 99, "no imaginable physical system which results in conditions of steady heat-flow to the surface can account for those periodical events which are at the basis of geological history and which have hitherto constituted its most elusive problem".

Lotze has assailed both Joly's hypothesis and the modifications proposed by the reviewer in 1925 by confronting them with the actual complexities of earth history. It must be admitted that an alternation in time of world-wide compression with world-wide tension cannot be readily admitted. Tensional phenomena in some regions seem, on the contrary, to be contemporaneous with compressional phenomena elsewhere. On the convection hypothesis this would be inevitable; on the theory of thermal cycles it remains inexplicable.

Of the first edition of Joly's book it was possible to write, "Prof. Joly's inspired originality should henceforth lead geology into a new phase" (NATURE, Dec. 19, 1925, p. 891). This forecast has already been amply justified, and although the second edition lags behind the progress that has been made possible by the first, the book remains a record of one of the most highly stimulating and suggestive contributions ever made to theoretical geology. ARTHUR HOLMES.

The Yellow-skinned Races of South Africa.

The Khoisan Peoples of South Africa: Bushmen and Hottentots. By Dr. I. Schapera. (*The Ethnology of Africa*, edited by J. H. Driberg and Dr. I. Schapera.) Pp. xi + 450 + 16 plates. (London: George Routledge and Sons, Ltd., 1930.) 31*s.* 6*d.* net.

WE have long needed an authoritative work on the Bushmen and Hottentots of South Africa. The former are an extremely important people for the ethnologist, and from them the Hottentots cannot be dissociated physically or culturally; hence the composite name "Khoisan" adopted by the author—Khoi = Hottentot and San = Bushman. We are therefore grateful to Dr. Schapera for taking the trouble to assemble all the available data concerning these peoples and therewith to make a trustworthy and interesting book which will be indispensable for students.

The Bushmen are relatively late-comers into South Africa from East Africa; they were preceded by the 'Boskopoid' race and doubtless by other races yet to be identified. The Rhodesian man of Broken Hill, who belonged to a much more primitive race, is not mentioned, evidently as he did not contribute anything to the Khoisan. Still later than the Bushmen came the Hottentots; they appear to have sprung out of a mixture of the old Bushman population of East Africa with an early immigration there of Hamites, who gave them cattle and those peculiarities of language by which they are distinguished from the modern Bushmen. The southern Bushmen represent the purest type, while the northern tribes show some degree of intermixture with other peoples, as their greater stature and darker colour suggest.

The Hottentots as a whole are a fairly uniform people; their skulls, according to Shrubsall, seem to indicate that there was a Bantu Negro mixture which perhaps took place before their arrival in South Africa. The Korana branch of the Hottentots are somewhat aberrant; they certainly have absorbed much Bantu blood, but there seem to be cranial indications of a Boskopoid element in their composition.

The greater part of the book deals with the culture of the Bushmen and Hottentots, which complicated subject is attacked by Dr. Schapera in a workmanlike manner, as is to be expected from a former student of Prof. A. R. Radcliffe-Brown. The Bushmen have never been systematically studied by a trained ethnologist and the information is fragmentary and occasionally contradictory. This has made it impossible to come to definite conclusions on many points, and it is to be hoped that these debatable matters will be settled by work in the field before it is too late, if it be not so already. A noticeable feature of the book is that the physical conditions under which the people live and their economic life are given due prominence, and the inter-relationship of these with the socio-religious life of the people is not overlooked.

The mimetic animal dances of the Bushmen were probably of a ritual character, but of their function and relation to the social life generally, scarcely anything is known. Purely decorative art is rare and very poorly developed, but their pictorial art, consisting of paintings and engravings executed on rock surfaces, is well known. It has for a long time been recognised that the paintings are of different styles and that some are superimposed on others, thus giving a relative chronology; recently Mr. M. C. Burkitt has demonstrated an interesting sequence,

but there is much yet to be discovered in studying a wider area.

The only Hottentot people whose social organisation is at all well known are the Naman of the south-west, of whom a special study from this point of view has been made by Mrs. A. W. Hoernlé. Her description has been supplemented in several respects by the observations of other writers, so that it is possible to arrive at a fairly clear conception of the social structure of this division, but the original organisation of the other Hottentot peoples has long since been totally obliterated.

There is ground for supposing that the Hottentots formerly revered the moon. Apart from invocations to the moon, their religious cult seems to have centred mainly in the worship of heroes, derived partly from animistic beliefs, partly from a personification of the natural forces producing rain. In a country like South Africa, where water is in places exceedingly scarce, it is not surprising that the annual rain ceremony is the most important religious ceremony of the Hottentots. The Hottentot religious conceptions show in many respects a striking resemblance to those of the Bushmen. The southern Bushmen to some extent stand apart from the rest; they share with the others the cult of the moon and several beliefs concerning the dead and natural phenomena, but the beliefs centring in the Mantis among the Cape Bushmen have no parallel farther north. Their mythology is far more elaborate than that of the Hottentots, which in its turn is more developed than that of the northern Bushmen.

There is a chapter on the difficult subject of the Khoisan languages, an exhaustive bibliography, and numerous excellent photographs. If the other volumes of this series prove to be as good as this one, we shall have a very valuable collection of monographs on African ethnography.

A. C. HADDON.

Modern Farming in Germany.

Handbuch der Landwirtschaft. Herausgegeben von Fr. Aereboe, J. Hansen und Th. Roemer. Fünf Bände. Lieferungen 12-25. (Berlin: Paul Parey, 1929.) 5·80 gold marks each part.

NOW that the publication of this handbook is complete, it is possible to form the comprehensive view of the whole work that was defeated earlier by its fragmentary method of production. With all the parts in hand, the objection based on non-consecutiveness is reduced to a problem for the bookbinder.

The complete handbook is admirable. One could not, if one wished, withhold admiration from a work on agriculture on a scale commensurate with the size of the subject: here the five volumes cover more than 3000 pages, and weigh, unbound, some ten kilograms. In addition to quantity, quality is undoubtedly present. The specialists who contribute know their subjects; the aim of the whole work is both to lay a foundation for the farming of the coming hundred years and to help the industry through its present crisis, and even if this may seem a little ambitious, the result has been good. While the book does not go deeply into fundamentals, on the practical side it covers the best of existing farming methods (using 'farming' in an extremely wide sense), describes ways of improving them, and introduces new ones. The reference, not unnaturally, is almost always to German conditions; for English readers the book will be useful chiefly as a fund of information about German farming, both in organisation and in details of its execution. Whenever one wants to know how so-and-so is done in Germany, it will be natural to turn first to this handbook.

The twenty-eight separate contributions that are included in the fourteen parts here assembled can scarcely be reviewed individually. All the volumes except that dealing with the principles of arable farming (vol. 2), which was completed in the earlier instalments, are represented: that is to say, much of the economics of farming (vol. 1) and of general animal husbandry (vol. 4), almost the whole of crop husbandry (vol. 3), with a special section on agricultural machinery, and of special animal husbandry (vol. 5). In the first and fourth volumes the individual contributions cover a certain aspect of the general subject, while in the third and fifth volumes a single type of crop or live stock is described in each contribution.

Many of the contributions are so thorough and informative that they are worth purchasing on their own merits: investigators who would not in any case buy the whole handbook might be recommended to get the sections bearing on their own work. Since the handbook was published in parts, this should easily have been arranged—but actually the method of production makes it decidedly difficult. The obstacle, which has been referred to in a review of the earlier instalments, is a lack of correlation between the parts as published and the actual sections of the handbook; it could have been obviated when publication was complete by a summary table indicating the numbers of the parts in which each contribution appears. This has not

been done, however; the information cannot be found either in the publisher's announcement or in the general table of contents printed in the cover of each instalment. In consequence, the advantage from the reader's point of view of publication in separate parts has been lost.

The Physiology of Micro-organisms.

Physiology and Biochemistry of Bacteria. By Prof. R. E. Buchanan and Prof. Ellis I. Fulmer. Vol. 1: *Growth Phases; Composition and Biophysical Chemistry of Bacteria, their Environment and Energetics.* Pp. xi+516. 34*s.* net. Vol. 2: *Effects of Environment upon Microörganisms.* Pp. xvii+709. 34*s.* net. Vol. 3: *Effects of Microörganisms upon Environment; Fermentative and other Changes Produced.* Pp. xv+575. 34*s.* net. (London: Baillière, Tindall and Cox, Vol. 1, 1928; Vols. 2 and 3, 1930.)

THE treatment of the subject, as may be seen from the size of the work, is exhaustive, yet the authors do not consider that they have presented more than an introduction to, or an outline of, our knowledge of the physiology and biochemistry of the bacteria, yeasts, and moulds. In their opinion, many of the topics discussed could profitably be submitted to monographic treatment, but limitations of space prevented them from carrying out such an elaboration. Their purpose, therefore, was to compile and systematise the material relating to the physiology of micro-organisms: they have well succeeded in their monumental task. The bibliographies of literature cited run to 30, 110, and 140 pages respectively in the three volumes: the whole work brings under one cover abstracts of papers scattered in a variety of journals, arranged according to the divisions of the subject selected by the authors. The treatise forms, therefore, a very useful work of reference.

Many will find the work also of value from another point of view; each section is preceded by a general discussion of the physical or chemical principles involved, which alone would be useful as an introduction to certain aspects of biochemistry. Thus there are extensive discussions of such subjects as the physical and physico-chemical characteristics of systems of various degrees of dispersion, the different types of energy and chemical thermodynamics, the velocities of chemical reactions and the effects of temperature changes upon them, the characteristics of certain electromagnetic waves and the characteristics of enzyme action and a classification of enzymes. Free use is made of chemical formulæ throughout. Whether such exhaustive discussions should find a place in a work of this type is perhaps doubtful, but there is no question as to their value for many workers who may not wish to be referred to the larger text-books of biochemistry.

The titles of the volumes give some idea of the scope of the work, but further details may be given to illustrate its comprehensiveness. In the first volume, a chapter is devoted to growth phases and growth rates in cultures of micro-organisms, in which may be found details of different methods of counting the numbers present in a given volume: the subject lends itself to a mathematical treatment. The chemical composition of the cells of micro-organisms is next considered: the account of bacterial pigments forms an interesting section. Brief reference is also made to the recent work on the antigenic polysaccharides. The section on the physico-chemical characteristics of systems of various degrees of dispersion is one of the most complete in the book and includes discussions on the properties of true solutions, surface tension, adsorption, viscosity and osmotic pressure, on the Donnan equilibrium, on conductivity and hydrogen ion concentration and the electrometric and colorimetric methods of measurement of the latter, and on the properties of colloids.

From that point the transition to the agglutination of bacteria by various agents is natural and easy. Reference is made to agglutinins, antitoxins, opsonins, and antibodies, familiar to the human pathologist and bacteriologist. The final chapter of this volume deals with the energy relationships of bacteria, especially the energy changes in oxidations and reductions carried out by them, and the utilisation of energy in synthesis, in the production of light and of movement, as for example in chemotropism.

The chapters in the second volume will be of interest to a wide circle of readers. The effects of temperature, of rays and emanations, and of various physical environments are described in detail: apart from the general scientific interest of the descriptions, human pathologists will find them of value from the point of view of the destruction of micro-organisms by the various agents cited, as well as of the changes in pathogenicity which can be induced. In succeeding chapters the effects of the chemical environment are considered: the treatment is systematic, inorganic compounds and their ions, non-nitrogenous and nitrogenous organic compounds being taken in order. Here the action of germicides may be found described in detail. The presentation of the structural formulæ of all the

compounds considered lends an added value to these chapters : in fact, they may be of use as a source of reference to those who wish to know the structure of a number of complex organic substances, including the antiseptic dyes.

The third volume deals with the changes produced in various compounds by micro-organisms and the agencies by which these are effected : one chapter is devoted to symbiosis. The arrangement of the subject matter is on the same lines as in the second volume. An important section is that dealing with fermentation. Structural formulæ are again freely used.

It is impossible in a short review to give more than an outline of the scope of the treatise, but enough has been said to show the wide appeal of the work. It is up-to-date, although in a science which is advancing so rapidly, revision with our increasing knowledge will in places be required, as the authors themselves acknowledge. Their desire that the work should indicate not only what has been accomplished, but also what remains to be done, appears to have been fully realised. It should be in the hands of all bacteriologists, as well as of those who have to deal with similar chemical processes carried out by the higher organisms. The volumes are clearly printed, and each is provided with three indexes, to authors, to subjects, and to micro-organisms.

Our Bookshelf.

Guide to the Study of Animal Parasites. By Dr. William A. Riley and Reed O. Christenson. (McGraw-Hill Publications in the Zoölogical Sciences.) Pp. xv + 131. (New York : McGraw Hill Book Co., Inc. ; London : McGraw-Hill Publishing Co., Ltd., 1930.) 7*s.* 6*d.* net.

THIS work is the outgrowth of Prof. Riley's fifteen years' experience in presenting the main facts of parasitology to students in the laboratory. The authors suggest that the first two practical periods should be devoted to a general survey of the parasites of the frog—*Trypanosoma* and *Lankesterella* (wrongly spelt throughout the book) in the blood, Helminthes in the lungs, alimentary tract, and bladder, and Protozoa in the large intestine and kidney. Attention is then directed to the Trematoda, represented by *Polystomum*, *Clonorchis*, and *Fasciola*, and a key to the chief groups of cercariæ is added. The study of cestodes begins with that of *Tænia pisiformis*, after which the human tænias and representative species of *Hymenolepis*, *Dipylidium*, *Diphyllobothrium*, *Multiceps*, and *Echinococcus* are briefly considered. *Ascaris*, the hookworms, *Trichinella*, and *Trichuris* are the Nematoda chosen for examination.

Instructions are given for the examination of fæces for eggs (with a key to the eggs of helminthes in human fæces) and of small mammals for adult worms. The section of the work on Protozoan parasites deals successively with *Entamœba histolytica* and *coli*, *Trypanosoma lewisi*, *Giardia* and other flagellates, *Monocystis*, *Eimeria*, human and avian malaria, *Babesia*, *Sarcocystis* and the ciliates of the frog's rectum. Suggestions are added on the use of text-books, journals, and indices relating to parasitology ; on the collecting, preservation, and mounting of specimens ; lists are given of the more important parasites of the cat, dog, pig, sheep, rabbit, rat, fowl, and frog, the organ infected being indicated ; references to works on parasitology, chiefly in English, are appended, and there is an adequate index.

The lists of parasites would have been shortened without impairing their value to the student by omitting species rarely recorded. *Sarcocystis*, common in the muscles of the sheep and the rat, and perhaps the trypanosome not infrequently present in the blood of the rabbit, might have been included in the lists.

The information and instructions set forth in the book, supplemented, as no doubt is the case, by additional details on anatomy and life-history given in the laboratory, form a sound practical guide to the beginner in parasitology.

The Unknown Self : a New Psychological Approach to the Problems of Life, with Special Reference to Disease. By Dr. Georg Groddeck. Pp. 207. (London : The C. W. Daniel Co., 1929.) 7*s.* 6*d.* net.

THIS little volume has been translated with the object of introducing the point of view of Dr. Groddeck to English readers. It consists of a series of short papers written at different times and for different audiences, but all informed by the same spirit. He has sought to understand *why* people get ill, in order to help them to get well. Although in sympathy with, and an exponent of, the psycho-analytic theory, yet he cannot be located to any one school of thought or therapeutic practice. He is in line with the thinkers who, at various times, have arisen as rebels against an intellectualism that would interpret the whole human being on materialistic lines.

The elusive prospect of being able to comprehend humanity on mechanical principles has always appealed to some thinkers. Galen in the second century criticised the narrow mechanical school of the methodists, while the misdirected application of the brilliant development of the so-called mechanical sciences in the seventeenth century stimulated Stahl to his polemical defence of a unifying animating principle over and above the machinery of life. Groddeck postulates an unknown and for ever unknowable force in man, which, for purposes of exposition, he calls the 'It'. The It is not merely the unconscious of the psycho-analytic school, but "includes both conscious and unconscious processes and holds absolute sway over the activities which it has built up. There is no opposition between the ego and the It ; rather is the ego a function of the It." No adequate definition

of the It can be given, but the author maintains that the reality of its existence is demonstrated constantly in everyday life, which "is an uninterrupted revelation, a continuous self-exposure of the It".

The first part of the book is concerned with setting out the more theoretical aspects of the theory, while in the clinical communications the application of the theory to the diagnosis and treatment of various common complaints is given. While there is much in the book that readers will find difficult to understand, they will not find it dull; while even the orthodox, if they are not too old in thought, will find it stimulating and challenging.

Elements of Forestry. By Franklin Moon and Prof. Nelson Courtlandt Brown. Second edition, revised and reset. Third printing, corrected. Pp. xvii+409. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1929.) 17*s.* 6*d.* net.

MOON and Brown's "Elements of Forestry" has had a wide popularity in the United States. First published in 1914, a second edition was issued in 1924, and now a revised and corrected third printing. In this latter, the entire text has been revised and corrected, particularly with reference to up-to-date statistics, new facts made available or recently determined, and in other ways the text has been brought up-to-date. The authors state that they "have purposely left out many statistics and figures, such as prices, which change from time to time". In a book presumably used as a text-book this is a wise decision, which the authors' experience since the first publication of the book will have shown desirable.

The scope of this book is far wider than any of its type we remember in Britain. The range of subjects dealt with in its 387 pages (omitting appendices) covers the whole business of forestry from the elements of sylviculture (after a preliminary chapter on forestry and its meaning and importance), forest protection, forest mensuration, lumbering, wood utilisation, wood technology and preservation, forest economics, and forest finance. A description of the United States Forest Service and the State forest activities follows, the book concluding with some regional studies of forest regions in the United States. For anyone possessed of some considerable knowledge and training in forestry and what it aims at, this book should prove of very great interest and merits its popularity. Whether it is equally useful for the student is perhaps more doubtful—since the treatment of many of the branches dealt with has of necessity been brief, condensed, and rather perfunctory, owing to the limits of space placed upon the authors.

A Text-Book of Economic Zoology. By Prof. Z. P. Metcalf. Pp. x+392. (Philadelphia: Lea and Febiger, 1930.) 4 dollars.

THE chief interest in foreign text-books is to see how other peoples meet problems of education. In a southern agricultural State such as North Carolina, which stretches from the Allegheny Mountains to Cape Hatteras, it is important that students should be taught about the pests and parasites of man and his crops. But it is still more necessary in a higher educational college that the professor should make his students think for themselves. The author's science is 'systematised knowledge', but facts are barren to the student unless he is helped to consider the laws and proximate causes relating to them. Surely here the professor is attempting an impossibility in dealing with the phyla of the animal kingdom in rotation, defining their characters, etc., without his class having acquired any knowledge of the anatomy of any animal in relation to the functions common to all animals. There is, too, a lack of balance, 37 pages of bird classification as compared with 3 pages for fish, while important diseases like bilharzia, sleeping sickness, hookworm, etc., surely deserve fuller treatment.

The book has potentialities and its tables and illustrations are good, while the list of economic animals is very complete, especially the ticks and mites. A central theme is necessary, but this we failed to find. We suggest that a short discussion of the facts of evolution and heredity is essential to the intelligent reading of a text-book of zoology.

A Study of the Oceans. By Prof. James Johnstone. Second edition. Pp. viii + 235. (London: Edward Arnold and Co., 1930.) 10*s.* 6*d.* net.

PROF. JOHNSTONE'S study of the oceans is brief but it touches many aspects of the subject. After a chapter on the origin of the earth and the geological history of the oceans and continents, he goes on to discuss the classical geography of the oceans, tracing the development of knowledge, mainly of the superficial extent of the oceans, up to the present time. The second half of the book contains chapters on the physical and human geography of the great ocean basins. No one could complain of lack of interest in the volume, but it is possible to suggest that too much has been tried within the compass of some two hundred pages. The present issue is the second edition, which differs from the first mainly by the addition of a number of short appendices on isostasy, the Wegener hypothesis, methods of navigation, and the tides. There are numerous sketch maps.

La photographie d'amateur. Par Dr. Rémi Ceillier. (Bibliothèque pratique de l'amateur.) Pp. 96. (Paris: J.-B. Baillière et fils, 1930.) 6 francs.

THIS little book contains a considerable amount of useful information on photographic apparatus and the use of it, and the photographic processes that amateurs are generally interested in. It will help the photographer to understand his work. We think it is a pity that the book has no index, and that the table of contents consists only of the short headings of the seven chapters of which it consists. Some of the lesser-used printing methods, such as carbon, bromoil, etc., are passed over with a mere mention, presumably so that the space available may be devoted to the more important subjects of lenses, cameras, and negative-making.

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.*]

Constitution of Osmium and Ruthenium.

THESE two elements yield volatile tetroxides and by means of these their mass-spectra have now been obtained. Osmium tetroxide was first experimented with ; its action on the discharge, even in the smallest amounts, is quite amazing. The whole mechanism of current flow is violently disorganised and only slowly recovers. In consequence the admission could only be by very small periodical doses during the exposure, and it was only with the greatest difficulty that spectra of adequate density were obtained. These indicate four strong isotopes and two very weak ones, one of the latter being isobaric with tungsten, W^{186}. Fortunately it was easy to photograph on the same plate several short exposures of the mercury group, which is sufficiently near in mass to provide a reasonably reliable density scale. The mass numbers and provisional relative abundance are as follows :

Mass number	186	187	188	189	190	192
Percentage abundance	1·0	0·6	13·5	17·3	25·1	42·6

Lines at 206, 208 due to OsO are close enough to Hg 202, 204 for a rough value of the packing fraction of osmium to be obtained. This appears to be $-1{\cdot}0 \pm 2{\cdot}0$, about that expected. These results combine to give a chemical atomic weight of $190{\cdot}31 \pm 0{\cdot}06$ and suggest that the present one of 190·9 is considerably too high.

Operations which were difficult with the osmium compound were found to be nearly impossible with that of ruthenium. Not only did the vapour rapidly attack the grease of the admission stopcock, but also the presence of mercury in the doubly charged form interfered seriously with the identification and measurement of the ruthenium lines. Every device was tried to eliminate the mercury lines, but only on one spectrum were they so reduced that it was possible to draw conclusions that ruthenium had six isotopes with the possibility of an extremely faint seventh. The following figures, which are only rough estimates from the photometry of the faint lines, are the best available :

Mass number	96	(98)	99	100	101	102	104
Percentage abundance	5	?	12	14	22	30	17

Assuming the packing fraction to be about -6, these give an atomic weight of 101·1. The present chemical value is 101·7, but as the lines 99, 100, and 101 are certain to have been enhanced a little by mercury, although its lines at 99·5 and 100·5 could not be seen, the divergence can be partially accounted for. Of the isobaric pairs 96, (98), 100 which ruthenium forms with molybdenum, the first is of unique interest, for should the doubtful isotope of zirconium (Zr^{96}) be confirmed, there would exist an isobaric triplet, an occurrence of great interest and so far unknown. F. W. ASTON.

Cavendish Laboratory,
Cambridge, Jan. 31.

Spectrum of Cosmic Rays.

SINCE 1928 I have been carrying out experiments on the absorption of cosmic rays in Lake Constance, which is 250 m. deep and lies 395 m. above sea-level. I was able to follow the cosmic rays to a depth of 236·5 m. Analysis of the absorption curve showed four components of different penetrating power.

The results were obtained by means of a registering electrometer specially designed for this purpose, which combined a wide range with great sensitivity. The declining throw of the filament was registered on a stationary photographic plate by means of a lamp that illuminated the filament for a few seconds once an hour from the side, thus giving a bright line on a dark background. The electrometer was connected to an ionisation chamber consisting of a steel cylinder of 33·5 litres capacity and 1 cm. thick filled with carbon dioxide at about 30 atm. pressure. The entire apparatus could be made water-tight, and was anchored in the middle of the lake and suspended at various depths with the help of floats.

The first experiments, in October and November 1928, showed that the cosmic rays could be traced and measured to a greater depth than R. A. Millikan and C. H. Cameron have stated. (Cf. *Phys. Rev.*, **31**, p. 921; 1928.) These authors found that between the depths of 57 m. and 67 m. below the surface of the atmosphere no further decrease in ionisation could be observed in their apparatus. On the other hand, my observations of 1928 showed (cf. *Naturw.*, **17**, 183; 1929) :

At a depth of	78·6 m.	an ionisation of		1·65	volts per hour.
,,	105·2	,,	,,	1·31	,,
,,	153·5	,,	,,	1·00	,,
,,	173·6	,,	,,	0·93	,,
,,	186·3	,,	,,	0·89	,,
,,	230·8	,,	,,	0·83	,,

Subsequent experiments in the winter of 1929–30 proved that the decrease in ionisation at greater depths had not been caused by a decrease in the radioactivity of the water towards the bottom of the lake. In these experiments the ionisation chamber was enclosed in a protecting tank 2·5 m. in diameter, which was filled with water from the surface of the lake. When the apparatus was sunk to various depths a constant layer of water 1 m. thick shielded the ionisation chamber from the radioactivity of the water outside. The results

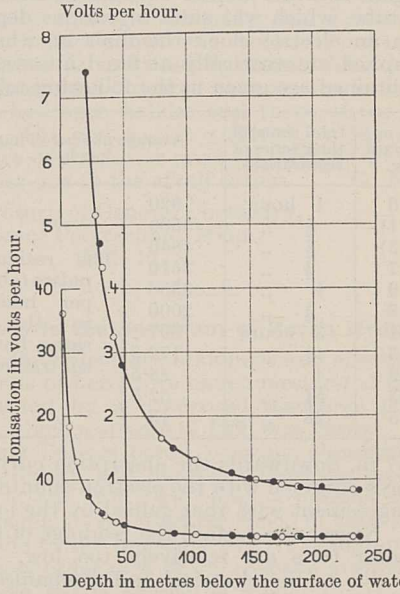

FIG. 1.

obtained in this way are in complete agreement with the curve plotted in 1928 without the protecting tank, a slight correction of 0·05 volt per hour being applied to account for the altered residual ionisation. The former values are thus shown to be independent of the radioactivity of Lake Constance. Fig. 1 shows all the

points obtained, those without the tank being marked by circles, the others by black dots. The experiments below 20 m. of water are reproduced on a tenfold scale. Fig. 2, showing the values below 75 m. of water

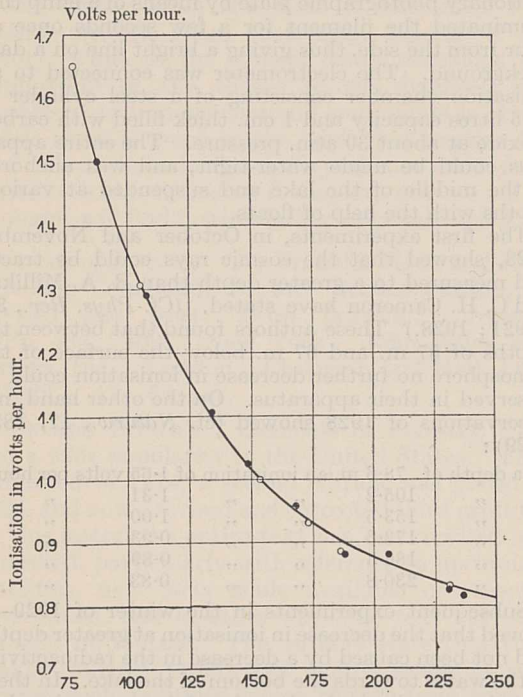

FIG. 2.

on a still larger scale, may serve to illustrate the accuracy of measurement.

In August and September 1930 the results were tested again with the help of a Geiger-Müller electron-counter tube, which was sunk to various depths and acted on an electric clock the dials of which were photographed automatically at fixed intervals. The results obtained are given in the following table:

Depth in m. below surface of water.	Total period of three series of registrations.	Average number of impulses per hour.	
0	1 hour	7920	The residual impulses (about 500 per hour) due to the apparatus, have been subtracted.
(about 1)	½ ,,	5500	
(about 3)	½ ,,	4840	
7	½ ,,	3610	
9	1 ,,	3350	
18	½ ,,	2000	
34	3 hours	867	
93	4½ ,,	172·5	
133	4 ,,	88·5	
183	5½ ,,	52·5	
235	28 ,,	13	

From 7 m. downwards the absorption curve of the cosmic rays obtained with the electron-counter tube is in good agreement with that gained by the ionisation method. Nearer the surface the readings of the electron-counter tube are relatively too low. This is probably due to the electrical and mechanical lag of the registering apparatus.

The analysis of the absorption curve was made by my collaborator, Herr W. Kramer, assuming incidence of the rays from all directions and taking the scattered radiation into account (cf. H. Kulenkampff, *Phys. Zeits.*, **30**, 561; 1929). Four components resulted. The relative intensities of the hardest three components on entering the atmosphere are 0·81 : 6·4 : 16·35, the hardest radiation being the least intense. The true absorption coefficients are 0·020, 0·073, and 0·21 respectively per metre of water. The fourth component, with the longest wave-length, could not be determined numerically.

According to Klein and Nishina's formula, the wave-length of the hardest component is $0{\cdot}63 \times 10^{-13}$ cm., whereas the complete transformation of a proton and an electron into radiation would correspond to a wave-length of $1{\cdot}313 \times 10^{-13}$ cm.

E. REGENER.

Physikalisches Institut der technischen Hochschule, Stuttgart, Jan. 13.

Excitation Probabilities of Singlet and Triplet States.

IT has long been known from experimental evidence [1] that triplet states in the spectra of two electron systems differ from the corresponding singlet states in their behaviour to electron impact. The probability of excitation of a triplet level has a sharp maximum for electron energies just above the excitation potential, whereas in the case of singlets the maximum probability is not sharp, and occurs at energies considerably beyond the resonance potential; also, for high velocities the triplet excitation is negligible compared with the singlet excitation. The difference must lie in the fact that the triplets can only be excited from the ground state by electron exchange, and Oppenheimer [2] has shown in general how this may be approximately calculated.

Using this theory and wave functions given by variation methods,[3] we have calculated the probability of excitation of the 2^3P and 2^1P states of helium as a function of the velocity of the exciting electrons. The curves obtained are shown in the accompanying diagram (Fig. 1), and exhibit the above-

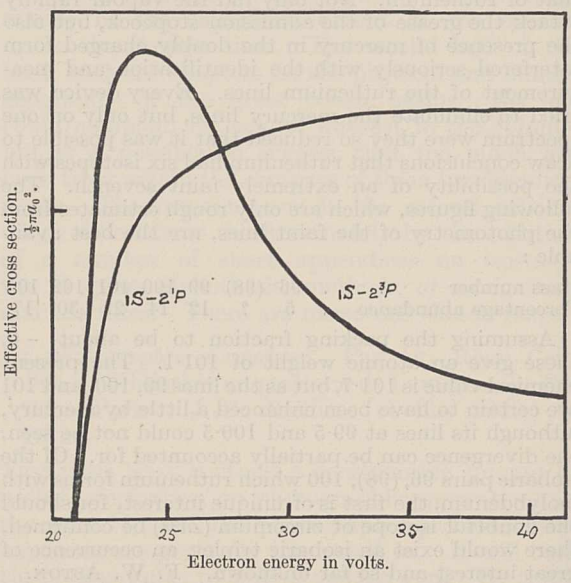

FIG. 1.—Excitation probabilities of singlet and triplet P states of helium. The ordinates for the singlet have been halved, to facilitate comparison.

$a_0 = 0{\cdot}53 \times 10^{-8}$ cm., the radius of the first Bohr orbit of hydrogen.

mentioned characteristics. No high accuracy is claimed for the absolute values owing to the approximate nature of Oppenheimer's theory, but it seems clear that quantum mechanics adequately describes the phenomena.

A detailed account of this work will be published

later, with calculations already in progress for other levels, including the effect of exchange on elastic scattering. The probability of dissociation of hydrogen molecules by electron impact into two neutral atoms in the ground state, which is a similar process to the excitation of triplet states, is also being considered.

H. S. W. MASSEY.
C. B. O. MOHR.

Trinity College, Cambridge,
Jan. 21.

[1] Hanle, *Zeit. f. Phys.*, **56**, 94; 1930. Skinner and Lees, NATURE, **123**, 836; 1929. Schaffernicht, *Zeit. f. Phys.*, **62**, 106; 1930.
[2] *Phys. Rev.*, **32**, 361; 1928.
[3] Eckart, *Phys. Rev.*, **36**, 878; 1930.

The Crystal Structure and Polymorphism of Hydrogen Halides.

IN a previous letter to NATURE (July 19, 1930, p. 97) I communicated some preliminary results upon the crystal structure of hydrogen iodide. I have now repeated, with greater accuracy the X-ray examination of this substance, in order to investigate the discrepancies previously observed in certain values of the lattice dimensions, and have also examined solid hydrogen chloride and bromide at different temperatures, using, for X-ray examination, the same apparatus as previously described (NATURE, Mar. 22, 1930, vol. 125, p. 457; *Rend. Acc. Lincei*, vol. 11, p. 679).

The results obtained for hydrogen chloride agree, in the main, with those of Simon and Simson (*Zeitschrift f. Physik*, vol. 21, p. 168), with the exception that the a constant of the cubic modification, stable over 98° abs., has been found to be smaller than that obtained by them, namely, $a = 5{\cdot}44 \pm 0{\cdot}01$ A. at the transition temperature (instead of 5·54 at 103° abs. by Simon and Simson). The volume of the elementary cell is then 161×10^{-24} c.c.; the density, for a cell containing 4 molecules, is 1·49, which is in better agreement with the experimental density (1·47) than their calculated results.

The modification of hydrogen chloride stable at lower temperature was examined by cooling the capillary of the spectrograph with liquid nitrogen. The photogram taken at 85° abs. shows numerous lines, of which only a certain number correspond to the tetragonal system for an axial ratio $c/a = 1{\cdot}10$, and for one side of the base of the elementary prism $a = 5{\cdot}27$ A. Most likely this modification of hydrogen chloride possesses a lower symmetry, perhaps rhombic, with axial ratios near those belonging to the tetragonal system.

Hydrogen bromide, like the chloride, is dimorphous. The modification, stable at high temperature, shows at 100° abs. a face-centred cubic structure. The side of the elementary cell is $a = 5{\cdot}77$ A., the volume 192×10^{-24} c.c., the density, for a cell of 4 molecules, 2·78.

The low temperature stable modification shows tetragonal symmetry, with an axial ratio $c/a = 1{\cdot}10$, and with a basic side $a = 5{\cdot}55$ A., or perhaps a pseudo-tetragonal structure with ratios very little different from those of a tetragonal one. The volume of the cell is 188×10^{-24} c.c. at 90° abs.

Various photograms of hydrogen iodide have been taken, cooling in succession the capillary of the spectrograph with liquid hydrogen chloride (188° abs.), methane (112°), oxygen (90°), nitrogen (77°). Hydrogen iodide was prepared by the action of iodine upon red phosphorus. I have succeeded in getting much better defined photograms than before. They contain many lines which cannot be ascribed to iodine impurities originating from photochemical decomposition of hydrogen iodide, as I thought at first, and which cannot be arranged in a cubical structure. On the other hand, following this hypothesis, some divergences could be observed between the calculated and the experimental lattice distances. I have thus come to the conclusion that hydrogen iodide does not show, as I had previously considered, a face-centred cubic structure, but a face-centred tetragonal structure with an axial ratio not much differing from the cubic one. As a matter of fact, all lines of the photogram can be assigned to a face-centred tetragonal structure, with an axial ratio $c/a = 1{\cdot}08$ and a side of the elementary cell $a = 6{\cdot}10$ A. at 100° abs. The volume of the cell is 245×10^{-24} c.c., and the density, for a cell of 4 molecules, 3·45. (The present values do not differ much from those previously calculated for a cubic structure.)

From the lattice constants of the cubic modifications of hydrogen chloride and bromide the ionic radii of chlorine and bromine can be calculated, assuming the ions to be tangential in the face-centred cubic lattice: the new values are somewhat higher than Goldschmidt's values calculated from the alkaline halogenides ("Geoch. Verteilungsgesetze d. Elem.", *Norsk. Vid. Ak.*, **7**; 1926), but they are perfectly consistent, as previously pointed out by Nasini and myself (NATURE, Mar. 22, p. 457; June 14, p. 889; 1930: *Rend. Acc. Lincei*, vol. 11, p. 1009; vol. 12, p. 141; 1930), with the atomic radii of the inert gases having the same number of external electrons, as the following table shows:

Cl^- = 1·81 (Goldschmidt),	1·92 (Natta)	A = 1·92 (Simon-Simson)
Br^- = 1·96	,,	2·04	,,	Kr = 2·04 (Nasini-Natta)
I^- = 2·20	,,	2·21	,,	X = 2·18 (Natta-Nasini)

The 2·21 value of the iodine ion is obtained from the ratio of the volumes of the elementary cells of the isomorphous modifications of hydrogen iodide and hydrogen bromide, assuming as the bromine ionic radius that calculated from the cubic modification of hydrogen bromide. We might also assume for the iodine ion a non-spherical form, as has already been suspected from the structure of other iodides.

I cannot agree with Simon and Simson's hypothesis as to hydrogen chloride, and I assume that hydrogen halides show ionic structure and not molecular lattices as supposed by them. This is proved by the agreement observed between the ionic radii of the free hydrogen halides and those of the alkaline halides. The contraction suffered by the anion in the lattice of the latter must be ascribed to polarisation forces due to the alkali cation.

G. NATTA.

Laboratory of General Chemistry,
Royal Polytechnic, Milan,
Jan. 17.

Bands in the Spectrum of Boron Hydride.

WITH the object of obtaining band spectra due to compounds of boron, we have investigated the radiation emitted by a condensed discharge in a tube through which a stream of BCl_3 was passed. Besides the atomic lines of boron, chlorine, aluminium (from the electrodes), and hydrogen (perhaps due to HCl present in the BCl_3), we found a number of widely spaced bands in the neighbourhood of 4000 A., which we ascribe to the molecule BH. Photographs taken in the first order of a 21 ft. concave grating showed that these bands consist of single P-, Q-, and R-branches, the Q-branch containing a considerable number of lines, and the lines $P(0)$, $P(1)$ being missing. The bands must hence be considered as a $^1\Pi \rightarrow {}^1\Sigma$ transition, probably corresponding to the $^1\Pi \rightarrow {}^1\Sigma$ transition observed for AlH by Eriksson and Hulthén.[1] The P- and R-lines of the strongest band are accompanied for higher rotational quantum

numbers by weak satellites due to the isotopic molecule $B^{10}H$. The frequencies of the principal lines, emitted by the molecule $B^{11}H$, may be represented with good approximation by writing for the rotationa terms of the $^1\Pi$-state

$$T' = \nu_0 + B'(J+\tfrac{1}{2})^2 + D'(J+\tfrac{1}{2})^4,$$

for the rotational terms of the $^1\Sigma$-state

$$T'' = B''(J+\tfrac{1}{2})^2 + D''(J+\tfrac{1}{2})^4,$$

with

$$\nu_0 = 23073{\cdot}60, \quad B' = \begin{cases} 11{\cdot}938, \\ 11{\cdot}908, \end{cases} \quad D' = -0{\cdot}00147,$$

$$B'' = 11{\cdot}798, \quad D'' = -0{\cdot}00114.$$

The two values of B' in the upper state arise from the fact that its rotational levels consist of two components each on account of Λ-doubling. Their difference increases proportional to $(J+\frac{1}{2})^2$ or practically proportional to $J(J+1)$ as required by the theory for $^1\Pi$-states.[2] The lines of the Q-branch start from the lower, the lines of the P- and R-branch from the higher ones of these components. From the above values of B one finds for the moments of inertia $I' = 2{\cdot}32 \times 10^{-40}$ gm.cm.^{2}, $I'' = 2{\cdot}35 \times 10^{-40}$ gm.cm.^{2}, for the internuclear distances $r_0' = r_0'' = 1{\cdot}23 \times 10^{-8}$ cm. Although the moment of inertia is slightly smaller in the upper state, so that one expects at first that the bands would be shaded toward the violet and that the P-branch would form the head, the fourth power terms in the formulæ for the term values reverse this behaviour and cause the R-branch to form a head in the neighbourhood of $J = 24$. Since the moments of inertia differ so slightly in the two states, the lines of the Q-branch lie at first extremely close together and only become resolvable for $J = 18$ on our photographs. The band just discussed very likely is the $0 \longrightarrow 0$ band of the system. Two weaker bands of the same general appearance with origins at 4367 A. and 3696 A. we believe to be the $1 \longrightarrow 1$ and the $1 \longrightarrow 0$ bands. Full particulars, also as regards the analysis of these weak bands, will be published elsewhere.

We wish to express our thanks to Dr. Kronig for many valuable suggestions during the course of this investigation.

W. LOCHTE-HOLTGREVEN.
E. S. VAN DER VLEUGEL.

Natuurkundig Laboratorium
der Rijks-Universiteit,
Groningen, Jan. 20.

[1] *Zeit. f. Phys.*, **34**, 775; 1925.
[2] See Kronig, *Zeit. f. Phys.*, **50**, 347; 1928. Hill and Van Vleck, *Phys. Rev.*, **32**, 250; 1928.

Spectra of Te IV and Te VI.

FOLLOWING the identification of the doublet system of Se IV (reported in NATURE of Oct. 11, 1930, p. 568, and recently communicated to the Royal Society), the corresponding spectrum of tellurium, of the same chemical group, has been examined. Vacuum spark spectra of the element, taken at Uppsala, in the region λ1400-λ400, have indicated the existence, among the lines of Te IV, of several pairs with separation 9222 cm.$^{-1}$, which could be easily assigned to the configurations $5s^25p$, $5s^25d$, . . . and $5s5p^2$ of trebly ionised tellurium.

Three pairs with $\Delta\nu = 11{,}814$ cm.$^{-1}$ have also been identified as being 5^2S-5^2P, 5^2P-6^2S, and 5^2P-5^2D of Te VI.

Further details will be published shortly.

K. R. RAO.

Imperial College of Science and
Technology,
London, Jan. 23.

Change of the Electric Polarisation of Ethyl Ether with Temperature.

ONE of us has recently determined the changes of the dielectric constant E and density D with temperature T (J. Mazur, NATURE, **126**, 649; 1930).

Starting from these data, we have computed, with the aid of the Clausius-Mossotti formula

$$P = \frac{1}{D}\frac{E-1}{E+2},$$

the values of the dielectric polarisation of ethyl ether for the interval of temperatures between $-118°$ C. and $+35°$ C. The results of the computation are represented on the accompanying graph (Fig. 1).

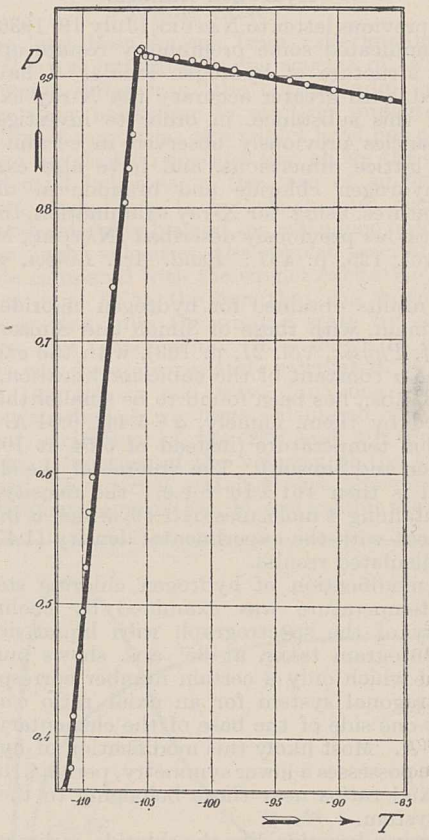

FIG. 1.

The value of the dielectric polarisation increases slowly with the lowering of temperature from 0·5858 at 35° C. up to the maximum value 0·9209 at $-105{\cdot}4°$ C. At this temperature there is a sharp decrease of the value of the polarisation.

This very marked change suggests that at the transition point $-105{\cdot}4°$ C. previously found by us (M. Wolfke and J. Mazur, NATURE, **126**, 684; 1930), the structure of the molecule of ethyl ether undergoes some modification. The behaviour of ethyl ether at the point of change $-105{\cdot}4°$ C. would thus differ from that of the helium (M. Wolfke and W. H. Keesom *Comm.*, Leyden, No. 1, 92[a]). A further study of this phenomenon is being made.

M. WOLFKE.
J. MAZUR.

Physical Laboratory,
Technical Institute,
Warsaw, Jan. 6.

Species-Pairs among Insects.

ATTENTION has recently been directed to the water beetles *Deronectes depressus* F. and *D. elegans* Panz. by F. Balfour-Browne in an interesting contribution to the *Scottish Naturalist* (Nov.-Dec. 1930, pp. 172-188). In a previous study (*Ann. Mag. Nat. Hist.*, Ser. 9, vol. 3, pp. 293-308 ; 1919) he showed that these two species could be separated by a number of characters—size, shape, colour, tarsal claws, width of ædeagus—but that intermediates could be found which formed an unbroken series connecting the two by insensible gradations. His recent paper discusses the distribution, which is of great interest. In southern England, *D. elegans* only occurs ; in northern England and southern Scotland, both species are found, with all grades of intermediates; in northern Scotland and throughout Ireland, only *D. depressus* and intermediates approximating to the *D. depressus* type occur.

In 1927 Georg Ochs (*Koleopt. Rundschau*, Bd. 13, pp. 34-36) directed attention to the whirligig beetles known as *Gyrinus natator* L., and showed that two forms, separable by size, colour, shape, punctuation, and slight differences in the ædeagus, were confused under this name. The true *G. natator* L. is found in the north-eastern palæarctic region, while the other form, *G. substriatus* Stephens, occurs in south-west Europe. At the extremes of their range both forms occur without admixture, while in northern Europe both can be found side by side. The common British form is *G. substriatus*, and D. Sharp, who examined very large numbers, appears to have met with no other. I have recently found a dark form occurring in Cambridgeshire and Scotland, which I described as *G. natator* var. *fowleri* (*Ent. Mon. Mag.*, vol. 66, p. 74; 1930). Since then, through the kindness of F. H. Day and H. Britten, I have examined specimens of the true *G. natator* L. from Cumberland. My specimens of *G. natator* var. *fowleri* form an almost perfect series connecting *G. natator* L. and *G. substriatus* Steph.

It therefore appears that we possess in *G. natator-substriatus* a species-pair almost exactly paralleling the *D. depressus-elegans* pair so beautifully worked out by Balfour-Browne. This seems unlikely to be mere coincidence, particularly as both the northern species are characterised by melanism and pure races of the southern species occur in southern England. It may be that other similar pairs exist in other groups. No doubt a proper study of such species will go far towards a solution of some aspects of that difficult matter the 'species problem', and throw new light on the process of evolution, here apparently in actual progress. I would therefore be glad to have further information and also material of *Gyrinus*, preferably in alcohol, from different localities, particularly Scottish, Irish, and Continental.

JOSEPH OMER-COOPER.
Armstrong College,
Newcastle-upon-Tyne, Jan. 22.

Curling.

I HAVE read with considerable interest the letter on curling by W. H. Macaulay and Brig.-General G. E. Smith in NATURE of Jan. 10, in which they attribute the final twist of the curling-stone to regelation. But surely the time has come when regelation in this connexion should be relegated to the place of a laboratory myth, and might almost disappear from elementary text-books. In 1921 the late Sir George Beilby produced his famous book on "Aggregation and Flow of Solids" (Macmillan and Co., Ltd.) and showed that these familiar ice problems can only be explained on the theory of surface and mass flow.

It is doubtful whether a really heavy man, even if he were standing on one skate only, could exert sufficient pressure to raise the temperature of the ice to anything like the amount required by the theory of regelation, while a curling-stone weighs only a few pounds and presents, relative to a man on one skate, a very large surface to the ice.

In curling, one is dealing with a large number of factors, but it is more or less possible to single out three which are of primary importance.

The first consists of the direction of mass-flow of the ice. On a really cold morning, and in the absence of sun and on a carefully flooded rink, this should be more or less constant. Anything like a rise in temperature caused by bright sunlight will upset the conditions considerably, and hence the interesting but somewhat disconcerting variability of the ice as the sun rises over the hills and throws its welcome rays on those who are curling, about eleven o'clock in the morning during the winter sports season in Switzerland.

In the actual curling there are two main forces acting on the stone in addition to gravity. These are, of course, the initial forward motion of the stone and the twist or *handle*. Both of these are inducing surface-flow on the ice, and the actual direction of the stone is the resultant of these two forces, one or both of which may be opposed or reinforced by the direction of mass-flow of the ice: and hence the very intricate nature of the problem. It is easy to see that if the direction of mass-flow of the ice is the opposite to that of the initial direction of the stone, as the stone slows down a considerable amount of rotation may occur, and the stone may even remain stationary but rotating.

Beilby showed that the normal surface of the ice, or that due to mass-flow, is entirely different from the *vitreous* surface due to surface-flow ; the ice composing the surface of the one being stable in the absence of friction, while the ice composing the vitreous film is only stable at temperatures far below the normal melting-point of ice. The conditions on the typical curling-rink in Switzerland are such that the transitions of surface-flow to mass-flow are very rapid and, in some cases, almost instantaneous.

That the problem is essentially one of the resultant of mass-flow and surface-flow is strongly borne out by the effect of sweeping. Anyone who has been on the curling-rink must have noticed the almost astounding effect that can be produced by good sweeping. The real effect of an expert sweeper is to induce a strong surface-flow and hence a vitreous film immediately in front of the stone: hence the velocity of the stone is maintained and it does not curl.

A. G. LOWNDES.
Marlborough College,
Wilts.

Biology in Education and Human Life.

IN my Henry Sidgwick Memorial Lecture (NATURE, Jan. 3, 1931) I protested that "those should be regarded as lacking education who are altogether ignorant of the nature of living things" (p. 21). Mr. A. D. Ritchie has directed my attention to a sentence of Robert Boyle's, who about two and a half centuries ago, in much more beautiful words than mine, urged similarly that it is "highly dishonourable for a reasonable soul to live in so divinely built a mansion as the body she resides in altogether unacquainted with the exquisite structure of it".

A. V. HILL.
University College,
Gower Street, London, W.C.1,
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The Monds and Chemical Industry: a Study in Heredity.

"I propose to present his character and story with this object: to cite him as the great example of those who do mightily yet cannot see what they are doing and who stand on the edge of doom with no vision of its approach." —*Wolsey:* HILAIRE BELLOC.

"IN this world, one is too frequently approved or disapproved without being understood." This remark is passed by the Japanese professor of art, Yukio Yashiro, in the preface to the new edition of his opulent work on "Sandro Boticelli", in discussing criticisms aimed at his book. Is it possible to understand any complex personality to the point of being able to "approve" his actions, by analysing them to their origin? Prove, German *prüfen*, is a very difficult verb to apply, at least in English; in German, it is without ambiguity.

Some day, perhaps, biography will be written almost in terms of structural chemistry and the doctrine of descent stated in terms of the permutations and combinations effected between genes: then, types, structural units, will be dissected out. It is fast becoming clear that even the most complex of natural molecular units are but repetitionals: that they are built up of simple parts frequently repeated. The candle is a fit emblem of its substance: as it may be made of any length, burnt to any shortness; to the mind's eye, it is the like of the Roman *Fasces*, in contexture. When, at last, we see ourselves as chemists shall see us, the most wonderful imprint of pattern will be displayed upon our skins. Maybe the analysis will not be possible before 'Jeansery' is at its last gasp and we are about to dissolve into radiation. Still, suspicions of structure are already held by some of us.

I merely wish to claim, in all modesty, that biography should be the recognised province of the structural chemist: he alone can appreciate the complete interdependence of character and structure. The supreme interest of chemistry comes from the fact, that it is the study of character as affected by structure. Our senses seem to be but distortions of structure and electrical ripples—purely physical 'emotions'. Witness the Poulsen phonograph, in which a steel tape is drawn across the magnetic field of the telephone: returning the tape against the way it came, we have speech reproduced. The tape hears and remembers what it hears; can tell what it has heard: it all but lives! It is so human that it also forgets. We cannot doubt that the molecules of the metal are displaced when magnetically spoken at, that they remember by retaining the new positions imparted to them, that speech is the molecular click as they revert to their original positions. Seeing that 'wireless' can hit us as it does, there is no difficulty in understanding that we cannot but respond to every impression from outside.

We need to be far more observant of hereditary character. The Mond family seems to me to be specially deserving of study in this connexion. Seldom has the biographer had the opportunity I have had of observing both father and son throughout their whole career of public activity. I first met Ludwig Mond when his son Alfred was only three or four years old, in the early 'seventies. The parents were cousins; their two sons, Robert and Alfred, have always seemed to me to be near hybrids but with a clear bias from the mother. The father was a man of very strong and determined character, almost rough originally; the mother, a woman of peculiar sweetness and sanity of outlook.

Alfred Mond was born when a touch of sulphur was still lingering in the air, under a just ascending star, a true nova of the first magnitude in industrial progress. Growing up in an environment of strongly alkaline *p*H he was to develop throughout the *p* gamut, ever progressing, first as politician of changing hue, from a radical bright red to a mild conservative blue, then as 'company combiner', until at last he became not merely leader as an industrial magnate but an industrial statesman—the first of his kind. No more interesting man has trodden the stage of public life during his period. In heredity and environment, he was subject to exceptional influences: probably he had no peer, at least in his later days, when again the *p*'s come in. He was a peculiar being, maybe the forerunner of a new type: the politician with intelligence, fully alive to the value and use of knowledge, even in the affairs of government: as far from the demagogue as he possibly could be: hence possibly the antagonism between him and Mr. Lloyd George, let us hope the last representative of an expiring crude and unscientific civilisation.

Ludwig Mond, his father, came to England fully prepared, both by German education and Dutch experience of the alkali trade, for the work he undertook—aflame with the pioneering spirit and full of masterful energy. He brought with him a process for the recovery of sulphur from alkali waste, then a nuisance as well as a by-product. This did not carry him far. Hearing of Ernest Solvay's invention of an improved and novel process of making soda from salt, without sulphuric acid, he went over to Belgium and was just in advance of another claimant, Walter Weldon, in securing the English rights to work the invention. As Mrs. Mond told me more than once, he was ambitious, even in those early days, to play the part of the constructive pioneer, to be original, not merely to make money. Originality, we have been told, consists in thinking for yourself, not merely in being different from others: Ludwig Mond, in this respect, was most original. He also knew his own limitations—that 'business' was not his forte: so he sought out the ablest business man within his reach and found him in (Sir) John Brunner. They were a perfect pair—one looked after the pounds in the works, the other after the pence in the office. Mond secured a mere sketch from Solvay: a vast amount of detailed work was necessary to bring the process to perfection: it was full of difficult engineering minutiæ. Taking off his coat, spanner in hand, he himself tightened up each bolt until the last leak of ammonia was overcome. The ammonia-soda process was thus

quickly established, almost in its full perfection: Mond was soon seen to be a destroying angel on Tyneside as the firm rapidly came to the fore. The old Le Blanc process was mainly kept alive for its by-products.

Ludwig Mond left Germany years before the time when the laboratory became a fashionable and necessary adjunct to the works—the source of advance, not merely a control station. He also never followed the German system of giving members of the staff an interest in improvements or discoveries they might make. Perhaps on this account the works remained an ammonia-soda works. Still, his own mind was at work, seeking fresh fields to conquer. Thinking in terms of ammonia, he was led, in the middle 'eighties, to take up the gasification of coal, largely with the object of recovering its nitrogen as ammonia. He established large works at Dudley Port, from which producer-gas was supplied to the surrounding district. The enterprise has not been the economic success that was expected, the more as conditions have changed to its disfavour—especially, of late, owing to the rise in the price of coal and the introduction of synthetic ammonia, which has much lowered the value of scrubbed ammonia. It is strange how little success has attended all tampering with coal—except at the hands of the gas companies, who have known how to roast it hard: all low temperature attempts have been economic failures and probably will remain so, at least until effective means of cleaning coal from dirt be devised. Still, Mond's experiment has been of remarkable interest in many ways, as it has involved producing and carrying vast quantities of gas long distances at controlled rates, without use of holders. The control secured is altogether surprising, on account of the scale of working. Also, a hive of 'small industries' has been established.

Had not Mond made what to me always seemed to be a blunder by burning coal to a *weak* gas, thinking its nitrogen to be of sufficient economic value to be worth recovery, although this involved the sacrifice of the tar, I believe he would have taken up the low temperature distillation of coal himself. I had brought the subject before the Iron and Steel Institute in 1885 and had almost persuaded him to undertake an intensive study of coal, when suddenly he became over-excited by thoughts of ammonia. Had he done so, he would have carried out the inquiry scientifically and thoroughly: thirty years ago, probably, we should have known where we were, and the public would never have been gulled into believing in the commercial possibility of oil from our coal. Undoubtedly, a vein of idealism now began to be apparent in him. He had little real feeling for coal as a substance, not being an organic chemist, nor had he specially directed his attention to fuel problems, although ever mindful of the need of preventing waste of energy. Probably, he went out of his depth.

At this time Mond's ever active mind embarked on a fresh quest. Mindful of the great loss of energy involved in the use of solid fuel, he sought to develop the Grove hydrogen-oxygen, sulphuric acid, platinum, gas cell: again perhaps a stroke of idealism. For this purpose, he needed hydrogen in large quantity. The only economic source was 'water-gas', the mixture of hydrogen and carbonic oxide produced by passing steam over heated carbon (anthracite). It was necessary to remove the carbonic oxide, a virulent poison to platinum. He used a known method, which involved passing the mixture of gases over heated nickel. In experiments carried out in his laboratory, in St. John's Wood, his assistant, Dr. Quincke, to prevent the passage of the poisonous carbonic oxide into the air, put the end of the escape tube from the apparatus into the air hole at the base of a Bunsen burner. He noticed that the gas burnt with a smoky flame—evidently there was some volatile product. Mond not only at once followed up this indication to the quick discovery of nickel carbonyl, $Ni(CO)_4$: finding this was easily resolved into nickel and carbonic oxide by heat, he forthwith developed a continuous reversible process for the manufacture of nickel on the large scale. He was greatly assisted by Dr. Langer, one of Victor Meyer's most able pupils. The achievement is without precedent in the history of scientific manufacturing enterprise, in virtue of its originality, the rapidity with which it was conceived and the intrepidity with which it was executed.

Ludwig Mond, therefore, was the founder of at least three industrial enterprises—two of them are great and highly successful and likely to be permanent. He knew his subject: he had practical chemistry in his bones, if ever man had. Ever a thinker and worker, a man of action, never a man of words—he wrote no letters apart from business—he was highly cultured: a good linguist, an art patron, himself a good judge. From boyhood up, Mrs. Mond had led him in literature and art. She was an idealist of the first water, saturated with Goethe. Their daily life was perfect.

The son's career was very different. He had not the advantage of a serious German education. At school and university, he will not have been overtaught: he was never spurred to special effort, as his father was, in order to make his way. From an early age, brought up in a specially cultured society, using his own great innate ability, he himself became a man of considerable culture. He read law but never entered into practice. So far as I know, he had merely gathered impressions of natural science and had no affinities to it, differing in this respect from his elder brother, who has considerable knowledge of physical science and experimental proclivities.

The son of parents situated as his were had no cause to exert himself. He gradually became the politician, perhaps, too strong a radical to please his father. Here probably he was greatly influenced by the late Sir John Brunner, an ardent politician. In the House of Commons, a speaker of weight, he was so clear-headed, so well informed, so obviously a thinker of unusual breadth and sanity, that he soon acquired distinction. In political office, he showed real administrative ability. That he had a scientific mind was shown by his gradual

change in political outlook and his change of party. Of course, for party purposes, a man must resist the influence of intelligence and stick to his party but it is only from this point of view that change of party is to be deprecated; actually, it is proof of strength and individuality—in no way discreditable.

In a measure, his translation to the Upper House, in 1928, probably in no way satisfied his ambition and was a disappointment, marking as it did the close of his political career. He had aspired to the highest office, beyond doubt, but pronounced idiosyncrasies of manner were against him: he was outwardly 'too foreign' to be acceptable. To satisfy his aspiration, in his later years, he devoted himself to industrial rather than to political statesmanship. The spirit of idealism, which I have spoken of as actuating the father, became greatly operative in the son. He showed himself to be gifted with a co-ordinating mind, whilst his father had been constructive. He entered into a discussion of the problems of labour and in the interests of 'rationalisation'—to use the fashionable word of the day—effected two great industrial combines. Whatever assistance he may have had, there is no doubt that his was the guiding spirit, his the driving force. To come back to chemistry, while the father was a true chemist, a highly original worker, who really made things, the son was like the modern physical chemist, who is more or less a visionary and a speculator in other people's works, not a worker himself. Apparently, the one cannot be the other. Some of us contend that the physical chemist does not know enough chemistry to justify the certainty of his opinions. It is a question whether Alfred Mond knew enough to deal with issues and problems of the complexity and magnitude of those he undertook. Although scientific in his outlook, a systematic user of knowledge, he knew nothing of experimental and physical science and cannot have had any real feeling for the industries with which he was connected.

In effigy to-day he commands an Imperial position in Chemical Industries—his father on his right hand. By a strange turn in the wheel of fortune, he was led to develop, on a colossal scale, the manufacture of ammonia from atmospheric nitrogen by the Haber-Bosch process, so taking a step commercially antagonistic to his father's perhaps most favoured enterprise: ruinous also to the Chile nitrate industry. It may be that one good turn deserves another: industrial progress, so-called, too often seems to involve the supercession of earlier workers. The grave economic, political issue of the present universal industrial rush to our atmosphere, however, has yet to be apparent. To make the inert active is always dangerous, if not an impiety; it may well be a jump from frying-pan into a burning fiery furnace of soil destruction.

Father and son probably could never have exchanged places: they were different natures. Ludwig Mond kept pretty well within the limits of his abilities and sought competent assistance when going outside them: to decide to what extent the son was Napoleonic and overstepped his, will not be easy. One thing is certain, that like his father before him, he gave his full strength to whatever service he undertook. Opinions greatly differ as to the wisdom of his action—as to the competency of a system such as he sought to develop. On account of the growing gravity of the industrial situation, the absolute need of completely scientific management—in other words, of complete understanding—a full inquiry into the problem of control should be undertaken with all possible care and without delay. The matter is already engaging attention abroad and such discussion is therefore of immediate national importance to us. It cannot be undertaken by men of affairs alone—they have not the necessary breadth of knowledge.

Much is said of academic research as the mainstay of industry and industry is being called upon to give support to the work. At the moment, there is great waste of energy and of funds, both national and private, on account of lack of co-ordination and clear-cut views as to the purpose of the work—particularly because of the lack of competent supervision. The great need in industry of full inquiry into the efficiency of the methods followed in its own management and conduct has yet to be recognised: in such direction, industrial research is imperative. HENRY E. ARMSTRONG.

Southern Whales and Whaling.

THE Discovery Committee appointed in 1923 as a result of the findings of the Interdepartmental Committee on Research and Development in the Dependencies of the Falkland Islands is now issuing, under the general heading of "Discovery Reports",* a series of reports by the Committee's scientific staff and others on the investigations being carried out in the southern hemisphere—mainly regarding the scientific aspect of whales and the whaling industry. As in other recent expeditions, the reports are not published in any definite sequence of subject, but as the different stages of the work are completed. The advantages of this procedure are obvious.

The principal industry of the Falkland Islands is whaling, and, since the inception of commercial operations in 1904, there has been a rapid rise in the success of the industry. The history of whaling operations in other parts of the world has acted as a powerful stimulant, both to the administrative controllers of the Dependencies and to scientific experts, to gauge the effects of excessive slaughtering of

* Discovery Reports, Vol. 1. Station List, 1925–27. Pp. 140+plates 1-6. 14*s*. net. Discovery Investigations: Objects, Equipment and Methods. Part 1: The Objects of the Investigations, by Dr. Stanley Kemp; Part 2: The Ships, their Equipment and the Methods used in Research, by Dr. Stanley Kemp and A. C. Hardy; Part 3: The Marine Biological Station, by N. A. Mackintosh. Pp. 141-232+plates 7-18. 9*s*. 6*d*. net. The Natural History of the Elephant Seal: with Notes on other Seals found at South Georgia. By L. Harrison Matthews. Pp. 232-256+plates 19-24. 4*s*. net. Southern Blue and Fin Whales. By N. A. Mackintosh and J. F. G. Wheeler; with two appendices by A. J. Clowes. Pp. 257-540+plates 25-44. 30*s*. net. Parasitic Nematoda and Acanthocephala collected in 1925–27. By Dr. H. A. Baylis. Pp. 541-560. 2*s*. net. The Birds of South Georgia. By L. Harrison Matthews. Pp. 561-592+plates 45-56. 12*s*. net. (Cambridge: At the University Press, 1929.)

whales and, if necessary, to devise a system of regulation to maintain the stock. It is not feared that the whales will be actually exterminated—because the industry must fail long before the whales are reduced to the point of extinction—but that the industry will collapse and the valuable supply of oil will be lost. Any restrictive legislation, whether national or international, must be based on the findings of scientific research. The prevention of waste at shore stations under the jurisdiction of the Government is a matter of routine, but the protection of the stock of whales calls for more knowledge than the scanty data at command can supply. It is, therefore, the object of these investigations to achieve more definite and increased knowledge of whales on which to base methods of conservation, and to Mr. Darnley and Sir Sidney Harmer credit is largely due for laying the foundations of this whaling research.

Vol. 1, which was published during the early part of the past year, contains the results of part of the work undertaken by the staff during the years 1925–1927, and consists of six parts, with a foreword by Mr. E. R. Darnley, chairman of the Committee. The Station List which occupies the first part is more or less stereotyped, but the tabulation, opposite each station, of the hydrological observations, including hydrogen ion concentration, oxygen and phosphate contents of the sea water at different strata, is a distinct advantage.

In the second part, the Director of Research, Dr. Stanley Kemp, gives a brief outline of the aims and objects of the investigations, stating that "the main object of the work is to obtain further information on whales and on the factors which influence them". This entails studies of the whales themselves and of their environment. Work at a shore station was considered essential and a marine laboratory was established at South Georgia, where the whales landed in the course of commercial operations were examined by the resident staff with the view of determining their specific identity and their relationship with similar types captured in other areas. Concurrently with the collection of statistics for racial studies, investigations were undertaken on the anatomy of the whale to elucidate the fundamental points in the life history of the species. As commercial whaling more or less ceases during the antarctic winter, the observations at the laboratory at South Georgia do not cover the full reproductive cycle, so that a transference of the staff during the southern winter was made to South African waters, where similar work was continued on the whales landed at Saldanha Bay. The study of the environment of whales could only be attacked by observations at sea, and it was considered necessary to have two ships to cover the enormous area in which observations would have to be made to cope with profitable lines of research. The *Discovery*, Capt. Scott's famous ship, purchased and specially refitted, was commissioned in October 1925, as the larger ship, for the major part of the oceanographical work; while the smaller *William Scoresby*, built on the lines of a whale-catcher, was designed for the pursuit of whales, with the primary object of shooting numbered discs into them in an attempt to get actual data as to their migrations. The general programme of investigation follows very closely on the lines adopted for the study of commercial food fishes by the International Council for the Exploration of Northern Seas.

In the same report, the equipment of the ships is discussed by Dr. Kemp and Mr. (now Prof.) A. C. Hardy. The structural alterations in the *Discovery* and the fittings for the working of the most modern scientific apparatus are described in detail (see also NATURE, June 20, 1925, p. 950). There are numerous diagrams and photographs illustrating the various points. The *William Scoresby* was built to the specifications of the Committee on the lines of a whale-catcher and was further adapted for commercial trawling. Apparently she has turned out to be very efficient as a sea-going ship and trawler but only moderately successful, so far as the experiments have gone, for shooting numbered discs into live whales—probably because of the ship's larger size, slower handling, and increased noise in comparison with the usual whale-catcher. The type of mark, however, its size, and the method of shooting, from a rifle which is effective only at a very short range, seem to affect the success of the operations. Several methods of marking have been and are being tried, mostly by Norwegians, but there appears to have been a lack of success in all of them. The problem is most difficult and its solution is absolutely essential for the success of the investigations, but no doubt every effort is being made to obtain successful results. In the same report the construction and fittings of the shore laboratory at Grytviken, South Georgia, are described by N. A. Mackintosh, who was in charge of this station. Here the methods employed for counteracting intense cold and high winds form an interesting adjunct.

A further part is devoted to the seals of South Georgia and is by L. H. Matthews. Attention is directed chiefly to a study of the natural history of the elephant seal, which has been the object of pursuit for about two centuries on account of its valuable commercial properties, and has undergone considerable fluctuations in abundance of the stock. The elephant seal is polygamous, as shown conclusively, if such proof were needed, by the photograph of a harem taken purposely during the *Endurance* Expedition in November 1914 and reproduced in this publication. Apart from this factor, which supports scientific selection in slaughtering, the sealing industry has been under efficient Government legislation since 1910, when special sanctuaries were set aside for the preservation of the species. Since the beginning of the century the southern fur seal has been observed on rare occasions in the Dependencies of the Falkland Islands, and the problem of re-establishing the species in these subantarctic islands, with the view of scientific farming on the lines of the successful experiments by the United States Government at the Pribylof Islands, has been receiving attention.

The section by Messrs. Mackintosh and Wheeler, on southern blue and fin whales, with appendices by Mr. Clowes, is a compendious report which

occupies about half the volume and is the result of the work on the whales landed from 1925 to 1927 at the shore stations—Grytviken, in South Georgia, and Saldanha Bay, South Africa. A considerable part of it is taken up with descriptions of the external characters of these two species and with tables of measurements of body proportions, with the view of establishing the specific characters of southern whales and to define the limits of variation. This is an essential part of the investigations, as information on the specific, sub-specific, or racial relationships with similar whales in other areas is of fundamental and far-reaching importance. From the treatment of their data, the authors are convinced that there are close resemblances between the whales of South Georgia and South Africa, and that there are no definite grounds for sub-specific or racial distinctions. Comparison between the whales of the northern and southern hemispheres has not so far been attempted, at least on a large scale, but the data which are still being collected will, no doubt, be utilised for fuller statistical treatment in the near future.

Examination of the stomach contents formed a routine part of the programme. The results were interesting, in so much as all the whales (excluding the sperm) were found to be feeding on Crustacea—and chiefly, if not exclusively, on Euphausiæ, *E. superba* at South Georgia and *E. recurva* at South Africa. This is an interesting and important point, which no doubt will be supplemented by observations from other southern areas. So far as the fin whale is concerned, this species in the northern hemisphere is known to be a mixed feeder and to subsist largely on fish, but it is considered to be solely a plankton feeder in the south.

Routine measurements of the thickness of blubber were also made with the view of establishing any seasonal increase or decrease and specifying its relation to the food supply. Thickness of blubber has a definite bearing on oil production, but, apart from seasonal variations, information is desired on other points, such as thickness in proportion to length of whale, involving a study of physical maturity, and in females, the conditions during pregnancy and lactation. In pregnant females the blubber is abnormally thick, but in whales generally there is a relative increase in thickness of the blubber with increasing whale length. Whales as a rule were found to be fatter at the end of the South Georgia season, while the thickness decreased in South African waters.

The anatomy and physiology of the reproductive organs have formed an integral part of the researches, and much good fundamental work has been done on the ovaries, mammary glands, and testes. The evidence available from these observations has been used in the interpretation of the breeding habits and growth of whales, but information from other sources, such as the occurrence of fœtuses, the seasonal movements and habits of whales, has been utilised in piecing together the life history and reproductive cycle. The conclusions drawn from the investigations rest ultimately on breeding and feeding migrations, which in the present state of our knowledge are more or less assumed from circumstantial evidence to be north and south; but these deductions would be enormously enhanced in value if supported by direct evidence through the capture of even a few marked whales.

Apart from this apparent weakness, which is largely due to the nature of the work on whales caught commercially, the authors have made good use of the data at their command and have given an acceptable estimate of several fundamental points on which accurate diagnoses are essential. Thus, they have defined the mean length of sexual maturity for—

Blue Whales,	Female,	at 23·7 metres	(77 ft. 9 in.)
,,	,,	Male,	,, 22·6	,,	(74 ,, 2 ,,)
Fin	,,	Female,	,, 20·0	,,	(65 ,, 7 ,,)
,,	,,	Male,	,, 19·5	,,	(63 ,, 8 ,,)

The pairing season takes place principally from May to August, with a maximum in June to July for both these species, but, as stated, the results indicate, at least for the fin whale, a protracted period over seven or eight months. The authors are convinced that whales are polyœstrous, and that if impregnation be missed during any period of ripening of an ovum, there are traces of this occurrence in the ovaries as corpora lutea of ' ovulation '. The frequency of this feature is unknown, but it does not strengthen claims to a breeding concentration and complicates the estimation of age by reading of the number of old ovarian scars. The length of the period of gestation has been estimated at a little more than ten months for blue whales and eleven and a half months for fin whales, with possible variations according to the time of impregnation. This conclusion has been drawn largely from an examination of the fœtuses obtained during the investigations and from the records of the smallest calves, which latter were extremely few. From the same evidence the season of parturition was defined and the period of birth of the calves was stated as mostly April and May for blue whales and June and July for fin whales. The accuracy of the determinations, however, depends largely on the question of the representative nature of the material examined.

The length at birth has also been estimated in a general way and probable estimates have been given as 7·0 metres (23 ft.) for blue whales and 6·5 m. (21 ft. 3 in.) for fin whales. The average length at which weaning takes place has been more difficult to determine, as the data on which the estimate has been made are rather scanty; but the rate of growth of the calf during the nursing period has been approximated with the help of data supplied to the British Museum by the whaling companies at South Georgia and at South Africa. The duration of the nursing period has been put at about seven months for blue whales, and for the fin whales, on slightly less representative material, at six months. During this period the astonishing result has emerged that the blue whale calf more than doubles its length, while the rate of growth of the fin whale calf is also rapid but not quite so considerable. The subsequent growth of the adolescent whale to sexual maturity again rests a good deal on conjecture, but

there seems sufficient justification for the authors' interpretation of the available statistics that sexual maturity is reached at the end of the second year, at lengths already stated for each species. No definite method for determining the age of whales, beyond the early stages, has emerged, though various studies have been made in this direction, but these have not advanced beyond the stage of fixing that the whale is either an old or a young one, for example, by the number of old scars on the skin, the condition of the vertebral epiphyses, and the number of old corpora lutea.

The application of the results obtained to economic conditions is discussed at some length, but as this necessitates a thorough understanding of the whole stock of whales, the question will have to be considered from all points of view. The arguments put forward by the authors refer to the particular areas in which the investigations were made, and rest largely on the assumption that there is little discrimination in the killing of the whales in any particular area, and that the nature and composition of the catches are likely to be fairly representative of the whale population. The problem of fluctuations in the number and condition of whales requires a lengthy series of observations, but several interesting points are touched upon in the present report which, with a fuller knowledge, may prove to be of great importance. Much is made of the concentration of whales in the area of the Falkland Islands, and some of the causes for this concentration are given considerable prominence, but there are a few million square miles of sea round the antarctic barrier still unexplored, and it may well be that other features will emerge which will call for intensive study. In the history of whaling operations in the northern hemisphere, it has been impressed on us that the *locus operandi* has shifted from one locality to another, and that in each case the killing off of the whales almost to extinction in any particular region has not been followed by a return to the region of the same type of whales in numbers sufficient to resuscitate the industry. This is, meantime, an unexplainable point, but one that requires attention.

The fifth part is a purely scientific report by Dr. H. A. Baylis and deals with the first consignment of material belonging to the parasitic Nematoda and Acanthocephala collected from whales, seals, and fishes. Five species of Nematoda and three of Acanthocephala are described as new to science. These are interesting from the point of view of the distribution of their hosts.

Another section by Mr. L. H. Matthews is on the birds of South Georgia. Thirty-one species are listed as having been observed at the island both by himself and by previous observers. The text is in the form of brief notes on the species, except in a few cases, for example, the Albatrosses, where the breeding habits are described from the writer's original observations. In most cases a popular name is given to the species, but one misses familiar terms like Night Hawk for the Cape Hen, Paddy for the Sheathbill, Nellie for the Giant Petrel, and Johnny for the Gentoo Penguin. Nineteen species were observed nesting, while other six are quoted from previous observers as breeding on the island. Fregetta is recorded as being observed only by the Transit of Venus Expedition at Royal Bay, but the scientific members of the *Endurance* Expedition observed a pair of these birds at close range at Larsen Harbour in November 1914. The report opens with a curious mistake as to Shackleton's itinerary on the famous boat journey in April and May 1916 from Elephant Island, South Shetlands, erroneously stated here as South Orkneys, which, by the way, has also been overlooked in the list of corrigenda. There are twelve plates (three in colour) attached to the report, and many of the figures are exceedingly good and most useful.

The New Zealand Earthquake of Feb. 3.

By Dr. C. DAVISON.

OUR knowledge of New Zealand earthquakes extends over little more than a hundred years. Since 1814, when missionaries first landed in the islands, there have been four great earthquakes—in 1826, 1848, 1855, and 1929—but none of these, unless it be the earthquake of 1855, can be compared with the shock that on Feb. 3 brought ruin to Napier and other towns in the North Island. Certainly none has been so destructive of life. On June 17, 1929, 17 persons were killed during the Murchison earthquake; in all previous earthquakes since 1848, not more than seven. During the shock of last week, at least 140 lives were lost, and the number may be increased when the ruins of the larger buildings have been searched.

The earthquake occurred at 10.48 A.M. and lasted for about two minutes. The principal towns damaged are Napier and Hastings. Napier lies on the shore of Hawke Bay, and the houses that suffered most are those in the business quarter, built for the most part on land reclaimed from the sea. Hastings is an inland town about 12 miles south-south-west of Napier. The other places at which buildings are damaged or lives have been lost lie within or near a band about 45 miles long and 12 or 15 miles wide running south-south-west from Napier or parallel to the coast line to Waipukurau. It is in the neighbourhood of Napier, however, that the material damage is greatest. Railway lines there are buckled, roads are fissured, and many landslips have occurred, especially to the north of the town.

The earthquake was recorded at Kew Observatory at 11 h. 6 m. 52 s., P.M. (G.M.T.) on Feb. 2; the amplitudes of the movements were about twice those caused by the earthquake of June 17, 1929, and the total duration of the disturbance was about four hours.

One of the most interesting features of the earthquake is the rise of the land about Napier.

The pool in the harbour known as the Iron Pot, where fishing-boats and small steamers hitherto lay, is now dry land. According to the report of the Governor-General, the bed of the harbour has been raised in places by 18 feet. It seems clear that the rise of the land was not abrupt, for steamers left the harbour and proceeded to sea " on account of the anchorage shallowing rapidly ".

For many years, slight earthquakes have been frequent in the Napier district. In the list of New Zealand earthquakes from 1848 to 1890 drawn up by the late Mr. G. Hogben, at least 27 earthquakes had their origins in this zone.

Though the stronger earthquakes of New Zealand can scarcely be ranked with the greatest of some other lands, they have all been accompanied by notable displacements of the earth's crust. In 1826, a cove in the South Island about 80 miles north of Dusky Bay was converted from a safe anchorage for sealing vessels into dry land. The earthquakes of 1848 visited the northern part of the South Island. A great rent was then formed in the mountain chain running south-south-west from Cloudy Bay, and was traced for a distance of 60 miles. During the Wellington earthquake of 1855, a tract of land at the southern end of the North Island measuring 4600 square miles was uplifted from one to nine feet. The fault along which the greatest movement occurred runs along the eastern flank of the Remutaka range, and the nearly vertical scarp was traced for a distance of about 90 miles. Lastly, with the earthquake of 1929, which occurred in the north-west portion of the South Island, the ground on the east side of the White Creek fault was shown, by the renewed levelling of the district, to have risen at one point by 16 ft. 1 in.

The investigation of the recent earthquake by the competent seismologists of New Zealand and the re-levelling of its central area can scarcely fail to add greatly to our knowledge. One of the most interesting points to be determined is the connexion of the earthquake with the fault or system of faults that was in action in 1855; for though 30 miles or more to the north-north-east of the end of the fault-scarp of that year, the meizoseismal area seems to lie along, or not far from, its line of continuation.

Obituary.

Mr. A. B. Basset, F.R.S.

ALFRED BARNARD BASSET was born on July 25, 1854. He was educated at Trinity College, Cambridge, and graduated in 1877 as 13th wrangler, a position which could scarcely have represented his real mathematical attainments. He was called to the Bar at Lincoln's Inn in 1879, but not being under the necessity of adopting a profession, he soon abandoned the law, and, apart from the duties of his private station, devoted himself mainly to mathematical research.

From 1883 onwards Basset produced a succession of papers on applied mathematics, mainly on subjects suggested by current discussions. The 'classical' hydrodynamics had at that time a great fascination for a number of rising mathematicians, and Basset's own contributions in this kind to the *Proceedings* of the Cambridge Philosophical Society, the London Mathematical Society, and the *Philosophical Transactions* were of distinct merit. Among the numerous subjects which he treated we may mention the equilibrium of revolving fluids, and the theorems of Dirichlet and Dedekind, the interest in which had been revived by Bryan, Greenhill, and Love. At a later stage he attacked the theory of elastic plates and shells, which was then a matter of controversy, and was led to recognise independently the true explanation of a rather serious difficulty. Mention should also be made of his work on viscosity, and in particular on Boussinesq's problem of the variable slow motion of a sphere in a viscous fluid. These are only a few items out of the long list which appears in the Royal Society's catalogue.

Basset's work was distinguished throughout by a remarkable command of analytical methods. As an example, it may be noted that he was an expert in the use of Bessel functions, and discovered new results in this connexion, at a time when the theory was only beginning to be familiar to English applied mathematicians. He was elected a fellow of the Royal Society in 1889, and was vice-president of the Mathematical Society in 1892–93.

Basset was also the author of several able treatises. A work on hydrodynamics, in which he incorporated much of his original work, was published in 1888, and did much to promote the interest in the subject. This was followed in 1892 by a treatise on physical optics, another of his favourite subjects, to which he devoted immense pains, but which scarcely met with the recognition which it undoubtedly deserved.

At a later period, Basset turned his attention to pure mathematics, and produced two text-books, on cubic and quartic curves, and on solid geometry. But his interest in scientific matters, and his relations with mathematical contemporaries, seem gradually to have faded, partly no doubt owing to failing health, and he lived in great retirement at his seat in Berkshire. He died on Dec. 5, at the age of seventy-six years. H. L.

Dr. F. M. Turner.

Dr. F. M. Turner died unexpectedly on Jan. 17 at the age of sixty-four years, after a surgical operation. Educated at Cambridge and Guy's Hospital, he was for thirty-four years the loved and respected superintendent of the South-Eastern Fever Hospital at New Cross. He was an acute student of infectious diseases, and published notable work on return cases of scarlet fever in 1906 and on the relation between vaccination and smallpox in *Biometrika* in 1906 and 1907.

Dr. Turner was a man of insatiable curiosity and had wide interests outside his immediate professional concerns, especially in fresh-water biology and the keeping of aquaria, in which he had a happy

knack. He read widely and always maintained a keen interest in fresh developments of biology. He took a large part in the investigation of the inheritance of sinistrality in *Limnæa peregra* with Boycott, Diver, and Garstang, recently published in the *Phil. Trans.*, and incidentally made a number of valuable measurements of the factors which influence the rate of growth of water snails. 'Semper's law' particularly attracted him, and he succeeded in showing fairly conclusively that the larger size of individuals reared in larger volumes of water is due to the greater supply of food. He also made a number of original observations on the kinds of algæ actually eaten by snails, and of their preferences and dislikes for different species. Some of his results are published in the *Naturalist* (p. 231; 1926) and the *Essex Naturalist* (p. 48; 1927), but many of his problems were waiting for the further experiments which he had planned to make when he retired this next summer.

WE regret to announce the following deaths:

Mr. J. D. H. Dickson, senior fellow of Peterhouse and author of numerous papers on thermodynamics and thermoelectricity, on Feb. 6, aged eighty-one years.

Mr. D. T. Jones, C.B.E., chairman of the Fishery Board for Scotland, on Feb. 4, aged sixty-five years.

Dr. C. Krumwiede, professor of hygiene and bacteriology at New York University, assistant director of the research laboratory of the Health Department of New York and past president of the Society of American Bacteriologists, on Dec. 28, aged fifty-one years.

Dr. Albert Schammelhout, secretary of the International Pharmaceutical Federation and an honorary member of the Pharmaceutical Society of Great Britain, on Jan. 20, aged sixty years.

News and Views.

EARLY this year we had the pleasure of offering congratulations on behalf of scientific workers generally to Sir Ernest Rutherford on the barony conferred on him by H.M. the King, announced in the New Year's Honours List (NATURE, Jan. 10, p. 65). A further proof of the world-wide recognition of his brilliant achievements is the award, which we are glad to announce, of the Echegaray Medal of the Royal Academy of Sciences of Madrid. This medal was founded by the Academy in honour of Señor D. José Echegaray, its president from 1901 until 1916, and is awarded triennially to any person, Spaniard or foreigner, who shall, in the opinion of the Academy, have distinguished himself to an eminent degree in one or other of the branches of science for the promotion of which the Academy exists. Previous recipients of the medal are: Señor José Echegaray (1907), Señor Eduardo Saavedra (1910), Prince Albert I. of Monaco (1913), Señor Leonardo Torres Quevedo (1916), Prof. Svante Arrhenius (1919), Prof. Santiago Ramón y Cajal (1922).

ON Feb. 15 occurs the centenary of the death of the famous mechanician and engineer, Henry Maudslay, who was not only the founder of one of the most historic engineering firms of London but also was the originator of important advances in machine tools and engine construction. He was the first to construct screw cutting lathes in which the slide rest is moved along the bed by means of a leading screw driven by change wheels; and it was from his interchangeable system of screw threads that Whitworth afterwards developed the well-known Whitworth system. Born in Woolwich in 1771, the son of a soldier who had become a carpenter in Woolwich Arsenal, Maudslay began work in the Arsenal at twelve years of age and by eighteen had acquired such extraordinary mechanical skill that Bramah employed him on the construction of his locks. Later on, at the age of twenty-six, Maudslay set up in business for himself in Wells Street, and in 1810 founded the works in the Westminster Bridge Road where, for nearly a century, marine engines were constructed for the Navy. He was the maker of the famous block-making machinery devised by Brunel for Portsmouth Dockyard. And among his workmen were Clements, who afterwards constructed Babbage's calculating machine, Nasmyth, the inventor of the steam hammer, and Whitworth. Into all his work, Maudslay introduced mathematical accuracy, while his constructions were all known for their beauty of proportion. The business he founded was carried on until 1905. On his death, Maudslay, at his own desire, was buried in Woolwich churchyard, where a monument recalls his merits as an engineer and a man.

THE Royal Commission on Transport, in its final report on the co-ordination and development of transport in Great Britain (see also p. 225), considers that of the two main causes of the present difficulties of railways, the long-continued depression in trade, especially in the 'heavy' industries, is the more important, though road competition will be a more permanent adverse factor. To meet such competition, a thorough overhauling of railway schedules, with speeding up of services and improved conveniences, including the removal of irritating conditions, revision of fares, and increased seating accommodation on main line trains, are recommended. In regard to grouping under the Railways Act, the report recommends that each company should confine its attention to the needs of its particular area; that joint lines should be merged and the traffic pooled at points served by two or more railways. Electrification of all suburban services where there is intensive passenger traffic, the closing of little-used and unremunerative branch lines, and progress in the use of larger waggons and of containers are other recommendations. In regard to road transport, expenditure on by-pass roads but not on new arterial roads is recommended; and the activities of the Ministry of Transport should be concentrated on the complete reconstruction of many existing roads, the widening of roads, improvement of road junctions and lines of sight, strengthening of weak bridges, freeing of toll roads and bridges, and the progressive reconstruction of built-up areas.

THE members of the Royal Commission on Transport are satisfied that users of motor vehicles are in general fairly taxed, but that the ratepayers' burden in respect of roads is too great; they recommend that no proceeds of taxation from motor vehicles should be diverted from the Road Fund, but that the present proportion between ratepayers and motorist should be reversed. The diversion of heavy goods traffic from the railways to the roads should be discouraged, steel tyres abolished, and pneumatic tyres used on all motor vehicles. The report recommends that no additional tramways should be constructed, and, without laying down a definite time limit, that they should gradually be replaced by other forms of transport. Certain canals are considered as still possessing real value as a means of transport, but they require rationalisation and development, although there is no territory where the construction of a new canal would be regarded as a serious proposition. A number of the smaller ports have been allowed to fall into a state of decay, and the first step to be taken towards assisting coastwise shipping is the improvement of the ports used by coasting vessels. In future road construction programmes, the requirements of harbour areas should receive a prominent place. The Commissioners are of the opinion that, in principle, it is undesirable that one form of transport should own docks and harbours to which access by other means of transport is required. A public trust is considered the best kind of authority to own docks and harbours, although transfer of the majority of railway-owned docks and harbours is not recommended. In regard to co-ordination, the appointment of a small permanent advisory council on transport, to study transport problems both generally and in particular areas, and to advise the Ministry on action which might be usefully taken to promote the co-ordination, improvement, and development of transport generally, is the only recommendation made, although the future of co-ordination is discussed.

THE debate on the second reading in the House of Commons of the Representation of the People (No. 2) Bill took place on Feb. 3. Several points in connexion with university representation in parliament were discussed during the debate. Statistics were quoted by Sir J. Withers, who stated that of the 12,000 university voters (NATURE, Jan. 31, p. 183), 10 per cent are living abroad, not, as has been suggested, as pleasure-seekers, but as tea-planters, consuls, Civil servants, and men of business. He considered their votes of great value, especially where foreign policy is concerned. He protested strongly against the proposed abolition of the university vote, on the grounds that the proposal was the result of a cynical bargain for party advantages, to get rid of Conservative members of the House, rather than a consideration of the public interest. Miss Rathbone pointed out the value of such representation, in that special channels were thus supplied through which mental training could express its views. Sir Graham Little stated that the reason for the removal of the twelve members had been quite frankly shown by Mr. Clynes, when he said that those members were mainly Conservatives.

IN defence of the Bill, especially the question of the abolition of university votes, Mr. Ramsay Macdonald said that, at the present time, university representation is simply plural voting. If any institution in the country requires special representation, it certainly is not the universities. The universities pervade the whole atmosphere of the House, they are represented in every party and on every bench, because of the culture and enlightenment which the universities have spread among all classes of society. On Feb. 2, during the motion for the second reading, Mr. Clynes said that whatever else university members may have exhibited, they have shown in the quality of their work in the House of Commons a lack of knowledge of public needs. Mr. Shaw, during the debate, expressed the view that university graduates should be content with the influence which their university training can give them in the community, without asking for a separate parliamentary vote. At the division, 295 voted for the second reading and 230 against, giving a Government majority of 65.

THE general secretary, Prof. C. Marie, of the committee for the publication of the "Annual Tables of Constants and Numerical Data (Chemical, Physical, Biological and Technological)", informs us that Dr. M. Volmer, professor of physical chemistry and electrochemistry at the Technische Hochschule in Berlin, has been elected a member of the permanent committee, and Prof. M. Bodenstein as honorary member of this same committee. Prof. W. A. Roth, editor of "Landolt Börnstein Tables", has agreed to participate in the editing of the thermo-chemistry sections of the forthcoming volumes. These nominations of German representatives are greeted with particular satisfaction, as they put an end to a situation for which events alone were responsible, but which were no less regrettable from a scientific point of view.

ACCORDING to the tenth annual report of the British Electrical and Allied Industries' Association (E.R.A.), being presented at the annual general meeting on Feb. 13, the Association's income seems to be assured, and will, it is hoped, soon reach £50,000 a year. The work has recently been reorganised so as to secure that research is undertaken for the benefit of the industry as a whole and not merely for particular sections of it. Provision has now been made to wind up all 'confidential researches' at the end of the year, the rights of interested sections in certain confidential work being safeguarded. Some of the work done is mainly of technical interest, but some of the reports disclose phenomena which are of a more general interest. At first sight a report of the effect of storage in a warm atmosphere on the properties of adhesive electrical insulating tapes seems purely technical; but it may well give rise to research of interest to physicists. The research on the heating of cables buried deeply in the earth has led to important conclusions. The experiments show that the thermal resistivity of the soil diminishes with the depth, and

hence cables carrying heavy currents can get rid of more of their heat than had been anticipated. This tends to compensate for the greater distance from the earth's surface, and so the carrying power of deeply buried cables is not necessarily worse—and is indeed sometimes better—than that of cables buried only two or three feet below the surface. This is generally due to the fact that the soil is more compressed at the greater depths. The experiments show the necessity of studying closely the difficult problem of the movements of the moisture in the soil, under the influence of the thermal gradients due to the heating of the cables. Methods have also been devised of improving the thermal conductivity in the neighbourhood of the buried cables.

THE Hurter Memorial Lecture delivered by Prof. G. T. Morgan before the Liverpool Section of the Society of Chemical Industry, on Jan. 16, gave a survey of recent developments in organic syntheses through the use of pressure. The original impetus in this field came in the production of intermediates for dyestuffs, and the experience thus gained by the great German firms was of fundamental importance in the development of the ammonia synthesis, and afterwards, following the study of the reactions between carbon monoxide and hydrogen at high temperatures and pressures in presence of catalysts, in the manufacture of methyl alcohol. Prof. Morgan is still hopeful that the synthesis of ethyl alcohol and higher alcohols is possible, without a simultaneous loss of carbon monoxide, by complete reduction to methane. Dealing with oxidation under pressure, the production of $\alpha\alpha'$-dipyrryl, with a bispyrrypyridine, which gives a remarkably stable ferrous co-ordination compound with iron, from pyridine and anhydrous ferric chloride at 350° and about 50 atmospheres, was cited. Reference was also made to studies on the Kolbe-Schmidt reaction and on the action of carbon dioxide on phenols and on amines in the presence of anhydrous metallic chlorides, which are still yielding results of importance in the dyestuffs field. Prof. Morgan believes that a systematic study of high pressure reactions will lead to discoveries whereby the use of pressure may be partly or entirely avoided, and points out that, as the discovery of more effective catalysts lowers reaction temperature, high pressure synthesis should approximate more closely to the elaboration of complex carbon compounds, associated in Nature with the vital activities of plants and animals.

AN interesting legislative experiment is apparently to be made in the United States. Science Service reports that Congress has unanimously passed a law which gives to the man who produces new plants "the same encouragement and protection that the inventor of new mechanical or electrical apparatus has received for more than a century". New plants can be patented, and for seventeen years the breeder of a new plant will have a monopoly on its production. It is added that, as yet, full procedure for handling plant patents has not been worked out. When this has been done, possibly the authorities may discover some difficulties in the way of this new legislative project. Plants propagated from seeds and from tubers are apparently excluded from its operation, but fruit trees, ornamental shrubs, etc., which can be vegetatively propagated come under its operation: it is not clear on what principle the tuber, a vegetative mode of propagation, should be excluded when other vegetatively propagated plants are included; but its exclusion may considerably reduce legal actions contesting patents under the new act. It will be interesting to see how the breeder establishes his claim to a new plant under the law. If he states that his new plant is the result of hybridisation between two named parents, how will this affect the operation of other breeders who desire to make the same cross? Will the same effect be ruled to follow, in law, if the same parents are used in the same manner upon another occasion?

AT Daytona Beach, on Feb. 5, Capt. Malcolm Campbell beat the world's land speed record, which was set up by the late Sir Henry Segrave at the same place on Mar. 11, 1929. Major Segrave's average speed over the measured mile was worked out as 231·36226 miles per hour, and the new record achieved by Capt. Campbell works out as 246·154 miles per hour. Exceptional credit is due to Capt. Campbell for his feat, since conditions were far from good. Visibility left much to be desired and the course was found to be uneven in places, especially at the northern end. These drawbacks did not deter him, however, and he set out, taking a flying start of 5·5 miles, which is 1·5 more than usual. His car, the Napier-Campbell *Blue Bird*, was fitted with a supercharged Napier aero engine, similar to those of the Supermarine seaplanes used in the Schneider Trophy contest in 1929. The engine develops more than 1400 horse power. The speeds returned for Capt. Campbell were: southward run, 246·575 miles per hour; northward run, 245·733 miles per hour—or an average of 246·154 miles per hour.

COTTON that has been grown entirely in England will be displayed in the Empire Marketing Board's stand at the British Cotton Textiles Exhibition which opens at the White City, London, on Feb. 16. Less than 30 miles from London there are 'cotton-fields' complete with plants which have flowered, fruited, and flourished for three generations. Specimens of various types of cotton grown in glass-houses at the Rothamsted Experimental Station will be shown alongside cotton from seven Empire countries. The plants have been grown for the purpose of scientific study of 'black-arm' disease, which attacks cotton in the Sudan, Nigeria, and Uganda. It is due to a bacterium which causes the young plants to wilt and die, and in another form, 'angular leaf spot', attacks the leaves and prevents the plant from producing lint. A grant has been made by the Empire Marketing Board for a study of the causes and spread of infection, and how 'black-arm' may be checked. Six tanks have been erected in which the temperature of the soil and the atmosphere, the humidity, and the amount of light can be controlled by those in charge. The workings of these tanks—the only apparatus of its

kind in the country—are to be shown by means of an exhibit of photographs, and cultures of the disease will also be exhibited.

IN continuation of the series of special exhibitions to illustrate the resources of raw materials of the British Empire which have been given at the Imperial Institute, a special exhibition of the mineral resources of the Empire will be opened by Mr. Amery on Feb. 17. This exhibition, besides bringing out some facts which are little realised by the general public—for example, the vast wealth of minerals produced within the Empire as compared with the rest of the world—will also show the utilisation of some of the lesser-known minerals, which are nevertheless of great importance. Again, it is not generally realised that 90 per cent of the world's nickel output, 90 per cent of the asbestos, and 72·5 per cent of the world's gold output were produced within the Empire in 1928. Sir Robert Horne will give an address on the mineral resources of the Empire in the cinema at the Imperial Institute at 5.30 P.M. on Thursday, Feb. 19. The seating accommodation is limited, and those desirous of attending should communicate early with the Secretary, Imperial Institute, London, S.W.7. There will also be a special series of mining films shown in the cinema throughout the exhibition. Entrance will be free. In connexion with the exhibition, the Institute is publishing a handbook on the mineral resources of the British Empire.

IT is announced that a course of lectures on "The Application of Anthropology to Practical Affairs in Africa" will be given by the Rev. Edwin Smith at the London School of Economics on Mar. 9, 10 and 11 at 5 P.M. The manner in which the lecturer will deal with his subject, as outlined in the announcement, suggests a thoroughly practical handling of the question both in the interests of the future administrator and others concerned with native affairs and from the point of view of the scientific investigator. Rapidly changing conditions among backward peoples must, sooner or later, bring the anthropologist face to face with the question of the best way to deal with his problems in the field. Is his aim to be directed towards the elucidation of native institutions, in so far as it is possible to ascertain their original form, or is he to record them as they now are and register their function in changing conditions? If anthropology is to serve as an applied science, it may not appear that the matter is open to question. This is, no doubt, one of the points which Mr. Smith will discuss, and upon which his knowledge of African conditions entitles him to respectful hearing. In his first lecture, he will consider if we are on the right lines, in view of the Government's declaration with reference to the value of anthropology. In his second lecture, African family life and the regulation of the sex impulse will be considered as a type problem calling for sound knowledge as a basis of any action; and in the third, he will deal with the changing African, and consider whether what the African is becoming, rather than what the African was, is a necessary study if anthropology is to help in the solution of African problems.

IN an age when iron is produced in enormous quantities and when scrap iron is scarcely worth picking up, it is difficult to realise the conditions in the fourteenth century, when, as stated by Rogers, on a farm "the most formidable item of expenditure on the supply of necessary dead stock was the annual cost of iron". The value of iron then was probably well over £100 a ton in our money, and even in the latter half of the seventeenth century wrought iron was twice as dear as rolled lead. Such are some of the statements given in the authoritative paper by Mr. J. W. Hall on "The Making and Rolling of Iron" contained in the recently published vol. 8 of the *Transactions* of the Newcomen Society. Originally produced direct from ore in quantities of 7 lb. at a time, 'manufactured iron' even 250 years ago was made in a finery not much bigger than a smith's fire. One great difficulty was the limited supply of charcoal, and between 1720 and 1750 the make of bar iron in the whole of Great Britain was only 250 to 350 tons a week. The principal steps in the history of iron-making include the use of coke in the blast furnace, Cort's invention in 1784 of 'dry' puddling on a sand bottom in a reverberatory furnace, and Joseph Hall's improvement in 1839 when he lined his puddling furnace with a partially fusible oxide of iron, an improvement which completely established the reputation of South Staffordshire bar. Brown's first chain cables for the Navy, costing 6d. a lb., were made of this bar, and it is the chain cable trade which to-day provides the chief outlet for the same material. In the working up of the iron, the trip hammer was used with great skill, and such hammers were used for iron long after rolling had been adopted for other metals. Slitting mills were in use in England in 1590. Rolls for iron were first used merely for finishing to size, but Cort's patent of 1783 laid the foundation of the existing methods of rolling sections.

A THIRD international conference on bituminous coal will be held at the Carnegie Institute of Technology in Pittsburgh, Pa., in November next, again organised by Dr. Thomas S. Baker, president of the Institute of Technology. Prominent fuel technologists from all parts of the world will be invited to attend the conference. In connexion with the organisation of the meeting, Dr. Baker has visited Europe to invite prominent scientific workers to speak at the congress. The purpose of the conference will again be to present for discussion the results of recent studies in coal, and particularly the economics of the new methods and processes that are being evolved. The programme will include papers on carbonisation, liquefaction, and gasification of coal; by-products of coal; the mechanism of combustion; cleaning of coal and its preparation for the market; pulverised fuels; power plants, and domestic heating. The advisory board supporting Dr. Baker includes J. A. Farrell, president of the United States Steel Corporation; J. H. Hammond, mining engineer; F. B. Jewett, president of the Bell Telephone Laboratories; A. W. Mellon, Secretary of the United States Treasury; F. A. Merrick, president of the

Westinghouse Electric and Manufacturing Company; A. G. Pratt, president of the Babcock and Wilcox Company; H. B. Rust, president of the Koppers Company; M. S. Sloan, president of the New York Edison Company; G. Swope, president of the General Electric Company; and W. C. Teagle, president of the Standard Oil Company of New Jersey. It is hoped that the conference will assist in discovering new processes and help the recovery of the coal industry.

THE council of the Institution of Electrical Engineers has made the tenth award of the Faraday Medal to Mr. Charles H. Merz, a well-known electric power and traction engineer. The Faraday Medal is awarded by the council of the Institution, not more frequently than once a year, either for notable scientific or industrial achievement in electrical engineering or for conspicuous service rendered to the advancement of electrical science, without restriction as regards nationality, country of residence, or membership of the Institution.

THE following appointments to the Colonial Agricultural Service have recently been made by the Secretary of State for the Colonies: Mr. H. Wolfe, deputy director of agriculture, Tanganyika Territory, to be deputy director of agriculture (plant industry), Kenya; Mr. N. D. Simpson, to be systematic botanist, Ceylon.

THE Empire Marketing Board has approved a grant, for two years, for an investigation into the technique of milk examination by the London School of Hygiene and Tropical Medicine. The present standards for the bacteriological grading of milk were established in 1923. It has since become clear that they are not sufficiently complete, and, in view of their great importance in securing a thoroughly reliable 'clean milk' supply, it has been decided to work out a new technique to be accepted as the official standard in all cases of litigation.

WE regret that an error was made in our reference to the new catalogue of lantern slides issued by Messrs. Flatters and Garnett (NATURE, Feb. 7, p. 211). Chief credit for this production was given to Mr. Flatters. We understand that Mr. Flatters has not been in the business for many years, and that the compilation of the catalogue (especially the botanical section) was due mainly to Mr. Henry Garnett.

THE Wellcome Foundation, Ltd., is to erect a new medical and chemical research building at the corner of Gordon Street and Euston Road, London, W.C.1, on the site, 225 feet by 135 feet, now partly occupied by its Bureau of Scientific Research. For many years the Foundation has maintained medical and chemical research laboratories; but recent developments have made it necessary to co-ordinate and extend these activities. The new building will furnish the additional accommodation required, and be provided with the most modern research equipment. The architect is Mr. Septimus Warwick.

THE 1932 meeting of the Iron and Steel Institute will be held in the United States of America, under the presidency of Colonel Sir Charles Wright, Bart. Joint arrangements, with reference to ocean and inland travel, are being made with the Institute of Metals, which is also holding a meeting in the United States in 1932. The inclusive dates for the meetings and excursions are Sept. 12–Sept. 29. The cost of the trip will be approximately £125 for the round journey; the major portion of this may be paid in advance, on an instalment plan, which began this month. Plans are under consideration for participation in some form by the Canadian Institute of Mining and Metallurgy, either at Toronto or Montreal, or both.

THE thirty-sixth general meeting of the Deutsche Bunsen Gesellschaft für angewandte physikalische Chemie, the leading association of research workers, scientific workers, and technologists in Germany in the field of applied physical chemistry, will be held on May 25–27 in Vienna. The subject of the symposium will be: "Recent Progress in the Science of Metallurgy with particular reference to Light Metals". The arrangements have been undertaken by Prof. Specketer, director of the I.G. Farbenindustrie A.-G., managing director of the Griesheim Elektron works.

THE Faraday Society has arranged a general discussion on "Photochemical Processes" to be held in the chemistry department of the University of Liverpool on April 17 and 18. Several distinguished chemists and physicists from the United States and the Continent have been invited to attend the conference and to send contributions. There will be four sessions, each with an introductory paper, which, like all the contributions, will be distributed previously, and taken as read. The four subjects are: "Molecular Spectra in Relation to Photochemical Change", "Photochemical Kinetics in Gaseous Systems", "Photochemical Change in Liquid and Solid Solutions", and "Photosynthesis". The introductory papers respectively are by Prof. R. Mecke, Prof. M. Bodenstein, Prof. Berthoud, and Prof. E. C. C. Baly.

FROM a recent article in *De Visscherij Courant* it appears that the slipper limpet is multiplying in the waters of Zealand in Holland. Frequent warnings by the coastal fishery authorities at Amsterdam have been issued, pointing out the necessity of exterminating these parasites in their early stages. As the food of the slipper limpet is the same as that of the oyster, it is feared that a great multiplication of the pest would have a serious effect upon the quality of the Zealand oyster. The Ministry of Agriculture and Fisheries desires to impress upon all persons who import Dutch or other foreign oysters, for the purpose of relaying, the importance of taking every precaution to avoid laying down oysters with slipper limpets attached to them. Every oyster should be examined for slipper limpet spat before it is laid down, for once the slipper limpet has become established on an oyster ground, it is practically impossible to eradicate it.

AMONG the many hazards of mining, one of the most difficult to avoid is the production of sparks by impact of rock, or of steel pick and rock. It has been

shown that the picks of mechanical coal-cutters can strike sparks which will ignite firedamp. In a recent report (No. 62) issued by the Safety in Mines Research Board, M. J. Burgess and R. V. Wheeler report experiments which show that sometimes the impact of a hand-pick on suitable hard stone will ignite firedamp. It was not easy and the work suggests that the production of suitable conditions is a rare occurrence in practice.

MESSRS. Francis Edwards, Ltd., 83 High Street, Marylebone, W.1, have just issued a useful little list of some 350 second-hand works dealing with the arctic and antarctic regions.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned :—An assistant aeronautical engineer in the Army Air Corps of the Irish Free State—The Secretary, Civil Service Commission, 45 Upper O'Connell Street, Dublin, C.8 (Feb. 24). An adviser in greenkeeping at the St. Ives Greenkeeping Research Station—R. B. Dawson, St. Ives Research Station, Bingley, Yorks (Feb. 28). An assistant woman demonstrator in physics at Royal Holloway College—The Principal, Royal Holloway College, Englefield Green, Surrey (Mar. 4). A professor of mechanical engineering in the University of Birmingham—The Registrar, The University, Edgbaston, Birmingham (Mar. 9). A director of the Institute of Plant Industry, Indore, and agricultural adviser to States in Central India and Rajputana—The High Commissioner for India, India House, Aldwych, W.C.2 (Mar. 14). A head of Biological Department of Epsom College—The Headmaster, Epsom College, Surrey (Mar. 31). A professor of philosophy at King's College, London—The Academic Registrar, University of London, South Kensington, S.W.7 (May 7). A part-time assistant master, qualified to teach biology, at the Technical Institute, Gillingham—C. Colles, Medway Technical College, Gillingham, Kent. A resident engineer at the Rotherhithe Works of the South Metropolitan Gas Company—The Secretary, South Metropolitan Gas Company, 709 Old Kent Road, S.E.15. A science master for physics at the Newport, Isle of Wight, Secondary School—The Director of Education, County Hall, Newport, Isle of Wight.

Our Astronomical Column.

Jupiter without its Satellites.—Mr. W. F. Denning writes: "The planet Jupiter will be observed apparently without visible satellites on Feb. 14. On that evening at 8.51 P.M. the first satellite will commence its transit across the disc of its primary. The fourth satellite will have previously begun its transit; while the second satellite will be hidden behind the planet, and the third will be suffering eclipse. The temporary obscuration of the satellites will continue for more than 2 hours and 15 minutes, for at 9.6 P.M. the first satellite will complete its transit. Jupiter has nine satellites; all but five are so faint that small telescopes cannot reveal them. To view the planet devoid of all visible satellites is a somewhat rare spectacle. The writer was privileged to witness it on Aug. 21, 1867, with a $4\frac{1}{4}$-in. refractor, and a delineation of the appearance presented was afterwards given in the *Astronomical Register*. Repetitions of the phenomenon will occur in 1932, and one of these which occurs in November may possibly be seen at Greenwich."

Pluto.—A recent *Daily Science News Bulletin* issued by Science Service, Washington, D.C., reports that Dr. S. B. Nicholson and N. U. Mayall, of Mount Wilson, have been studying the mass and orbit of Pluto. They first obtained corrections to Pluto's orbit by applying perturbations by the large planets; the period appears to be very close to 248 years. With the orbit thus obtained they investigated the mass that was indicated by the observations of Neptune. The two planets were in conjunction in longitude in 1891, and at their least distance apart, 19 units, in 1895. They made use of the data given by Dr. J. Jackson in his paper on Neptune's orbit (*Mon. Not. Roy. Ast. Soc.*, June 1930). Two different methods of treatment, one including, the other excluding, Lalande's observations of 1795, gave for Pluto's mass 1·08 and 0·72 in terms of the earth's mass.

Even the smaller of these masses would require the diameter of Pluto to be at least 7000 miles, assuming that the density is unlikely to exceed that of the earth. Such a diameter is not impossible. With an albedo the same as that of the planet Mercury, it would make the visual magnitude in opposition about 14. The visual magnitude was stated to be brighter than the photographic one, and some of the estimates made it as bright as 14. M. Baldet, using the 33-inch Meudon refractor, estimated the diameter as 0·2″, or about 4000 miles. But the limbs would be so feebly illuminated that the real diameter may be greater than his estimate.

Solar Physics Observatory, Cambridge.—The eighteenth annual report of the director of the Solar Physics Observatory, Cambridge, covering the period Aug. 1, 1929–July 31, 1930, shows satisfactory progress, although much of the routine work has been hampered by somewhat extensive instrumental alterations, which, however, should greatly assist the work in future. In particular may be mentioned the installation of an electric Gerrish drive for the 36-inch Common reflector in place of the old clock drive, and the re-designing of the spectroheliograph. The loss which the observatory has sustained through the sudden death of the first senior observer, Mr. F. E. Baxandall, in October last, is referred to in appropriate terms. Mr. Baxandall's chief unfinished investigation, on the spectrum of β Lyræ, has been edited by the director, with the collaboration of Dr. F. Hogg, director of the Amherst Observatory, and published as vol. 2, part 1, of the *Annals of the Solar Physics Observatory*. An important addition to the instrumental equipment is a registering microphotometer, specially designed by the Cambridge Scientific Instrument Co., in close collaboration with the assistant director, Dr. Carroll, the purchase of which was facilitated by a generous donation from Mr. J. H. Reynolds, honorary treasurer of the Royal Astronomical Society. A full description of the instrument has recently appeared in the *Monthly Notices of the Royal Astronomical Society*. On the meteorological side, the results of a study, during the last five years, of the discharge of electricity from an elevated metal point during periods of disturbed weather conditions have been discussed in a paper presented to the Royal Society. An extension of this work is now in progress.

Research Items.

A Benin Ivory.—In *Man* for January, Capt. T. A. Joyce figures and describes a carved ivory ewer from Benin recently presented to the British Museum by the Christy Trustees. The ewer is made of a section of elephant tusk covering an iron lining which is prolonged into a lip everted over the ivory jacket. An iron foot also everted has been added at the base. A wooden handle is fitted at the side, obviously a later addition, as it cuts into the carved design at the lower point of junction with the vessel. The entire exterior of the ivory is covered with carving in rounded relief. The ornament is arranged in two horizontal bands separated by a band carved in interlaced pattern. At the base of the ewer is a second band of interlaced carving. In the upper register is represented a catfish, a centipede, a frog, a two-headed bird, and a fish; in the lower an elephant's head, a crocodile seizing a fish, and a grazing antelope. The designs are excellent examples of the tendency towards symmetry characteristic of artists of all ages. The elephant's head is seen from above, the tusks and ears have been curtailed to fit the space, and the trunk is divided into two diverging sections, each terminating in a human hand holding a branch. The specimen is believed to be unique. It was probably carved soon after Portuguese power began to spread on the west coast of Africa in the sixteenth century. The shape of the ewer suggests European influence, but the artist has preserved his native style in all its purity. The ewer is 9·2 in. in height.

Ancient Coastal Cultures of Northern Peru.—The results of a second Marshall Field Expedition to Northern Peru in 1926 are described by A. L. Kroeber in vol. 2, No. 2, of the *Memoirs*, Anthropology, of the Field Museum, Chicago. The objective of the expedition was the coastal area between Lima and Nazca, and the aim to determine the cultural relations of the northern and southern Chimu areas and the cultural sequence within each. The cultural history of the northern Peruvian coastal area may be summarised as follows: (1) *Early Chimu* (formerly Proto-Chimu). This affords the first archæological evidence for a well-developed culture of specialised type. No origin or formative period is known, and no attempt to connect it with Ecuador, Central America, or Mexico has proved valid. The people built terraced, small-topped pyramids, higher than any erected elsewhere in Peru. The dead were buried in rectangular chambers, in a variety of positions. Gold, copper, and their alloys, and perhaps silver, were melted and cast. Tin and bronze were unknown. The pottery was the highest achievement of any South American culture or people. (2) *Middle* or *Tiahuanaco* appears to be an overrunning of an intrusive culture, possibly people, from the highlands. It is represented at relatively few sites, and chiefly from its pottery, which is in fragments. (3) *Late Chimu*. Fundamentally an emergence of Early Chimu with increments. Now Chimu culture was no longer merely provincial, but extended far to the north of the old Chimu domain. Here it may have been ancient and hence spread south. At the moment of transition from prehistoric to historic, when the Incas conquered the Chimu area, the whole of the northern coast was under the influence of a ruler who lived at Chanchan. Pyramids were no longer as high as under Early Chimu, and had broad tops, which were used for interments. The custom prevailed of placing a small piece of copper in the mouth of the dead. Metal was abundant; but bronze articles were in a minority. In textiles, mountain wool gave way to a preference for all-cotton fabrics. Pottery had settled into a syncretised style of little originality but facile elegance. The conquest of the Incas appears to have had little effect on Chimu culture, which indeed was externally prosperous and perhaps spreading up to the time of the Spanish Conquest.

Rice as Food.—Among the populations of various countries the value of rice as a foodstuff is receiving increasing recognition, with the result that the consumption is gradually gaining ground. Thus, in France, following an appeal by Prof. Achard on behalf of rice grown in the French colonies, the importation has recently risen by more than 30 per cent. In Italy, however, the cultivation of rice, far from expanding, is losing way, in spite of the fact that the soil and climate of certain districts are admirably suited to the production of rice of the highest quality. Moreover, although Italy could produce twice or thrice its actual consumption, very little rice is being exported. In an article published in the *Rendiconti* of the Royal Lombardy Institute of Science and Letters (Parts 11-15), Prof. Luigi Devoto points out that the experience of the past few years has fully confirmed the view that, when properly prepared, rice is of great value, not only to healthy persons, but also to patients suffering from infectious diseases, affections of the digestive organs, certain skin diseases, obstinate lack of appetite, hyponutrition, and a number of other complaints. In view, also, of the large amount of labour employed in the cultivation and marketing of rice, the question is one of considerable national importance at the present time, and Prof. Devoto emphasises the advantages that would accrue from more extended production and consumption of this commodity throughout Italy.

West Indian Fishes.—H. W. Fowler, in his paper, "The Fishes obtained by Mr. James Bond at Grenada, British West India, in 1929" (*Proceedings* of the Academy of Natural Sciences of Philadelphia, vol. 82; 1930), records eighty species, two of which are new, and several others are of special interest, since the fishes from this rich region are very little known. Figures and detailed descriptions are given of the two new species, *Ariomma bondi*, the first of this genus from the Atlantic, closely related to the Hawaiian *Ariomma lurida*, and *Malacoctenus bondi*, which is recognisable by its colour markings.

Polish Cladocera.—M. Ramuet has described the cladoceran fauna of the lakes in the coastal region of the Polish Baltic, "Untersuchungen über die Cladocerenfauna des polnischen Ostseeküstenlandes" (*Bulletin International de l'Académie Polonaise des Sciences et des Lettres*. Classe des Sciences Mathématiques et Naturelles, série 3: Sciences Naturelles (II.), N. 5-6, B. II., 1930). There are ten large lakes, from 3700 metres to 380 metres in length and 900 metres to 270 metres in breadth, and several smaller lakes of various kinds, some of which are in the neighbourhood of peat moors. The larger lakes have a moderately developed coast-line, and are without islands and deeply indented bays. A short description of each lake with notes on the flora is given, and in some cases the more important animals. Fishes abound in most of the large lakes and usually the bivalve *Dreissensia polymorpha* is found in large quantities. In the systematic portion a record is made of the species of *Cladocera* in each lake, which show a certain similarity and belong to a type characterised by the presence of *Diaphanosoma brachyura*, *Daphnia cucullata*, and

Bosmina longirostris. Seventy species in all are now known from the coastal regions of West Prussia, including those from the Polish coast-land and the Danzig Free Territory. The paper is well illustrated by photographs of the lakes themselves and their surroundings, and by line drawings of the *Cladocera*.

Musculature of the Larval Shrimp.—The report for 1929 on the Lancashire Sea-Fisheries Laboratory at the University of Liverpool, edited by Prof. James Johnstone and Dr. R. J. Daniel, contains papers on the hydrographic observations made during 1926–29 by Dr. Daniel; on the surface drift bottle experiments in the Irish Sea, July 1925–June 1927, by Dr. Daniel and Miss Mabel Lewis; and on the abdominal muscular system of the zoea and mysis stages of the shrimp (*Crangon vulgaris*) and their bearing on phylogeny, by Dr. Daniel. The hydrographical investigations have been carried out with the assistance of grants from the Ministry of Agriculture and Fisheries. Sea water samples were collected from the Irish Sea between Holyhead and Dublin, and at the same time drift bottles were liberated from the places where the water samples were taken. Dr. Daniel's work on the musculature of the larval shrimp is of much interest. Following his former papers dealing with the adult shrimp (*Crangon vulgaris*) and the mysid *Pranuus flexuosus*, in which work distinct differences were found in the muscles of the two species, the present paper investigates the larvæ of *Crangon*. Even in the first stage, the so-called zoea, the muscles are very like those of the adult, which fact might be regarded as direct evidence against its schizopod ancestry. A more probable interpretation is, however, that as the metamorphosis is much abbreviated compared with some of the more primitive Crustacea, such as most of the euphausiids, the development is compressed by the early addition of adult characters, and that during the larval period adult organs or characters as well as complete larval stages may be anticipated. The author is of the opinion that "it may be taken that the occurrence of adult muscular structure in the zoea and mysis of *Crangon vulgaris* is a further indication of this gradual suppression of complicated larval series in the higher Crustacea".

Root and Shoot in the Angiosperm.—Mrs. Arber has recently published in a more extended form (*New Phytologist*, **29**, Dec. 1930) the discussion of this subject that she presented at the International Botanical Congress at Cambridge. From the point of view of formal morphology she concludes that stem and leaf should not be treated as discrete morphological entities, but that root and shoot belong to primary and equivalent morphological categories. She points out, in this latter connexion, that root and shoot alike normally give rise to other like units, the shoot producing lateral shoots, the root lateral roots. This conception of the morphological equivalence of shoot and root seems to meet with little difficulty in the dicotyledon, but the fibrous root system of the monocotyledon, often forming anew at each node and with no very permanent main system as a prolongation of the main axis, may raise a doubt as to whether this view is fully in accordance with all the facts. There are obvious difficulties in the way of extending this view to include the relations of shoot and root system in the Filicales. The paper contains an interesting review of various morphological facts, gathered mainly from the author's investigations of the Gramineæ, which bear upon the relation of leaf and stem. Thus, leaves terminal upon the axis are described from three genera of grasses. Axes with dorsi-ventral symmetry are cited, as well as leaves with characteristically radial organisation.

Bathymetrical Work in the Baltic.—Various charts of the northern part of the Gulf of Bothnia show notable divergences, especially in deeper water. These are due no doubt to different interpretations of the soundings. With the view of obtaining a detailed bathymetrical chart of that part of the Baltic, it was surveyed with an echo sounder in the summers of 1927–29. The methods and results are described by H. Renqvist in *Havsforsknings Institutets Skript*, No. 68 (Bathymetric chart of the Bothnian Bay and the North Kvark). Several thousand soundings were taken and allowed the construction of a detailed map showing an extraordinarily uneven floor, a state of affairs that was overlooked in the deeper water when few data were available. Dr. Renqvist insists that many of the former discrepancies were due to soundings having been wrongly placed on the chart. On an irregular floor a slight error in position might well have a wide result. He claims that errors arise when a ship has to stop for sounding, for it is then difficult, without cross-bearings to land, to fix the true position, since the slowing down and restarting of the ship vitiate calculation of average speed and so of position. In echo sounding there is a uniform speed on the definite course throughout, and the shorter time occupied in taking such a line of soundings reduces the period during which one is unable to take bearings to the land. This also obviates sources of error.

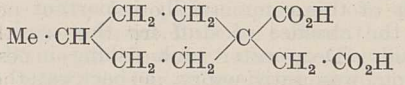
The Gas Equation.—In the issue of the *Physikalische Zeitschrift* for Dec. 1, 1930, Dr. E. Neusser, of the Vienna Technical High School, examines the experimental material available for hydrogen and carbonic acid gas in order to determine the variations with pressure and temperature of the two quantities a and b of van der Waals' gas equation. Observations of volumes at two pressures near together and at the same temperature are used to calculate a and b over as wide a range as possible. The units used are the litre, atmosphere, and gram molecule of the gas. In both gases a and b are found at constant temperature to decrease with the pressure, the curves for a and b being very similar. At constant pressure above the critical point both a and b increase with increase of temperature, while below the critical point there is a rapid fall of both a and b from their values for the gas to their values for the liquid. For the lowest temperatures for which the values have been calculated the decrease is of the order of 50 per cent. The curves given in the paper show why the attempts to modify the van der Waals equation to bring it into closer agreement with observations have met with so little success.

Aero-navigation by Wireless.—The difficulties which have to be overcome in navigating an aeroplane in a fog, which the light from a beacon cannot penetrate, seem at first sight to be almost insuperable. As it cannot remain at rest like a ship on the sea, it is sometimes forced to make a dangerous landing. In the *Proceedings* of the United States National Academy of Sciences for Nov. 15, Messrs. H. Diamond and F. W. Dunmore, of the Bureau of Standards, describe a method of landing in a dense fog. When flying overland two radio receiving sets are used. One is the usual set, which receives the radio beacon signals when flying between cities, and also spoken orders. For landing at the proper angle, a short-wave receiver is used, the signals having a wave-length of 3 metres. The aeroplane flies midway between waves coming from two beam antennæ. When the aeroplane is steering in the correct direction, the amplitudes of the vibrations of two reeds on the pilot's board are equal. When it moves to the right or the left of the true course, this is shown

at once by one of them having a larger vibration than the other. A somewhat similar arrangement, using lower power and a smaller loop antenna, is used to give the pilot the direction of the runway on which he is to land. The pilot knows when he is approaching the boundary of the field on which he intends landing, as he hears a special signal in the headphones which gets louder as he approaches the field but disappears completely when he is directly over the antenna, which is placed on the edge of the field. To tell the proper angle at which he is to glide, high-frequency signals are directed along a narrow beam. The line of greatest signal strength is along the axis of the radio beam, and at a short distance away it drops considerably. The pilot should hit the axis of the beam and then start to drop, keeping the signal strength constant, the approach to the transmitter compensating for the greater distance from the axis. This gives very approximately the proper landing curve; the instrument indicates whether he is flying too high or too low. A vertical pole antenna and a horizontal doublet antenna fixed on the aeroplane are used to receive the landing system signals.

Determination of Reducing Sugars.—Schuette and Terrill, in the December number of the *Journal of the American Chemical Society*, describe experiments on the use of cupropotassium carbonate solution, first proposed by Soldaini in 1876, in the determination of reducing sugars. They investigated four types of solution and show that it is doubtful whether Beyersdorfer's form of the solution can be used as a selective reagent for levulose, as has been asserted. The effects of varying the experimental conditions were fully studied and mathematical expressions described.

Strainless Ring Structure in Cyclohexane.—In a communication to the Editor, Dr. Muhammad Qudrati-Khuda, of Presidency College, Calcutta, states that he has found evidence of a 'strainless ring' structure in cyclohexane. He has discovered that 4-methyl-cyclohexane-1-carboxy-1-acetic acid,



is capable of existing in four stereoisomeric modifications. The stabilising of these forms is attributed, as in decalin, to a restraint of the internal rotatory movement of the carbon atoms, brought about in this case by substituting heavier groups for some of the hydrogen atoms of cyclohexane. A fuller account is to be published shortly.

Molecular Iodine.—The separation of two forms of molecular hydrogen (both being represented by the formula H_2) has naturally raised the question of whether other diatomic gases can be similarly treated. From its band spectrum it would be anticipated that this should also be possible with iodine, and an attempt on this substance, which appears to have been partly successful, is described by R. M. Badger and J. W. Ormiston in the December number of the *Proceedings of the National Academy of Sciences*. The method adopted was photochemical; only one form is excited by exposure to the green line of mercury (λ5461), and this can then be removed by a reaction with hexene. After a prolonged treatment, evidence was obtained that the residual iodine molecules had different fluorescent properties from the original mixture of the two forms, but the amount of separation which had been effected was evidently not large. The reasons for this are not clear, but the authors consider the method sufficiently promising to be followed still further.

Specific Heats and Entropies of Metals.—The specific heats of thallium, calcium, and magnesium from 10° to 200° abs. have been determined by Clusius and Vaughan, whose results are given in the December number of the *Journal of the American Chemical Society*. The extrapolation to absolute zero could be made with some certainty, and thus the absolute entropies calculated. The results for the atomic heats were higher in the case of thallium and lower in the case of magnesium and calcium than those of previous workers. Whilst in the case of calcium (which was found difficult to free from hydrogen), the atomic heat curve could be very approximately represented with a single Debye function, this was not possible with thallium, the θ value of which decreased below 17° abs., nor with magnesium, the θ value of which increased appreciably below 30° abs. A more rapid decrease of atomic heat than is to be expected from the T^3 law has previously been observed only with copper and tungsten. The vapour pressure constants are calculated from the results. Although the error is of the order of 25 per cent, it is claimed that it agrees very well with that given by the usual statistical formula (0·443 and 0·493), the entropy of magnesium vapour at 1 atm. and 25° being 35·29 units determined empirically and 35·51 from theory.

Entropy of Hydrogen.—Recent progress in the development of statistical mechanics and the discovery of the two forms of hydrogen molecule foreseen by the wave theory have made it necessary to revise carefully the calculation of the entropy (or free energy) of hydrogen from spectroscopic and other data. This question is dealt with in two papers by Giauque in the December number of the *Journal of the American Chemical Society*. In the first of these, a considerable simplification is introduced into the method of calculating the free energy from spectroscopic data. Every state is assumed to possess the same statistical weight: the statement that a certain state has an *a priori* weight of three means that the state is really three states which have been grouped together for simplicity of calculation, having so nearly the same energies that they are affected in nearly the same way by temperature but really individual states in a statistical sense. Previous calculations are shown in some cases to be in error. A simple new derivation of Reiche's well-known equation

$$S^\circ = R[\ln Q_T + T \,.\, d \ln Q/dT]$$

is given and it is believed that this equation will hold for all states, including multiplicities due to nuclear effects such as spin. When the necessary atomic or molecular levels are known, Q may be calculated. In the second paper the author considers the case of hydrogen, on the basis of recent data (NATURE, Mar. 22, 1930, pp. 462-463), and "the numerous misunderstandings which have arisen concerning the effect of nuclear spin on the entropy of hydrogen" are cleared up. A new calculation of the heat capacity of hydrogen, without assuming rigidity of the molecule, is given. The absolute entropy of hydrogen at 25° C. is found to be 33·98 cal. per 1° per mol. This, however, is not the value to be used in combination with $\int C_p \ln T$ for other substances, since an entropy of mixing must be subtracted on account of the existence of ten kinds (one para- and nine ortho-) in the solid. A detailed discussion of this point is given, and it is concluded that, whilst some uncertainty may remain as to the effect of nuclear spin on other substances, no reasonable doubt exists as to the value of the entropy of hydrogen.

Light Intensity of a Quartz Mercury Lamp.

DR. TSUNESABURO ASADA, of the Shiomi Institute of Physical and Chemical Research, Osaka, Japan, has sent us an interesting communication describing measurements he has made on the intensity of the light emitted by a quartz mercury lamp. The instantaneous values of the light intensity at several points of the luminous part of an alternating current quartz mercury lamp, the terminal voltage, and the current were all measured by the help of an

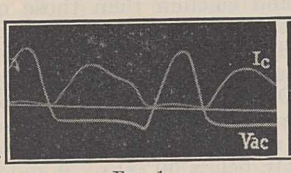


FIG. 1.

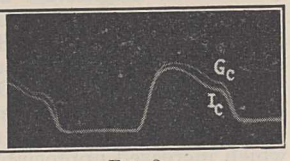


FIG. 2.

oscillograph. In carrying out the test, the image of the lamp was projected by means of a lens on to a screen.

The intensity of the light on each part of the image was found by a vacuum cæsium photoelectric tube. The photoelectric current was first amplified by a triode, which was found to give no deformation of the shape of the current wave.

In Fig. 1 an oscillogram is shown of the current I_c flowing in one of the anodes C and the terminal voltage V_{ac} across it. This oscillogram shows clearly that so long as there is an appreciable current through the electrode, its terminal voltage is practically constant.

Fig. 2 is an oscillogram of the current I_c and the intensity of the light G_c in the neighbourhood of the anode C. From these two oscillograms it is concluded that so long as the terminal voltage is constant the intensity of the light emitted is directly porportional to the current.

A special direct current mercury lamp was made of transparent fused quartz which could be used at various current densities. The light intensity of the lamp was measured by a monochrometer and a vacuum photoelectric tube. It was found that the relation between the intensity of the light G, the current I, and the potential difference V between the anode and the cathode could be expressed by a formula of the form

$$G = kI(V - V_0)^n$$

where k and V_0 are constants.

V_0 is the least potential difference between both the electrodes required to maintain the arc, and is a constant for a given lamp. For a given wave-length, the number n is constant.

It was found by plotting curves having log (G/I) as ordinates and log $(V - V_0)$ as abscissæ that, provided the potential difference was not very small, the resulting curve was a straight line. The formula is an experimental one. It shows that when the temperature of the mercury vapour is raised by increasing the terminal voltage, the radiations of longer wave-length increase much more rapidly than those of shorter wave-length. This radiation, therefore, follows quite a different law from black-body radiation.

Experiments with the alternating current mercury lamp show that the formula given above still holds, provided we take the mean value of the light intensity, the effective potential difference between one of the anodes and the cathode, and the effective value of the input current. The value of n, however, is different from that for the direct current mercury lamp.

Marine Biology in Madras and Ceylon.

THE Administrative Report for the year 1928–29 of the Madras Fisheries Department, by Dr. B. Sundara Raj, Director of Fisheries, Madras (Report No. 1 of 1930, *Madras Fisheries Bulletin*, vol. 24, 1930), embraces a large variety of subjects. Part 1 describes the activities of the Department, including marine and estuarine fisheries, inland food fishes, pearl and chank fisheries, biological specimen supply, anti-malarial and socio-economic work, and fish industries. Part 2 deals with finance, Part 3 with staff and equipment, with various appendices. The importance of investigation relating to food fish is emphasised as being the primary object of a scientific department of fisheries. It is evident that here great difficulties are encountered from lack of proper accommodation and staff; nevertheless, it is shown that progress is being made. Research on marine fisheries was undertaken by the trawler *Lady Goschen*, and on three shore stations at West Hill (Calicut), Krusadai Island, and Vizagapatam, the first two stations being provided with small laboratories; and at the Madras Aquarium laboratory work is being done on the early stages of the edible oyster. Survey of fishing banks and experimental trawling was carried on, including extensive cruises from Mangalore to Cape Comorin; fishes and certain invertebrates were identified and plankton collections made. So far only the otter trawl is used for fishing. The Danish seine could not be employed, as the motor boat originally intended for the purpose was condemned as too old for the open sea. Proposals have been made to the Government for the purchase of a small motor boat, and a drift net and long lines for surface fishing are ordered.

Investigations in the Collair Lake on the prawn *Peneopsis monoceros*, the "Chakku Royya", were continued, but still little is known about the breeding grounds of this commercially important crustacean. Again the absence of staff for this work is to be regretted. Deep-water tank fishing in the Mopad Reservoir was satisfactory, a backwater net from Ennore, drift nets, and long lines being used with good results. Fish breeding and stocking experiments appear to have been unsuccessful for various reasons. Pearl oysters still continue to make sudden appearances and disappearances. It is proposed to undertake extensive research connected with this subject when the Krusadai Biological Station is instituted; meanwhile regular inspection of the pearl banks goes on, and any spat-falls will be noted.

The Fisheries Training Institute, Calicut, provides courses of study in the elements of navigation and handling of sailing boats, with classes in fish-curing, and pupils are on the increase.

The Administration Report of the Marine Biologist of Ceylon for 1929 (Part 4—Education, Science, and Art (G). July 1930), by Dr. Joseph Pearson, contains information on the pearl fishery, Gulf of Manaar, the window-pane oyster fishery and chank fisheries, with fishery statistics, report of the second assistant marine biologist and of the marine superintendent.

The year 1929 was unfortunate for several reasons, and the absence of Dr. Pearson made it necessary to abandon the inspection of the new paar which was discovered in the region of Twynam's Paar, and which in the previous February and March was densely covered with oyster spat for a considerable part of its area of some 30 square miles. The usual survey of the Pedro and Wadge Banks was also abandoned.

In November, however, a portion of the area off Chilaw was examined by a running survey by dredge for the purpose of charting the paar area, and a chart is given with the present report. In this charting no idea can be given of the number of oysters present, but a picture is provided of the general limitations of the paar ground and the general slope of the area. It also shows the nature of the paar and will indicate the presence of oysters, although small patches of oysters may be missed. Current observations on the main Pearl Banks were continued. There is a westerly trend in all currents which would tend to take all pelagic oyster larvæ present when the observations were made out into the deep water, where they would be lost.

Dr. Pearson has obtained all particulars for a new boat to take the place of M.L. *Lion*, which has been condemned. The new boat is to be of the modern Scotch type of fishing boat, with a length of 45 feet, beam 13 feet 6 inches, draught 5 feet 6 inches.

Afforestation in New Zealand.

THAT private companies have been formed in New Zealand to promote afforestation work is well known. Many of these companies have now been federated into the New Zealand Timber Growers' Association, which publishes an official quarterly known as the *Timber Growers' Quarterly Review*, the second number (for September last) of which has recently appeared. This number deals primarily with reports, etc., of the 1930 Conference of the member companies of the Association.

The attitude of the companies towards this new national industry and the aims and objects of the latter are well portrayed and merit a close study in Great Britain. The member companies in the Association now represent a combined capital of £5,000,000. "Afforestation in a minor way", it is truly said, "is practically useless and would really mean nothing whatever either to New Zealand or the Empire; and although the companies represented in the Association to-day have joint afforestation schemes in hand comprising over 250,000 acres, the desired objective is a million acres of exotics." The magnitude of the task can be readily appreciated, as also the value of combining.

The delegates to the Conference had the opportunity of meeting the Prime Minister, Hon. G. W. Forbes, who has recently been at the Imperial Conference in London, and the Minister responsible for the N.Z. Forest Department, the chief matter under discussion being the important one of future co-operation in research work. Here the Association is taking the broadest views. The president, Mr. W. Fraser, in discussing the question with the Minister, pointed out that while the Association "had planned in the first instance to establish its own arms of research, the successful functioning during the past 12 months of the Biological Committee, to which not only the Association but also the Bureau of Scientific and Industrial Research, the Cawthron Institute, the Sawmillers' Federation, and the Forestry Department had contributed brains and money, had indicated the possibility of still further co-operation in matters that are equally of joint interest and joint advantage".

The New Zealand Timber Growers' Association is said to consist largely of business men who may be regarded as trained executives and organisers. It also embodies technical forestry men of wide and sound experience and established judgment. It regards research as being a most important and vital adjunct or partner of business, and is prepared to forward energetically and substantially to endow useful research along business lines in the interests of afforestation. This was the message of the 1930 Conference.

There was no attempt on the part of the Conference to minimise the value of the work (much of it of an experimental nature) of the State Forest Service during the past quarter of a century. Far otherwise. But the importance of the provision of a large volume of softwood timber, which it has been shown can be grown on large areas of available land, has been fully realised; also that this work, to be done expeditiously, is a purely business proposition, quite outside the capacity of a State Department, which could not be granted the funds from the public purse to carry it on with such rapidity.

The realisation of this fact and the coming of the private companies, run on investors' capital, is remarkable and furnishes evidence of a shrewd foresight on the part of the New Zealanders. Not less remarkable, if we compare it with the reduplication of research work in different institutes and so forth in Great Britain, is the swift recognition by the leaders of the Association that co-operation in research with the existing centres would be the most practical step to take, instead of bringing into being new and independent ones.

Archæological Investigation in Oregon, U.S.A.

RESULTS of archæological investigation on the middle Columbia River undertaken by the University of California in 1924–26 are recorded by W. D. Strong, W. E. Schenck, and J. H. Stewart in the University's *Publications in American Archæology and Ethnology*, vol. 29, pt. 1, under the title "Archæology of the Dalles-Deschuttes Region". This area was chosen for investigation as the geographical and economic conditions at this point of the river are such as to have made it one of great importance to primitive man, and it must have been occupied from a remote period.

Seven distinct types of evidence were exposed, these including the Wakemap Mound, village sites on Miller's Island, burials—cremation and pre- and post-Caucasian inhumations—as well as numerous petrographs. Of these, the most important were the mound, on account of the depth of the deposit containing evidence of occupation, and the cremation burials, on account of the richness of their culture. It was noted that the culture of the cremation burials was quite distinct in character from that of the mound, the former being of an entirely ceremonial and ornamental character, while the objects from the mound were entirely utilitarian. On the whole, however, there was good reason to think the two are connected, and to regard them as representing two sides of a single culture. It is also suggested that the old type conical, semi-subterranean house is connected with the mound culture, but that connexion is not yet proved.

It seems probable that most of the rock carvings are to be associated with the mound and cremation culture, most of them being attributed to the Wakemap people. There is a lack of relationship between the post-Caucasian burials and the mound and

cremation culture; but some can be assigned to the Sahaptin. The relationship of the pre-Caucasian burials at the upper end of Miller's Island to the Wakemap culture is not yet clear.

The general conclusion as a result of the investigations seems to be that the earliest comers to this region possessed a culture, already well developed, which was basically Salish. After a long period it was gradually modified by coastal influence, very probably through Upper Chinookan tribes, but also probably from the centre of Washington. This is manifested principally in the art, which combined the plateau and coast styles to produce a local style, expressed in the petrography and the ground and sculptured stone-work. The ultimate fate of the Wakemap and cremation culture is unknown; but the continuity of Salish culture was broken by the Sahaptin and Waiilatpuan migrations. The Dalles-Deschuttes Salish disappeared. They may have been absorbed by the Wasko and Wishram.

Malayan Medicine.

THE two publications on Malayan medicine, referred to in NATURE for June 7, p. 862, have now been supplemented by "The Medical Book of Malayan Medicine" (*The Gardens' Bulletin*, Straits Settlements, 1930, vol. 6, part 3), edited by Dr. J. D. Gimlette and Mr. I. H. Burkill.

In 1928 the attention of the two editors was directed to a manuscript in the possession of the Pharmaceutical Society, entitled "This is the Medical Book of Malayan Medicine". The history of the manuscript has been lost, but the editors, from their expert knowledge of the subject, have been able to suggest that the original document, of which this manuscript is a translation, made by a *munshi* (teacher of languages) named Inche' Ismail, consisted of a series of notes on diseases and the prescriptions necessary to cure them, made by a native practitioner, probably resident in Penang. The compiler seems to have allowed a British official in Malaya to have the notes translated by Ismail, possibly with the view of the translation forming part of the collections assembled in the Straits Settlements for display on behalf of that Colony at the Colonial and Indian Exhibition held in London in 1886.

The manuscript, corrected and edited, is now published with Dr. Gimlette's diagnostic notes of the diseases which appear to be indicated by the Malayan practitioner's descriptions of symptoms, and with Mr. Burkill's determinations of materia medica. There are 543 prescriptions in the book, ranging from a village simple such as the juice of a banana tree, used for a disease which, judging from the symptoms, Dr. Gimlette thinks, may be either rheumatic or dengue fever, up to No. 289, in which a concoction of 29 drugs is prescribed for anointing the body in cases of smallpox. This is not a record for polypharmacy, for *Confectio Damocratis*, supposed to have been invented by Mithridates the Great (born 134 B.C.), contained at least 44 ingredients, and had a great reputation in the Middle Ages as a prophylactic against the plague.

Modern medicine is not likely to reap any considerable benefit from the labours of the two learned editors, but this, like the two previous publications in the same series, is of great interest and importance as a contribution to the history of the development of medicine. In this connexion special mention should be made of the glossary of Malayan names for drugs and diseases, which is arranged as part of the excellent index to the volume.

University and Educational Intelligence.

CAMBRIDGE.—The Faculty Board of Physics and Chemistry have reappointed Dr. J. Chadwick, of Gonville and Caius College, assistant director of radio-active research at the Cavendish Laboratory.

The prize of £30 from the Gordon Wigan Fund for a research in chemistry in the year 1930 has been awarded to P. S. H. Henry, of Trinity College, for a dissertation entitled "The Experimental Determination of the Specific Heats of Gases".

Two new professorships have been established by Grace of the Regent House. One is in geography, and the first holder will be Mr. F. Debenham, of Gonville and Caius College. The other is in experimental psychology, and the first holder will be Mr. F. C. Bartlett, of St. John's College.

LONDON.—The Julius Mickle Fellowship was awarded to Dr. C. H. Andrewes for 1931, for his research work on viruses.

OXFORD.—On Feb. 3 Congregation passed a decree accepting the offer of the Forestry Commission and the Secretary of State for the Colonies to make contributions at the rate of £5000 a year as from March 1929 to July 1931 to the maintenance of an Imperial Forestry Institute in Oxford, the University undertaking to make during the same period contributions to the Department of Forestry at a rate not exceeding £300 a year in addition to its current contribution. Mr. C. G. Morison, in proposing the decree, explained that it is a renewal of a former decree. The Institute, which has now been in existence for about five years, is active in research and in giving post-graduate instruction. The relations between the Institute and the University are at present engaging the attention of Council.

A COURSE of lectures on "Dielectrics" will be delivered at the Northampton Polytechnic Institute, St. John Street, E.C.1, by Dr. L. Hartshorn, on Mar. 4, 11, 18, and 25. They will deal with the phenomena of leakage, absorption, power losses in alternating fields, dielectric strength, and so on, and will be especially addressed to those concerned with the manufacture and industrial applications of insulating materials.

MR. A. T. STARR has been appointed to the staff of Faraday House Electrical Engineering College, London. Mr. Starr took the London B.Sc., with first-class honours in mathematics, in 1925, receiving also the Lubbock Prize. At Cambridge he obtained a major scholarship at Corpus Christi College, took a first-class in both parts of the Mathematical Tripos, and received honourable mention in the Smith's Prize examination. For the past three years Mr. Starr has been working in the laboratories of the International Telephone and Telegraph Company.

A CONFERENCE on "Changing Education in an Old Empire", organised by the New Education Fellowship, will be held at Bedford College, London, on July 24-30, under the presidency of Sir Percy Nunn. Mr. K. Lindsay is the honorary secretary, to whom all communications should be addressed, c/o New Education Fellowship, 11 Tavistock Square, London, W.C.1. It is hoped that the Conference will lend support to the project of establishing in London a permanent educational institute to act as research bureau and central clearing-house of educational ideas for the Empire.

Birthdays and Research Centres.

Feb. 12, 1872.—Prof. A. J. EWART, F.R.S., professor of botany in the University of Melbourne.

The chief investigation I have now in progress is an attempt to produce graft hybrids between species of Eucalyptus, which I have been working on for more than ten years. Another problem in hand is in regard to the influence upon animals of the prolonged ingestion of plants containing saponin.

Feb. 16, 1848.—Prof. HUGO DE VRIES, For.Mem.R.S., formerly professor of plant anatomy and physiology in the University of Amsterdam.

My chief investigation now in progress is on the inheritance of characters of new mutants of *Œnothera Lamarckvana*.

A subject to which I think attention might usefully be given is the difference and analogy between phylogenetical and explosive mutability.

Feb. 17, 1884.—Prof. JOHN READ, professor of chemistry in the United College of St. Salvator and St. Leonard, University of St. Andrews.

The endowed chemical research laboratories at St. Andrews have accommodation for about sixteen research workers, apart from members of the staff, and as a rule this is fully utilised. Most of the numerous publications which have appeared from this organic chemical school during the last twenty-five years have been concerned with the chemistry of sugars and the more complex carbohydrates; stereochemical problems also have been studied.

My students have continued the stereochemical tradition, in publications upon such subjects as the optical resolution of simple asymmetric compounds and stereochemical relationships in the hydrobenzoin series. A second series of investigations deals with the formation of halogenohydrins from unsaturated compounds. Our chief field of work, which maintains the traditional interest of the school in natural organic products, is the systematic chemical and stereochemical study of menthols, menthones, piperitones, phellandrenes, carvone, and related substances derived directly or indirectly from essential oils of plants. We are interested also in the biochemical origin and ancestry of these substances. In my opinion, results of great biochemical value would attend systematic collaborative work between organic chemists and botanists in tracing the chemical effect of hybridisation, as evidenced, for example, in the composition of essential oils in a suitable genus such as *Eucalyptus*.

Feb. 17, 1890.—Dr. R. A. FISHER, F.R.S., head of the Statistical Department, Rothamsted Experimental Station, Harpenden, Herts.

The great event of our generation for the progress of the human mind is, I believe, the development of a comprehensive and rational theory of inheritance. If this 'mystery of mysteries' is capable of a simple and definite formulation, need any biological problem, however complex, be regarded as incapable of exact treatment?

The new knowledge has so far had no appreciable effect on the means whereby practically important improvements are made in domesticated animals and plants. The characters which confer value are always quantitative and depend upon the cumulative effects of numerous separable factors. Selection of favourable combinations as practised from time immemorial by breeders, such as Chevalier or Burbank, is still the only effective method. What is needed, and seems now practicable, is the quantitative evaluation by extensive measurements, combined with systematic mating, of the selective possibilities of the populations available for selection. This is an almost untouched field and will remain so so long as genetics and biometry are mutually exclusive studies.

Feb. 26, 1864.—Mr. JOHN EVERSHED, F.R.S., lately director of the Kodaikanal and Madras Observatories.

The main objects of my present research are to determine the solar rotation at high levels, and the general shift towards red of the calcium, hydrogen, and iron lines. Previous work here has shown that prominences give a daily angular speed of rotation about 3° in excess of that given by the reversing layer. I shall attempt to determine whether this excess holds throughout the sunspot cycle, or is connected with sunspot frequency.

My measures show that the shift of the lines *H* and *K* towards red exceeds the Einstein effect, both in prominences and chromosphere, by 0·007 A., and iron lines at the limb in the same spectral region give nearly the same excess. The cause of this 'limb effect' is a mystery, and measures of solar spectra will be continued in the hope of throwing new light on the problem.

Societies and Academies.

LONDON

Royal Society, Feb. 5—**C. F. Jenkin**: The pressure exerted by granular material. A model consisting of a rectangular frame holding a single layer of steel discs was made which reproduces the leading phenomena observed in sand, particularly the effects of 'arching'. The solutions are found for the forces exerted by the discs under a number of different conditions, including three typical examples of arching. In the light of these results, an apparatus was designed for measuring the pressure of sand on a retaining wall in which *end arching* was eliminated. The most important new result obtained is that the centre of pressure may be very much higher than was supposed, and that the pressure distribution on the wall is quite different from the triangular distribution commonly assumed.—**F. L. Arnot**: The diffraction of electrons in mercury vapour. An investigation of the angular scattering of electrons in mercury vapour over an angular range of from 18° to 126° is described. Results are shown for fifteen different velocities of the primary beam between 8 and 800 volts. All the scattering curves show distinct maxima and minima, maxima of four different orders being obtained. The absolute scattering of 82-volt electrons between 15° and 60° has been redetermined.—**S. Rama Swamy**: On the transmission of light by thin films of metal. Quantitative observations on the transmission coefficient of metal films for different wave-lengths of light in the visible range and its changes on heating the films are described and discussed. Thin films of gold and silver, obtained by cathodic sputtering, were heated in a furnace and their absorption spectra photographed at different temperatures, a pointolite lamp being the source of light. The transmission coefficient was deduced from the photometric measurements of the spectrograms.—**D. C. Colbourne**: The diurnal tide in an ocean bounded by two meridians. The diurnal tide is considered in an ocean on a rotating globe bounded by two meridians 60° apart and of uniform depth 12,700 ft. The solution of the general dynamical equations of the tides satisfying the required conditions is obtained by the introduction of a null function according to the method developed by

Goldsbrough. By means of this solution the tidal amplitudes and phase angles at numerous points have been calculated. Amplitudes of the diurnal tide are considerably smaller than those of the semi-diurnal tide, and the range of values obtained for the phase is unusually limited.

Linnean Society, Feb. 5.—**Miss S. Finnegan**: Brachyura collected by Dr. Crossland on the *St. George* Expedition to the Pacific, 1924–25. Sixty-five species of crabs were collected, of which eight are new, and one new variety is described. In addition, the opportunity has been taken to analyse all the existing records of Brachyura from the region in question, and to attempt to identify the various geographical elements in the fauna. The chief conclusions are that certain genera may be regarded as typically American. So far as the scanty geological evidence goes, these genera do not date further back than the Pliocene. There is evidence that the similarity between the Indo-Pacific and Panamic faunas was greater in the past that it is to-day.

DUBLIN.

Royal Irish Academy, Jan. 26.—**G. H. Nall**: Irish sea trout. This paper deals with the results obtained from the examination of some 2200 samples of scales taken from sea trout from ten river systems in the west of Ireland. The average age, rate of growth, age at migration and at first return from the sea to spawn, the number of spawning marks, etc., are determined and comparisons made with similar results obtained from the examination of sea trout scales in various rivers in Scotland. The chief characteristic of the sea trout from the west of Ireland rivers which emerges from this study is the relatively small size attained. The average duration of life is comparatively short. The proportion of sea trout which returns to the river, after only a short stay of a few months in the sea, is high. It is suggested that some of the rivers are deficient in food for the large numbers of fry which are present. The low growth-rate during sea life is possibly due to the absence of rich feeding-grounds adjacent to the mouths of the various rivers.

CRACOW.

Polish Academy of Science and Letters, Nov. 10.—**W. Kapuschinski**: The fluorescence of zinc vapour. The saturated vapour of zinc, excited by ultra-violet light, gives a fluorescence spectrum containing lines and bands. Details of the study of this spectrum are given.—**L. Orkisz**: The final orbit of the comet 1925, 1 (Orkisz). The elements given are based on observations made between April 5, 1925, and May 12, 1926.—**K. Dziewonski, B. Grünberg, and Mlle. J. Schoenowna**: Researches on the acenaphthene sulphonic acids.—**S. Kozik**: Two chlorites in veins from Haute Tatra. These chlorites occur in veins about 2 cm. thick in granite; their composition is quite different from that of the granite.—**F. Bieda**: Remarks on the nomenclature and classification of certain species of Nummulina (1).—**J. Zerndt**: *Triletes giganteus*, a huge megaspore found in coal. This spore has been found in coal from nearly all levels of Polish coal strata. It measures 6·4 mm. in diameter and is the largest megaspore known.—**M. Kostowiecki**: The relation between Hassal's corpuscles and the neighbouring blood-vessels in the thymus of the human fœtus.

SYDNEY.

Linnean Society of New South Wales, Nov. 26.—**O. H. Sargent**: Xerophytes and xerophily, with special reference to protead distribution. The author records observations on the distribution of Proteads in Western Australia, particularly in its relation to soil conditions and rainfall. He details experiments in estimating the water needs of a few species, and also in estimating the degree of transpiration by the two types of leaf (broad leaves and needles) found on *Hakea trifurcata*.—**W. L. Waterhouse**: Australian rust studies (3). Initial results of breeding for rust resistance. Following upon specialisation studies of *Puccinia graminis tritici* in which it was shown that prior to 1926 two groups of forms, namely, (1), 43, 44, and 54, and (2), 45, 46, and 55, were present in Australia, breeding for complete resistance was undertaken. Many commercial varieties behave reciprocally to these two groups. The inheritance of resistance was traced in the cross between these, as well as between other varieties. Resistance is dependent upon a single dominant factor in these varieties.—**I. A. Brown**: The geology of the south coast of New South Wales (3). The Monzonitic Complex of the Mount Dromedary district. The main intrusion probably assumes a laccolithic form. A number of rare rock-types are included. Detailed petrographic descriptions of the various types are given, and these are compared with rocks in other parts of the world. The mineralogical and chemical evidence of consanguinity of a number of types supports the field evidence of the comagmatic origin of the monzonitic types. The possible origin of the nepheline-bearing and garnet-bearing rocks is considered, and is compared with that of similar occurrences at Magnet Cove, Arkansas; the Fen District, Norway; and elsewhere.—**G. Carey**: The leaf-buds of some woody perennials in the New South Wales flora. Leaf-buds in New South Wales are divided into three classes: (*a*) scaly, (*b*) intermediate, and (*c*) naked. A great variability of bud types is shown among genera of any one family, and among the species of a single genus. The evidence points to the fact that bud structure and development are influenced by the physiology of the shoot.—**H. L. Jensen**: Notes on a cellulose-decomposing soil-fungus of an unusual character. A fungus, probably belonging to the genus *Botryosporium*, was isolated from an English field soil with addition of manure. This organism proved very sensitive to acid reaction, *p*H 4·5 being very near the limit of acidity at which growth could be induced; a good growth would only take place at *p*H values above 6·0, and an optimum zone seemed to stretch from *p*H 6·6 to *p*H 7·4 and possibly higher. In neutral or alkaline solution the fungus exerted a very strong cellulose-decomposing activity, in unbuffered physiologically acid solution almost none. Its sensitiveness to acidity is greater than that of any fungus hitherto studied in this respect.

VIENNA.

Academy of Sciences, Oct. 16.—**E. Beutel and A. Kutzelnigg**: (1) Analysis by luminescence.—(2) Luminescence of painter's white colours and application of analysis by luminescence to the investigation of paintings.—(3) Observations in the alkaline earth group and numerical criteria of luminescence.—**A. Haas**: A relation between the radial velocity of spiral nebulæ and the disintegration velocity of matter.—**K. Lehnhofer**: Deformities in species of *Sapphirina*.—**F. Halla**: Röntgenographic distinction between magnesite and dolomite.—**A. Deseyve**: Secondary corpuscular radiation released from light elements by α-rays. The disintegration of silicon and phosphorus with α-particles from polonium seems new. (See Radium Institute Circular No. 267.)—**E. Tschermak**: (1) New observations on the fertile hybrid *Triticum turgido-villosum*.—(2) Xenia in Leguminosæ. Several cases of apparent direct action of foreign pollen on colour and form of seeds.—

E. Dittler and H. Lasch: Synthetic researches on the formation of mixed crystals of barium and strontium felspar with orthoclase.—F. Raaz: The structure of synthetic gehlenite, $2CaO.Al_2O_3.SiO_2$.

Oct. 23.—R. Scheu: Relations between tensile strength in oscillation by bending and by twisting.—M. Beier: Zoological expedition to the Ionian Islands and the Peloponnesus. (14) The slugs treated by H. Wagner.—K. Gödel: Some mathematical results on definiteness of decision and freedom from contradiction.

Official Publications Received.

BRITISH.

Borough of Cheltenham Public Library, Art Gallery and Museum. Forty-sixth Annual Report of the Public Library Committee and the Thirty-first Annual Report of the Art Gallery and Museum Committee, 1st April 1929 to 31st March 1930. Pp. 24. (Cheltenham.)

Union of South Africa. Department of Mines and Industries: Geological Survey. Memoir No. 12: Asbestos in the Union of South Africa. By Dr. A. L. Hall. Pp. 324+37 plates. (Pretoria: Government Printer.) 7s. 6d.

South Australia: Department of Mines. Mining Review for the Half-year ended June 30th, 1930. (No. 52.) Pp. 87+6 plates. (Adelaide: Harrison Weir.)

Air Ministry: Aeronautical Research Committee. Reports and Memoranda. No. 1314 (Ae. 457): Some Approximate Solutions of the Boundary Layer Equations. By V. M. Falkner and Sylvia W. Skan. (T. 2937: T. 2758.) Pp. 35+21 plates. (London: H.M. Stationery Office.) 2s. net.

Report of the Meeting of the Ross Institute Industrial Anti-Malarial Advisory Committee, held in the Council Chamber of the Rubber Growers' Association, 2 Idol Lane, E.C.3., on Tuesday, December 16th, 1930, at 2.15 p.m. Pp. 16. (London: The Ross Institute.)

Torquay Natural History Society. Transactions and Proceedings for the Year 1929–30. Vol. 5, Part 4. Pp. 259-368. (Torquay.)

The Proceedings of the Physical Society. Vol. 43, Part 1, No. 236, January 1. Pp. viii+118. (London.) 7s. net.

Indian Central Cotton Committee: Technological Laboratory. Technological Bulletin, Series B, No. 10: Studies in the Sampling of Cotton for the Determination of Fibre-Properties. Part 3: The Size and Reliability of a Satisfactory Sample. By Ram Saran Koshal and Dr. A. James Turner. Pp. ii+39. (Bombay.) 1 rupee.

Transactions of the Mining and Geological Institute of India. Vol. 25, Part 2, November. Pp. 81-182. (Calcutta.) 4 rupees.

FOREIGN.

Conseil International de Recherches, Union Géodésique et Géophysique Internationale: Section d'Hydrologie scientifique. Bulletin N. 5: Réunion du Comité executif de la Section (Genève, 14 avril 1927). Notes et communications. Pp. 31. Bulletin N. 13: Réunions du Comité exécutif de la Section (Paris, 4 avril 1928—Séville, 4 mai 1929). Notes et communications (1 mars 1930). Pp. 40. Bulletin N. 14: Rapport de la Commission des glaciers, 1930. Pp. 53. Bulletin N. 15: Note e comunicazioni della Sezione nazionale italiana. Pp. 148. (Venezia: Carlo Ferrari.)

Ministry of Agriculture, Egypt: Technical and Scientific Service (Plant Protection Section). Bulletin No. 101: Growth Fluctuations during the Development of Seed-Cotton. By Dr. W. Lawrence Balls. Pp. ii+15+2 plates. (Cairo: Government Press.) 5 P.T.

Journal of the Faculty of Science, Imperial University of Tokyo. Section 1: Mathematics, Astronomy, Physics, Chemistry. Vol. 2, Part 3. Pp. 51-72. 0.40 yen. Vol. 2, Part 4. Pp. 73-131. 0.90 yen. Section 3: Botany. Vol. 3, Part 1. Pp. 484. 7.00 yen. (Tokyo: Maruzen Co., Ltd.)

Collection des travaux chimiques de Tchécoslovaquie. Rédigée et publiée par E. Votoček et J. Heyrovský. Année 2, No. 12, Décembre. Pp. 699-724+xxiv. (Prague: Regia Societas Scientiarum Bohemica.)

National Research Council of Japan. Report No. 4-5, April 1924–March 1926. Pp. ii+65-118. Report No. 6-7, April 1926–March 1928. Pp. iii+119-228. (Tokyo.)

U.S. Department of Commerce: Bureau of Standards. Bureau of Standards Journal of Research. Vol. 5, No. 6, December. Pp. ii+1189-1318. (Washington, D.C.: Government Printing Office.) 40 cents.

CATALOGUES.

Radiostol. Pp. 4. (London: The British Drug Houses, Ltd.)

Watson's Microscope Record. No. 22, January. Pp. 28. (London: W. Watson and Sons, Ltd.)

Eastman Organic Chemicals. List No. 22, January. Pp. 99. (Rochester, N.Y.: Eastman Kodak Co.)

Diary of Societies.

FRIDAY, FEBRUARY 13.

ROYAL ASTRONOMICAL SOCIETY (Annual General Meeting), at 5.—Presidential Addresses by Dr. A. C. D. Crommelin on the award of the Gold Medal to Prof. W. de Sitter, and the Jackson-Gwilt Medal and Gift to C. W. Tombaugh.

BIOCHEMICAL SOCIETY (at Lister Institute), at 5.—W. T. J. Morgan: A Specific Precipitating Polysaccharide from *B. dysenteriæ* (Shiga).—L. F. Hewitt: Oxidation-Reduction Potentia s of Pneumococcus Cultures.—B. C. Guha: Investigations on Vitamin B_2.—E. Boyland and O. Meyerhof: Glycogen Synthesis in Muscle Poisoned with Mono-iodoacetic Acid.—Gladys Bird and P. Haas: The Cell Wall Constituents of Laminaria. Mannuronic Acid.—M. G. Macfarlane: The Influence of Potassium Mono-iodoacetate on Fermentation by Yeast Preparations.—R. Robison and E. J. King: Hexosemonophosphoric Esters.—W. Robson and J. Lamb: The Erlenmeyer Synthesis of Amino-acids.

ROYAL COLLEGE OF PHYSICIANS OF EDINBURGH, at 5.—Dr. D. K. Henderson: Social Psychiatry (Morison Lectures) (3).

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

BRITISH PSYCHOLOGICAL SOCIETY (Æsthetics Section) (at Bedford College), at 5.30.—R. Ellis Roberts: Reality in Life and Literature.

MALACOLOGICAL SOCIETY OF LONDON (Annual General Meeting) (at Linnean Society), at 6.—G. C. Robson: Some Problems of Molluscan Evolution (Presidential Address).

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS (at Mining Institute, Newcastle-upon-Tyne), at 6.—W. C. S. Wigley: Ship Wave Resistance—an Examination and Comparison of the Speeds of Maximum and Minimum Resistance in Practice and in Theory.

SOCIETY OF CHEMICAL INDUSTRY (Chemical Engineering Group) (at Institution of Civil Engineers), at 6.30.—D. MacDonald: Silver, and its Application to Chemical Plant.

INSTITUTION OF LOCOMOTIVE ENGINEERS (LONDON) (at 36 George Street, Manchester), at 7.—D. W. Sanford: The Development of the Piston Valve to improve Steam Distribution.

INSTITUTION OF MECHANICAL ENGINEERS (Informal Meeting), at 7.

INSTITUTION OF STRUCTURAL ENGINEERS (Informal Meeting) (at Chamber of Commerce, Birmingham), at 7.—S. L. Horolle and others: Discussion on Foundations.

MANCHESTER ASSOCIATION OF ENGINEERS (at Engineers' Club, Manchester), at 7.15.—C. H. Faris: The Applications of Electro-deposited Metal to Engineering.

SOCIETY OF CHEMICAL INDUSTRY (Glasgow Section, jointly with other Chemical Societies) (at Ca'doro Restaurant, Glasgow), at 7.30.—Prof. G. Barger: Ergot and Ergotism.

SOCIETY OF CHEMICAL INDUSTRY (South Wales Section, jointly with Microscopical Society of Wales) (at Cardiff Technical College), at 7.30.—C. A. Seyler: The Microscopy of Coal.

BLACKBURN TEXTILE SOCIETY (at Blackburn Technical College), at 7.30.—S. N. Duguid: Smoke Abatement and Fuel Economy.

JUNIOR INSTITUTION OF ENGINEERS, at 7.30.—H. C. Reid: Monolith Foundations.

INSTITUTE OF METALS (Sheffield Section) (at Sheffield University), at 7.30.—N. C. Marples: The Applications of High-Nickel Nickel-Copper Alloys and Pure Nickel in Industry.

ROYAL SOCIETY OF MEDICINE (Ophthalmology Section), at 8.30.—J. H. Doggart: Recurrent Vascular Keratitis of Unknown Origin.—Dr. Rosa Ford: A Case of Retrobulbar Neuritis masked by Chloroiditis, and due to Latent Sinusitis.

ROYAL INSTITUTION OF GREAT BRITAIN, at 9.—Prof. F. Ll. Hopwood: Ultrasonics: Some Properties of Inaudible Sound.

SOCIETY OF DYERS AND COLOURISTS (London Section).—A. J. Hall: Bleaching, Dyeing, and Finishing Processes and their Effect on Finished Goods.

SATURDAY, FEBRUARY 14.

BRITISH PSYCHOLOGICAL SOCIETY (jointly with Cambridge Psychological Society) (in Psychological Laboratory, Cambridge), at 2.45.—Papers by Prof. W. S. Hunter and Dr. R. S. Creed.—At 6.—Papers by Prof. E. D. Adrian and Dr. J. T. MacCurdy.

ROYAL INSTITUTION OF GREAT BRITAIN, at 3.—J. Stephens: On the Reading and Speaking of Verse (1): On Speaking Verse.

LEICESTER LITERARY AND PHILOSOPHICAL SOCIETY (Chemistry Section) (at Leicester Museum), at 8.—J. A. Christian: Modern Methods of Sewage Disposal.

MONDAY, FEBRUARY 16.

VICTORIA INSTITUTE (at Central Buildings, Westminster), at 4.30.—Dr. J. Knight: Demon Possession in the Light of Modern Research (Dr. Schofield Memorial Paper).

ROYAL GEOGRAPHICAL SOCIETY, at 5.—Dr. L. Dudley Stamp: Land Utilisation Survey.

INSTITUTION OF ELECTRICAL ENGINEERS (Mersey and North Wales (Liverpool) Centre) (in Arts Theatre, Liverpool University), at 7.30.—Prof. W. Cramp: The Birth of Electrical Engineering (Faraday Lecture).

INSTITUTE OF METALS (Sheffield Section) (at Sheffield University), at 7.30.—Conjoint Discussion on Refractories for Heating and Melting Furnaces.

ROYAL INSTITUTE OF BRITISH ARCHITECTS, at 8.—F. W. Deas: The Work of Sir Robert Lorimer.

EUGENICS SOCIETY (at Rembrandt Hotel, Thurloe Place, S.W.).—Sir J. Arthur Thomson: Warnings from Nature (Galton Lecture).

TUESDAY, FEBRUARY 17.

ROYAL INSTITUTION OF GREAT BRITAIN, at 5.15.—Sir William Bragg: Recent Experimental Physics (2): The Sizes of Atoms.

ROYAL STATISTICAL SOCIETY (at Royal Society of Arts), at 5.15.—D. Caradog Jones: The Social Survey of Merseyside.

ROYAL SOCIETY OF MEDICINE, at 5.30.—General Meeting.

ZOOLOGICAL SOCIETY OF LONDON, at 5.30.—H. C. Wilkie: The Middle Ear of the Horse (*Equus caballus*).—M. K. Serebrennikov: On the Polychromatism and Albinism of the Siberian Squirrels.—W. S. Bristowe: (*a*) A Contribution to the Knowledge of the Spider Fauna of South-West Ireland, and in particular the Islands off the Coast; (*b*) The Spiders of the Island of Grassholm, and some Additions to the Skomer Island List.—Dr. A. D. Misra: On the Internal Anatomy of the Female Lac Insect, *Lacifer lacca* Ckll. (Homoptera: Coccidæ).

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN, at 7.—J. E. Saunders: Who's Who in Two Zoos.

WEDNESDAY, FEBRUARY 18.

ROYAL METEOROLOGICAL SOCIETY, at 5.—L. J. Sutton: Note on Haboobs.—Prof. S. Chapman and Miss M. Hardman: The Lunar Atmospheric Tide at Ocean Island.—A. C. Best: Horizontal Temperature Differences over Small Distances.—E. Ll. Davies: A Portable Temperature Gradient Indicator.

ROYAL MICROSCOPICAL SOCIETY (at B.M.A. House, Tavistock Square), at 5.30.—Prof. R. Chambers: The Nature of the Living Cell, with Demonstration by Micro-Dissection, Micro-Injection, and Cinematography.

OVERHEAD LINES ASSOCIATION (at Institution of Electrical Engineers), at 5.30.—Discussion on Wayleaves.

INSTITUTION OF ELECTRICAL ENGINEERS (London Students' Section), at 6.15.—V. S. Lake, W. F. J. Walton, and others: Discussion on Are the Present Methods of Those Interested in the Supply of Current and Apparatus Conducive to the Spread of Domestic Electrification?

INSTITUTION OF AUTOMOBILE ENGINEERS (Manchester Centre) (at Engineers' Club, Manchester), at 7.—E. V. Pannell: Light Alloy Piston Development.

INSTITUTION OF ELECTRICAL ENGINEERS (Tees-side Sub-Centre) (at Cleveland Technical Institute, Middlesbrough), at 7.—S. G. Brown: Loudspeakers since their Conception, with Gramophone Pick ups and Wireless Recording Apparatus.

ILLUMINATING ENGINEERING SOCIETY (at Home Office Industrial Museum, Horseferry Road), at 7.—Discussion on Problems in Illuminating Engineering:—W. J. Jones: The Relation between Intensity of Illumination and Visual Capacity.—J. H. Parker: The Lighting of the Kingsway Tunnel.—O. P. Bernard: Lighting at the International Exhibition of Persian Art.—H. H. Long: Lighting for Furniture Spraying.—H. R. L. Goring: A Problem in Cathedral Lighting.—R. A. Ives: A Problem in Flood Lighting.

INSTITUTION OF AUTOMOBILE ENGINEERS (Leeds Centre) (at Metropole Hotel, Leeds), at 7.15.—Dr. W. H. Hatfield: Rustless Steels as applied to Automobiles and Aircraft.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS (Graduate Section) (at Bolbec Hall, Newcastle-upon-Tyne), at 7.15.—D. Tagg: The Utilisation of Waste Heat in Oil-Engine Installations.

INSTITUTION OF ELECTRICAL ENGINEERS (Sheffield Sub-Centre) (at Royal Victoria Hotel, Sheffield), at 7.30.—C. C. Paterson: Aduress.

ROYAL SOCIETY OF ARTS, at 8.—G. H. Jack: The Art of the Bridge Builder.

ROYAL SOCIETY OF MEDICINE, at 9.15.—Dr. H. L. Tidy: Poisoners of Ancient Times.

THURSDAY, FEBRUARY 19.

ROYAL SOCIETY, at 4.30.—Prof. A. J. Allmand and L. J. Burrage: The Discontinuous Nature of the Process of Sorption of Gases and Vapours by Porous Solids.—C. H. Collie: The Decay Constant of Uranium II.—*Papers to be read in title only*:—Prof. L. N. G. Filon and F. C. Harris: The Photo-Elastic Dispersion of Vitreous Silica.—G. B. Deodhar: Some Investigations in Röntgen Spectra.—J. G. A. Griffiths and Dr. R. W. G. Norrish: The Photosensitised Decomposition of Nitrogen Tetrachloride.—Prof. S. Chapman and J. M. Stagg: On the Variability of the Quiet-Day Diurnal Magnetic Variations. II.—A. Thom and J. Orr: The Solution of the Torsion Problem for Circular Shafts of Varying Radius.—Prof. C. G. Darwin: Examples of the Uncertainty Principle.—E. C. Bullard and H. S. W. Massey: The Elastic Scattering of Slow Electrons in Argon.—V. C. G. Trew and J. F. Spencer: The Magnetic Susceptibility of Binary Systems of Organic Liquids.—W. G. Kannuluik: On the Thermal Conductivity of Some Metal Wires.—Prof. P. Kapitza: The Study of the Magnetic Properties of Matter in Strong Magnetic Fields. I., II.

LINNEAN SOCIETY OF LONDON, at 5.—V. S. Summerhayes: The Angiospermic Flora of the Seychelles Archipelago.—J. Ramsbottom: The 'Proceedings' of the Society of Amateur Botanists.

ROYAL INSTITUTION OF GREAT BRITAIN, at 5.15.—Prof. J. B. S. Haldane: Respiration (1).

SOCIETY OF CHEMICAL INDUSTRY (Edinburgh and East of Scotland Section) (Annual General Meeting) (jointly with Local Section of Institute of Chemistry) (at North British Station Hotel, Edinburgh), at 7.30.—C. Parkinson: Lithographic Processes and Problems.

SOCIETY OF CHEMICAL INDUSTRY (Nottingham Section, jointly with Institute of Fuel) (at University College, Nottingham), at 7.30.—J. L. Stevens: Petrographic Treatment of Coal; the Mechanical Separation of Coal into its Constituents and their Commercial Applications.

LEICESTER LITERARY AND PHILOSOPHICAL SOCIETY (Botany and Biology Section) (at Leicester Museum), at 7.30.—P. A. H. Muschamp: The Blue Butterfly.

INSTITUTION OF ELECTRICAL ENGINEERS (Irish Centre—Dublin) (at Trinity College, Dublin), at 7.45.

CHEMICAL SOCIETY, at 8.—F. Challenger and B. Parker: A New Method for the Preparation of Organo-thallium Halides.—W. F. K. Wynne-Jones: The Dissociation of Salts in Nitrobenzene.—D. R. Pryde and F. G. Soper: (*a*) The Formation of Acyl-chloroamines from Hypochlorous Acid; (*b*) The Direct Interchange of Chlorine in the Interaction of p-toluenesulphonamide and N-chloroacetanilide.

BRITISH INSTITUTE OF RADIOLOGY (at 32 Welbeck Street), at 8.30.—A Radium Symposium:—C. E. S. Phillips: Note on the Preparation of Radium Salts for Therapeutic Use.—Prof. E. N. da C. Andrade: A Model to Illustrate the Passage of an Alpha Particle in the Neighbourhood of an Atomic Nucleus.—Dr. W. Roy Ward: Some Aspects of Radium Therapy.—Dr. A. Burrows: The Organisation of the Radium and X-Ray Cancer Service in Australia.

ROYAL AERONAUTICAL SOCIETY (Gloucester and Cheltenham Branch).—A. L. Williams: Heat Treatment of Steels.

ROYAL AERONAUTICAL SOCIETY (Yeovil Branch).—Squadron Leader R. B. Sorley: Lay-out and Equipment of Service Aircraft.

FRIDAY, FEBRUARY 20.

ASSOCIATION OF ECONOMIC BIOLOGISTS (Annual General Meeting) (in Botany Department Lecture Room, Imperial College of Science and Technology), at 11.30 A.M.—Discussion on Biological Races and their Significance in Evolution, to be opened by the President. Other speakers:—Dr. W. B. Brierley (Fungi); Dr. P. Bruce-White (Bacteria); Dr. T. Goodey (Nematodes); Dr. W. H. Thorpe (Insects); Dr. W. B. Turrill (Seed-Bearing Plants).

GEOLOGICAL SOCIETY OF LONDON (Annual General Meeting), at 3.—Prof. E. J. Garwood: Presidential Address.

PHYSICAL SOCIETY (at Imperial College of Science and Technology), at 5.—G. G. Sherratt and J. H. Awbery: On the Velocity of Sound Waves in a Tube.—P. S. H. Henry: The Tube Effect in Sound-velocity Measurements.—W. A. Wood: Note on the Elimination of the β-wave-length from the Characteristic Radiation of Iron.

BRITISH INSTITUTE OF RADIOLOGY (Medical Meeting) (at 32 Welbeck Street), at 5.—Dr. H. Cohen and Dr. P. H. Whitaker: Cinematograph of Ventriculography.—Dr. R. E. Roberts: (*a*) Lympho-sarcoma Involving the Stomach; (*b*) Carcinoma of Lung with Pathological Specimens.—Dr. J. H. Mather: X-Rays of a Case of Idiopathic Myositis Ossificans: 1896 and 1930.—Dr. H. K. Graham Hodgson: Demonstration of the Technique of Method of Sinus Investigation.—C. T. Holland: Radiographs of Unique Conditions.

SOCIETY OF CHEMICAL INDUSTRY (Liverpool Section) (Annual Meeting) (at Liverpool University), at 6.—L. Wild: Modern Developments in Printing.

INSTITUTION OF MECHANICAL ENGINEERS (Annual General Meeting), at 6.—Capt. A. Swan and others: Investigation of Steels for Aircraft Engine Valve Springs.

SOCIETY OF DYERS AND COLOURISTS (at Manchester Literary and Philosophical Society), at 7.—J. S. Wilson: Solazol Dyestuffs.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN (Pictorial Group), at 7.—Informal Meeting.

SOCIETY OF CHEMICAL INDUSTRY (Newcastle Section) (at Armstrong College, Newcastle-upon-Tyne), at 7.30.—Dr. S. R. Illingworth: Some Aspects of the Carbonisation of Coal.

JUNIOR INSTITUTION OF ENGINEERS (at Royal United Services Institution), at 7.30.—A. J. Grant: The Construction of the Variable Density Tunnel for the National Physical Laboratory at Teddington.

SHIPLEY TEXTILE SOCIETY (at Shipley Technical School), at 7.30.—A. B. Shearer: Rayon: its Uses in Woven Fabrics.

ROYAL SOCIETY OF MEDICINE (Electro-Therapeutics Section), at 8.30.

ROYAL INSTITUTION OF GREAT BRITAIN, at 9.—Prof. J. B. S. Haldane: Prehistory in the Light of Genetics.

GEOLOGISTS' ASSOCIATION (North-East Lancashire Group) (at Technical College, Blackburn).—W. L. Turner: With the Geologists' Association in Czechoslovakia (Lecture).

ROCHDALE TEXTILE SOCIETY (at Technical Schools, Rochdale).—Gregg: Modern Weaving Methods.

SATURDAY, FEBRUARY 21.

NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS, at 2.30.

ROYAL INSTITUTION OF GREAT BRITAIN, at 3.—J. Stephens: On the Reading and Speaking of Verse (2): Difficult Poets.

PUBLIC LECTURES.

SATURDAY, FEBRUARY 14.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—Major G. M. Coombs: Fiji and the Fijians.

MONDAY, FEBRUARY 16.

LONDON SCHOOL OF HYGIENE AND TROPICAL MEDICINE (Public Health Division), at 5.—Col. L. W. Harrison: Venereal Disease Schemes.

TUESDAY, FEBRUARY 17.

UNIVERSITY COLLEGE HOSPITAL MEDICAL SCHOOL, at 5.15.—Dr. Janet Vaughan: The Pathology and Treatment of Pernicious Anæmia. (Succeeding Lecture on Feb. 24.)

GRESHAM COLLEGE, at 6.—W. H. Wagstaff: Geometry. (Succeeding Lectures on Feb. 18, 19, and 20.)

WEDNESDAY, FEBRUARY 18.

LONDON SCHOOL OF HYGIENE AND TROPICAL MEDICINE (Public Health Division), at 5.—Col. L. W. Harrison: Venereal Disease: Treatment Centres.

KING'S COLLEGE, LONDON, at 5.30.—H. J. Wood: The Great Age of Discovery: The Search for a Western Passage.

BELFAST MUSEUM AND ART GALLERY, at 8.—Prof. Gregg Wilson: The Story of a Fish.

FRIDAY, FEBRUARY 20.

INSTITUTION OF PROFESSIONAL CIVIL SERVANTS (at Chartered Surveyors' Institution), at 5.30.—T. Wilson: Westminster, its Palaces and Parliaments.

SATURDAY, FEBRUARY 21.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—R. W. Sloley: Water-Clocks and Sun-Dials.

EXHIBITION.

TUESDAY, FEBRUARY 17, TILL END OF APRIL.

EXHIBITION OF THE MINERAL RESOURCES OF THE EMPIRE (at Imperial Institute).

Thursday, Feb. 19, at 5.30.

Sir Robert Horne: The Mineral Resources of the Empire (Address).