THURSDAY, MAY 22, 1919.

APPLIED CHEMISTRY.

(1) *Coal-tar Dyes and Intermediates.* By E. de Barry Barnett. (Industrial Chemistry Series.) Pp. xviii + 213. (London: Baillière, Tindall, and Cox, 1919.) Price 10*s.* 6*d.* net.

(2) *Coal-tar and some of its Products.* By Arthur R. Warnes. (Pitman's Common Commodities and Industries.) Pp. xxii + 105. (London: Sir I. Pitman and Sons, Ltd., n.d.) Price 2*s.* 6*d.* net.

(3) *Van Nostrand's Chemical Annual.* Fourth issue, 1918. Thoroughly revised and enlarged. Edited by Prof. John C. Olsen. Assistant editor, M. P. Matthias. Pp. xviii + 778. (London: Constable and Co., Ltd., 1918.) Price 15*s.* net.

(1) THIS volume, by Mr. E. de B. Barnett, is one of the series of works on industrial chemistry now being published under the editorship of Dr. Samuel Rideal. The series aims at giving a comprehensive survey of the present condition of the chemical industries, the various subjects being treated from the chemical rather than from the engineering point of view. The books appeal mainly to the advanced student, whose mind, in the opinion of the editor, "is often crammed with the hard facts and details of his subject which crowd out the power of realising the industry as a whole," and who, "on commencing his industrial career, is positively handicapped by his academic knowledge because of his lack of information on current industrial conditions." There is, no doubt, room for difference of opinion as to the best course of instruction to be pursued in the case of one who is being prepared for a career in applied science, and it may be that the change from the purely academic side to that of application has hitherto been too abrupt, and that something in the nature of an intermediate course on the principles of technology is desirable. This fact, indeed, is now generally recognised, and we have the evidence for it in the creation of such places as the Imperial College at South Kensington, and in the extension of the newer universities, such as Manchester, Liverpool, Leeds, and Birmingham, all of which have largely developed their technological side, either by the establishment of new chairs or, as in the cases of Manchester and Glasgow, by uniting themselves with schools of technology already existing. Conditions arising out of the war will no doubt accelerate this movement, not only in this country, but also throughout the British Dominions. As we know, it has given an enormous impetus to technical education in America and in Japan, and bids fair to jeopardise the industrial future of Germany, at least in the chemical arts. Whatever the future may have in store for our defeated enemy, there can be no doubt whatever that her supremacy in certain branches of manufacturing chemistry is irretrievably gone.

The book under review appears, therefore, at an opportune time, and it is one of many similar productions which aim at rousing British chemical manufacturers to a sense of their present opportunity. It deals with an industry which took its rise in this country, but was in large measure lost to us through a variety of causes, not the least of which was our deplorable educational system and the supine inactivity of public opinion which failed to insist upon its betterment. We are, however, quickly changing all that, and we may confidently hope that the coming generation will see a marked improvement. The manufacture of the so-called coal-tar dyes has already received a great extension in this country, and is rapidly assuming the position of a staple industry. It is bound to pass through many a critical phase in the near future, but the conjoint efforts of our schools of instruction, with wise management on the part of our producers, together with the benevolent attitude of Parliament, will, we trust, serve to steer it safely through its difficulties. This country will never again have such an opportunity to recover its lost position in this industry, and it would now be the height of unwisdom for it to neglect its chance.

The book before us, of course, makes no pretension to be a complete treatise on the subject with which it deals. It can scarcely be expected that a volume of some 200 pages would adequately cover so vast a field. It gives, however, a fairly satisfactory *aperçu* of the various processes involved in the manufacture of what are known as "intermediates"—that is, of compounds employed in the manufacture of actual dyestuffs, such as nitration, amidation, sulphonation, hydroxylation, etc.—and describes the mode of production and uses of the more important of these substances and of their main chemical and physical properties. This constitutes part i. of the book, and is made up of five sections, extending in all to some eighty-three pages. It is naturally highly condensed, and no attempt is made to illustrate it by any figures of the plant in actual use, which we consider an unfortunate omission. Drawings of plant, such as an engineer would make, do more to present what the editor calls "the reality of the living industry" than whole pages of verbal description.

Part ii., which constitutes the bulk of the work, is divided into fourteen sections, each dealing with a special group of dyestuffs. These sections are naturally of very unequal length, such groups as the azo-dyes, the triphenylmethane dyes, the azines, the indigoid dyestuffs, and the anthraquinone dyes—among the more important of the synthetic dyes—extending over several pages, whilst the nitroso- and nitro-dyes, the indamines and indophenols, oxazines, thiazines, quinolines, acridines, and sulphide dyes are somewhat summarily dismissed. A valuable

feature of the book is its bibliography and its summary of patent literature, which may render it of use to the works chemist. The main drawback is, of course, that such summaries in so progressive a subject rapidly become out of date.

The book concludes with a short statement concerning the possible future of a synthetic dyestuff industry in Great Britain. Here the author is on debatable ground, and certain of his views may be open to criticism. Indeed, he concedes that the question whether such an industry can be established here on a paying basis admits of a considerable difference of opinion. The high cost of transport has in the past been a severe handicap, and there can be no doubt that the railway companies have done little to promote the interests of the manufacturers; it remains to be seen, however, whether nationalisation and the re-opening of inland waterways and coasting harbours will effect the desired improvement. The author pleads for at least temporary protection to the "key" industries, and especially to the dyestuff industry, which has in effect been promised by the Government. He naturally welcomes the financial assistance by loans and grants-in-aid already made by the State for capital cost of plant and depreciation and specialised technical research, but he sees many difficulties in complying with the conditions imposed by the Board of Trade, and in his opinion the success of the whole scheme of bureaucratic administration is very questionable. He thinks a better scheme would be to establish a central "Board of Chemical Industry" on the same lines as the U.S. Bureau of Chemistry, and he gives a sketch of its constitution and functions. As it is suggested that the proposed Board should be a Government department, it is not very obvious how it differs, or at least need differ, from the organisation already proposed, as the admitted aims and duties are identical. Much, of course, depends upon facilities for the manufacture of "intermediates," and it is suggested that benzol and toluol producers might themselves convert these products and sell them to the actual dye-makers, or that the coke-oven undertakings might take over their manufacture. This would, no doubt, be a great advantage from a purely economic point of view, and allow the smaller dye-makers to compete on better terms with the larger concerns, and so tend to diminish the chance of the monopoly which the present combine is not unlikely to bring about.

(2) This little book is a member of Pitman's series of Common Commodities and Industries. It attempts to explain within the limits of 100 crown octavo pages the main features of the origin and uses of coal-tar and of the methods employed to obtain commercially valuable materials from it. Although necessarily very slight in treatment, it possesses certain features of value which are lacking in the work just noticed. It is fairly well illustrated, and its descriptions of manufacturing processes are adequate, considering its scope. The book covers, however, much less ground than Mr. Barnett's work, and it is not so much concerned with synthetic dyestuffs as with such products as benzol, toluol, sulphate of ammonia, carbolic acid, creosote, pitch, etc.—in other words, with the primary products of the tar-distiller. It appeals to the business man and the student of commerce rather than to the chemical student or the technologist. Its author is the lecturer on coal-tar distillation at the Hull Technical College, and the book is evidently based upon considerable experience of the industry. It is well written and eminently readable, and merits the attention of the special class for which it is intended.

(3) This book is now in its fourth issue. It is a type of work which is becoming increasingly common, and of which practically every country which is concerned to any extent with chemistry and the chemical arts can furnish examples. They are mainly intended for the chemical analyst, works manager, and consultant, and are compiled on very much the same lines. They consist for the most part of tables, such as the chemical and physical constants of the elements, critical data of gases, gravimetric factors and their logarithms, molecular and atomic weights and their logarithms, and a collection of useful analytical factors, physical constants of inorganic and organic compounds, hydrometer tables, specific gravity tables, thermochemical data, tables of weights and measures, a list of definitions of fundamental units of weight and mass, etc. An unusual feature is a list of arithmetical problems illustrating methods of calculation occasionally needed in industry, with their answers. Certain of these are not original, and may be found in works dealing with chemical arithmetic. But the list is fairly representative, although it might be assumed that any user of the annual would have already familiarised himself with such calculations during his studentship. The compilation concludes with a list of the more important books interesting to the chemist which have been published since October, 1913, with their prices in American currency.

The value of a compilation of this kind depends wholly upon its accuracy, and it is evident that no pains have been spared to ensure this. The most trustworthy data have been selected, and the editors have had the assistance of a competent body of experts, who have dealt with special groups. Although the work is called an "annual," it should be noted that the several editions are not necessarily revised in each successive year. The first issue appeared in 1906, the second in 1909, the third in 1913, and the present issue is dated November, 1917. Considering, however, the nature of the subject-matter, it is reasonably certain that the book has been kept well up to date, and that it fully realises its aim as a convenient reference book of numerical data.

A GEOLOGICAL BIBLIOGRAPHY OF INDIA.

A Bibliography of Indian Geology and Physical Geography, with an Annotated Index of Minerals of Economic Value. Compiled by T. H. D. La Touche. Part i., "A Bibliography of Indian Geology and Physical Geography"; part ii., "An Annotated Index of the Minerals of Economic Value." Pp. xxviii+571 and ii+490. (Calcutta: The Geological Survey of India; London: Kegan Paul and Co., Ltd., 1917 and 1918.) Price, part i., 5*s*. 4*d*.; part ii., 6*s*.

GEOLOGISTS, and especially students of Asiatic geology, owe a debt of gratitude to Mr. La Touche for having prepared, and to the Geological Survey of India for publishing, these two useful volumes, which the printer and paper-maker have made distinctly portly. The first is a bibliography of all that has been published regarding the geology of India and adjacent countries, arranged by authors, with a separate heading for all anonymous writings, and we note that Mr. La Touche has refrained from the needless pedantry of classing those unsigned contributions as anonymous of which the authorship was openly avowed and is well known. The bibliography seems very complete, for a somewhat critical search has failed to discover any omissions and has met with only one error, where two authors, who happen to have the same surname and initials, have had their separate identities merged into one person.

The second volume will probably prove of wider interest, being an annotated index to all published information regarding rocks or minerals of economic value. It is conveniently arranged in alphabetical order of the substances dealt with, and under each heading is given a brief review of recorded occurrences and production where the mineral has been worked, with references to the original authorities enumerated in the first volume. Glancing over this annotated index, we note that the production of diamonds, for which India was especially famed in olden days, had fallen to some 55 carats in 1915, the latest date quoted by Mr. La Touche, and to 18 carats in 1917, the latest date for which returns have been published. The more plebeian form of carbon, known as coal, has become a very important industry in India, and of it more than 18,000,000 tons a year are now mined. Iron, too, has become an important industry, and in 1917 nearly 365,000 tons of pig-iron and steel were produced by the two principal companies concerned in the industry.

The influence of the war on mineral production has been marked; it is apparent even in the work under review, and becomes more noticeable when it is compared with the review of mineral production during 1917. The output of tungsten has nearly doubled, more than 4500 tons of wolfram having been produced in India during 1917, mostly from the Tavoy district of Burma. Vanadium, at present one of the most keenly sought after of all metals, figures in Mr. La Touche's work by a single reference to the reputed presence of 2 per cent. in the ash of certain lignite of Travancore. Of magnesite, the production has risen from about 400 tons in 1914 to more than 18,000 tons in 1917. Mica, of which 40,000 cwt. had once been produced, fell to 27,000 cwt. in 1915, but the demand for war needs had once more raised the quantity returned as production to more than 40,000 cwt. in 1917; in the same year more than 62,000 cwt. were exported, a discrepancy which gives rise to a naive comment by the Director of the Geological Survey that "there is a thriving trade in mica theft in some of the mining areas, and stolen mica naturally does not appear in the output returns."

Such are some of the reflections which have occurred to us in examining this work, but its real value is as a book of reference. As such it will be invaluable, and the constant standby of all who are in any way concerned with the mineral resources of our Indian Empire, or with the important contributions which it has made to pure geology and the kindred sciences.

RESEARCH ON WOUNDS OF WAR.

Ambulance de "L'Océan," La Panne. Tome ii., fasc. 1. Travaux publiés sous la Direction du Dr. A. Depage. Pp. 376. (Paris: Masson et Cie; London: H. K. Lewis and Co., Ltd., 1918.) Price 18 francs net.

THIS volume contains, in the first half, articles dealing with operative and post-operative methods and results of various wounds in war. In the second half more stress is laid upon the bacteriological aspect and histological appearances of war-injured tissues. In the first article, by Dr. Depage, is a general discussion of excision and delayed primary and secondary suture of wounds. The author deals with the application of this method of treatment to various regions of the body, and lays particular stress on avoiding transverse incisions in the limbs, which, although giving free access, lead to unduly severe loss of tissue and difficulty in suture. The percentage results of success obtained are excellent.

Dr. Depage and Dr. Delrez then report on a series of cases of severe injury to the feet, with or without involvement of the bones and joints. Very good photographs and radiographs show the wounds of some of the more severe in the various stages and the final results. The authors strongly recommend the removal of the astragalus to assist in the early drainage, and very complete inversion until the tissues are clean, after which the surfaces are approximated and fixed with wire sutures.

Dr. Delrez contributes a long article upon that most controversial subject—wounds of the knee-joint. After discussing the indications for immediate amputation, he gives examples and figures of a large number of cases, dividing them into classes according to the extent and nature of

injury to the neighbouring bones. He finds that the limit of conservative operation is when there is an injury of the patella and condyles at the same time, and recommends resection and fixation for permanent ankylosis. The rest of the article discusses wounds of the ankle and wrist, elbow and shoulder, and also the treatment of septic arthritis that supervenes when the original excision of the wound fails to attain primary union. Dr. Neuman then contributes the results of laparotomies performed from June, 1915, to March, 1918. He begins with a short historical review of the treatment of abdominal penetrating wounds, and then shows the personal statistics, which clearly emphasise the importance of an advanced post for laparotomies. The article then contains a detailed classification of the different types of abdominal wounds, with the appropriate treatment for each type and the statistical results. The article by Dr. Janssen contains a valuable review of the history of cranio-plastic operations, and a detailed account of his own method of cartilaginous or osteoperiostitic heteroplastic grafts and the after-results.

Prof. Dustin contributes an article on the fasciculation of the various nerves of the arm and cervical plexus, and points out the importance of the arrangement of the fibres in estimating the prognosis of total section. Dr. Harde reports the relative frequency of the tetanus bacillus and other anaerobic organisms in a large series of wounds, and shows that very few cases ever develop clinical manifestations of the organisms, although they can be bacteriologically identified from the tissues. Further contributions on microbic growth and the mechanism of elimination of organisms from the circulation bring us to the last and longest article, by Prof. Levaditi.

This is a critical investigation into the effects of streptococcal invasion. The sections are arranged as follows: (1) The method of invasion, early and late; (2) the morphological and cultural characteristics of the different types discovered; (3) the reasons why clinical manifestations do not necessarily follow invasion; (4) hypersensibility and acquired immunity arising during the period of infection; (5) the effects of vaccination. Many charts of individual patients and details of their treatment and complications illustrate this important research.

The whole production is excellently printed and illustrated, and contains important contributions to some of the most intricate of war problems.

L. J. AUSTIN.

OUR BOOKSHELF.

Faith in Fetters. By the Rev. T. R. R. Stebbing. Pp. 223. (London: T. Fisher Unwin, Ltd., 1919.) Price 6*s.* net.

THE author, a veteran naturalist of distinction, a great authority on Crustaceans, has here raised a protest against the continuance of superstition in modern theological doctrines and religious conceptions. The conventionally orthodox attitude to the Bible is an anachronism. But he tilts too often against windmills, and there is more than a hint of wooden literalism in the examples he gives of Biblical contradictions and of anthropomorphisms which have become grotesque. The science of literature and of folklore has surely changed the educated man's attitude to the Bible much more than Mr. Stebbing's mode of treatment would suggest. The Thirty-nine Articles do not fare much better at his hands than do the Scriptures, for they are redolent with impossible anthropomorphisms. To take these literally may be superstitious, but it is surely possible to read them sympathetically as historical survivals. A theological or philosophical idea may be living and useful, though its particular form has grown musty.

From internal evidence the author shows that "the supposed inspiration and consequential infallibility of the Old Testament Scriptures rests on no solid foundation." But it seems to us that in his prosaic, unscientific treatment of the literature in question Mr. Stebbing leads his readers into a way of looking at things not less erroneous than a belief in "inspiration." If the author thinks that Church councils should make clear that they officially accept the scientific view of the Scriptures which the best modern scholars have expounded and many humble, clear-headed preachers adopt every Sunday, we are with him; but it should surely be possible to get rid of superstition without jettisoning imagination.

Le Tube Coolidge. Ses Applications Scientifiques, Médicales et Industrielles. Par H. Pilon. Pp. iii+83. (Paris: Masson et Cie, 1919.) Price 4 francs net.

M. PILON has written an interesting and timely brochure upon the Coolidge X-ray tube. He first enters into a description of the three types of these tubes which are available at the present time, namely, the standard tube, the first model of the inventor and the one ordinarily used; Modèle A, in which attention is especially directed towards the production of a very fine focus on the anti-cathode; and, lastly, the radiator type of tube, which was designed to meet the special requirements of the American Army Medical Service; this tube is a beautiful example of the inventive genius of Dr. Coolidge, the diameter of the tube being reduced to as little as 8 cm.

The second part deals with the radiation emitted by the tubes, the data being selected from the work of Coolidge and Moore, de Broglie, and others; a number of well-chosen illustrations exhibit the conditions necessary for clearness in radiographic images.

The concluding section is, for the main part, a reply to various criticisms which have been passed upon the performance of the Coolidge type of tube. A small section is devoted to the industrial applications of X-rays, and a final word is wisely said as to the necessity for the adequate protection of operators against the powerful and penetrating radiation from the modern X-ray tube.

Heredity

LETTERS TO THE EDITOR.

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

The Inheritance of Acquired Characters.

SOME years ago I directed attention (*Eugenics Review*, January, 1917, Transactions of the South-Eastern Union of Scientific Societies, 1917) to a remarkable series of experiments by Kammerer, carried out in the Biologische Versuchs-anstalt, Vienna, the results of which were published in a number of papers appearing in the *Archiv für Entwicklungsmechanik*. In these experiments Kammerer subjected a number of species of amphibia and reptiles to the action of a modified environment throughout a period extending from their early youth until the attainment of sexual maturity, and as a result modifications, both of structure and habit, were produced. When these altered individuals were allowed to pair and produce young, these young showed traces of the influences to which their parents had been subjected in two ways, viz. (*a*) when they continued to live in the same environment, the modifications of structure and habit which had appeared in the parents reappeared in *intensified form* in the young; (*b*) when they were transferred back to the original environment proper to the species to which they belonged, they still showed, *in their younger stages of growth*, some degree of the same change in habits and structure as the parents had exhibited.

These results, as I pointed out, would, if confirmed, definitely establish the inheritability of acquired characters, one of the most fundamental questions in biology. But Kammerer's results were received by many of his zoological colleagues, not only here, but also on the Continent, with a storm of criticism. Doubts were cast on his *bona-fides*, and it became fashionable to ignore his results in discussing the laws of heredity. One of the most interesting of Kammerer's experiments had for its subject the "midwife toad" Alytes. This beast differs from other toads, and, indeed, from the Anura in general, in the circumstance that the sexes pair on land, and not, as is the rule among Anura, in the water. In all these water-breeding forms the male is provided with a horny patch situated on the hand below the index finger, in order to enable him to retain his hold of the female when he clasps her under the water. As all know, the eggs are fertilised after being laid, and the young emerge as tadpoles provided with three feathery external gills on each side of the head; but these gills become covered over by the growth of an opercular fold from the hyoid arch and then atrophy, and are functionally replaced by more internally situated gills.

In Alytes the male is devoid of the horny patch on the hand, as the skin of the female, being comparatively dry, is sufficiently adhesive to allow him to retain his hold without it. When the eggs are laid—as is usual amongst toads, in long strings—the male, after fertilising them, winds them round his legs, and thus encumbered he lives in seclusion for several weeks until the young are ready to hatch out. He then visits the water, and the young emerge as advanced tadpoles, in which the external gills have already been covered over. The eggs are fewer in number, much larger in size, and more abundantly provided with yolk than those of other Anura.

Now Kammerer states that if Alytes be kept under conditions of greater warmth than they are normally accustomed to, they will live and flourish if provided with a tank of water in which they can bathe if they feel so inclined. In these circumstances they begin to pair in the water, and the eggs slip off the legs of the male and lie in the water. Most perish, but, by keeping the water aseptic, a few will develop. These, reared to maturity, produce, when sexually ripe, more numerous eggs of smaller size than is normal to the species, and the young hatch out at an earlier stage of development. If we open the egg of a normal Alytes, we discover that the *embryo* is provided with only *one* external gill on each side. Now in this F_1 generation the tadpoles emerge in this stage, and Kammerer figures free-swimming tadpoles of Alytes with one large external gill on each side. When the F_1 tadpoles are reared to maturity, they pair in the water and give rise to tadpoles with *three* external gills on each side, and these tadpoles, reared to maturity, develop into *males with a horny patch* on the finger.

Concerning this experiment, our leading authority on genetics, Prof. Bateson, thus speaks in his latest book ("Problems of Genetics," p. 201):—"To my mind this is the critical observation. If it can be substantiated it would go far to proving Kammerer's case. The figures which Kammerer gives [of the horny patch: E. W. M.] are quite inadequate, and as they merely indicate a dark patch on the thumbs, it is not possible to form any opinion as to the nature of the structure they represent. . . . I wrote to Dr. Kammerer in July, 1910, asking him for the loan of such a specimen, and on visting the Biologische Versuchs-anstalt in September of the same year, I made the same request, but hitherto none have been produced."

Now during the war it has been difficult to obtain German scientific publications, but, through the kind permission of the Board of Trade, we have been enabled to import all the numbers of the *Archiv für Entwicklungsmechanik* published during the war. In the latest of these, published in Berlin early in the present year, there is a paper by Kammerer in which he gives the results of further rearing of Alytes under conditions of greater warmth than normal. His original description of the horny patch on the hand of the male was based on its appearance in males of the F_2 generation, but he describes now males of the F_6 generation, in which the horny patch is so marked that its development exceeds that in the normal male toad (Bufo). He gives photographs of two Alytes males side by side, one of a normal male, one of a modified male, and in this latter the horny wart can clearly be made out. Further, he gives a whole plate of figures of sections through the skin of the hands of normal and modified males, and the last show unequivocally the characteristic horny papillæ which make up the patch.

It must, we think, be conceded that Kammerer has fairly taken up the gauntlet thrown down to him by Prof. Bateson, and the present position of the matter is that a strong *prima-facie* case for the inheritability of acquired variations has been made out. Of course, it is open to those who have attributed fraud to Kammerer to assert that the whole of the evidence adduced in this paper has been manufactured out of whole-cloth, even though the photograph of the modified male is stated to have been taken by an American student in Vienna and not by Kammerer himself. Such doubting Thomases could be convinced only by a journey to Vienna and an inspection of the modified males, for it is unreasonable to expect Kammerer to send these priceless specimens to any zoologist who chooses to doubt his word. It is to be hoped that,

once peace is signed, this journey will not be delayed. Meanwhile, the average zoologist who reads Kammerer's paper may be pardoned if he feels that the hypothesis of wholesale premeditated fraud is a difficult one to sustain.

It may perhaps be said that no notice should be taken of Kammerer's results until some other investigator repeats them. Such a course is not pursued with regard to any other zoological investigations. When new discoveries are published we thankfully receive them. We keep, perhaps, an open mind until they are repeated, but freely concede that a *prima-facie* case has been made out for them.

To Mendelian critics I would point out that the difficulty of instituting experiments designed to test the inheritability of acquired characters is colossal. Compared with them, the carrying out of experiments in Mendelian inheritance is child's play. With the kind concurrence of Dr. Chalmers Mitchell, I have persuaded Mr. E. Boulenger, Curator of Reptiles, to make preliminary arrangements to have some of Kammerer's experiments repeated in the Zoological Gardens. I found that a minimum of six years would be required before decisive results could be obtained. This new paper of Kammerer's appears to represent the result of seven or eight years' work. The proper rejoinder of the Mendelian is not to gibe at the absence of confirmatory evidence from other investigators (and some even of this is available), but to obey the Scriptural injunction, "Go thou and do likewise."

E. W. MACBRIDE.

Imperial College of Science, May 7.

The Conditions attached to Government Grants for Scientific Research.

MAY I again direct attention to the conditions under which grants are made to individual research workers by the Committee of the Privy Council for Scientific and Industrial Research (London: H.M. Stationery Office, 1919. Price 6*d*.)? The matter is of some importance, as not only are those who refuse to accept these conditions debarred from participating in the grants made from the public purse for scientific research, but other sources which used to be available, and to which such conditions were not attached, are also being cut off. I understand, for example, that the Carnegie Trust for the Universities of Scotland intends very largely in the future to discontinue its grants in aid of research, and to refer applicants to the Government.

By accepting a grant under these conditions, a research worker undertakes not to publish his or her results without the consent of the Committee, and gives up the ownership in the commercial rights of his discoveries, which otherwise, under the Patent law, belong to him. It is the Committee, not the inventor or discoverer, that is to determine to what extent and in what proportion the Committee and those who have made the discoveries are to secure the ownership of the results by patent, presumably on the ground that the Committee has provided the funds for the research. If that is the ground, ought not the Committee to state precisely what is the share it claims, whether the share is limited to the amount of the monetary contribution, or if it intends to make a profit? I understood the money was given by Parliament to foster research, not to exploit it. As it is, a worker accepting a grant places himself absolutely, as regards the legal right to his own property, in the hands of a Committee, and if, as is bound to occur, differences arise as to what is the share of the discoverer or who is the discoverer, the matter is not put into the hands of an impartial arbitrator to settle, but is settled by one of the parties in the dispute. In precisely the same way, with existing secret patents, if a dispute arises between a patentee and the Government, it is the Treasury, who pays for the use of the patent, that settles the dispute.

The condition is justified on three grounds. First, on the ground of national interest, especially in the present abnormal circumstances, and that it is not in the national interest that results of commercial value should be made available to other countries to the detriment of our own. As regards actual war conditions, patents containing any information likely to be of use to the enemy have not been published, so this is secured independently of the question of the ownership of the patent. As regards the future, one is justified in asking whether it is the intention of the Committee that the results of researches obtained by the expenditure of national funds should be kept secret, as most scientific men would regard this as short-sighted.

The second ground is that, where results are to be patented, delay in publication is in the interest of the investigator. This is scarcely relevant. It is surely in the highest degree dangerous to delay applying for a provisional patent until the results have been communicated to the Committee and its consent obtained, for any person who, by lawful or unlawful means, gets the information is then in a position to prevent the real discoverer from protecting himself.

The third ground is that it is the object of the Department to secure to the discoverer a fair share in any profits that may accrue from his discovery. Admittedly, the class of inventors and discoverers is in very great need of being protected from the sharp practices that have sprung up under the shadow of the Patent law, and primarily from the Government itself. But why should a small part of them, who receive Government funds, be singled out and protected? If the discoverer prefers to secure for himself the legal ownership of his discoveries, rather than for the Committee, I do not think he should be debarred from participating in this money. The most, I think, the Committee has a right to stipulate is that its interest is limited to the amount it has contributed, and that, in the event of a dispute, the matter shall be referred to an impartial arbitrator for settlement.

FREDERICK SODDY.

THE ATLANTIC FLIGHT.

THE attempt to cross the Atlantic by aeroplane, though as yet unsuccessful, has produced one record-breaking long-distance flight. The American seaplane, NC4, has flown from Newfoundland to the Azores, a distance of 1380 miles, thus establishing a record for distance. Trepassey Bay was left on May 16 at 10.05 p.m. G.M.T., and Horta, Island of Fayal, Azores, was reached at 1.23 on the following afternoon, the duration of the flight being 15 hours 18 minutes.

Mr. Harry G. Hawker and Commander Mackenzie Grieve started from St. Johns, Newfoundland, on May 18, at 5.45 G.M.T., for a direct flight to the British Isles, but no news has since been heard of them. It is greatly to be regretted that this daring attempt has failed, and we sincerely hope that the two brave aviators, who flew the Sopwith machine, have been rescued by a passing ship.

It is probable that Mr. Hawker's failure was due to bad weather, and in this respect it seems a pity that so difficult a feat should have become a race between various competitors. Had Mr. Hawker waited until the weather conditions were really favourable, there seems little doubt that he would have succeeded.

In considering the present situation, it is well to realise the immense progress that has been made in the last ten years. In 1909 Blériot first flew across the Channel, and his feat was then regarded in very much the same light as is the Atlantic flight to-day. We must, therefore, not be discouraged by the failure of the first attempt to fly direct from the New World to the Old, and although the Atlantic flight cannot now be considered as a commercial project, it may well be that in ten years' time it will be as simple an undertaking as a commercial flight from Paris to London is at the present day.

It is worthy of note that the great progress in flying range made since Blériot's Channel flight has been due in great measure to improvements in the engine, and only secondarily to better aerodynamic design. It is highly probable that engine improvement will be the main factor influencing the development of long-distance commercial flying in the future.

The main difficulty of trans-Atlantic flying will always be the weather, but it is to be hoped that an extended research into the meteorological conditions at various altitudes will do much to simplify the problem by enabling aviators to choose the most favourable route and altitude of flight.

Meanwhile, we can but await the attempts of other competitors for the honour of the Atlantic conquest by air, in the certainty that effort will not be relaxed until the flight is accomplished, and in the hope that Mr. Hawker and his navigator have been spared to make another attempt.

Trans-Atlantic Flying and Weather.

It cannot be too well understood that a flight from Newfoundland to the Azores at this time of year is vastly different from a flight to the British Isles. The Azores flight is made within a zone where fair weather prevails. The stages to Lisbon and thence to Plymouth may offer considerable difficulties. For seaplanes, and with look-out vessels fairly close to hand, the risk to life is greatly lessened.

So far as the direct flight from St. Johns, Newfoundland, to the British Isles is concerned, it is at present not easy to minimise the risks. Weather undoubtedly is the controlling factor. There are usually exceptionally few days in the year when the North Atlantic is free from cyclonic disturbances, but of all seasons the present time is probably normally the most favourable. The conditions, however, vary so immensely in different years that to choose a period for a trans-Atlantic flight without reference to the actual existing weather conditions involves immense danger. For a practically safe flight eastwards the prevailing distribution of atmospheric pressure over the Atlantic should be anticyclonic, with direct indication that no cyclonic disturbances exist along the route. In these conditions, which synchronous charts of the Atlantic show to exist occasionally, aircraft would have a steady westerly wind over the whole course. On the other hand, when cyclonic disturbances are known to exist in the open Atlantic, as they have for several days past, and for a much longer period, stormy and probably adverse winds would have to be negotiated for a considerable distance. The information given in the International section of the Daily Weather Report, issued by the Meteorological Office, which includes wireless reports from the Atlantic, shows what complete data have been available for those taking part in the flight. A moderate south-easterly gale was blowing at the surface well to the westward of the Irish coast at the time of the eastern flight, whilst nothing definite was known as to the direction and velocity of the upper air. Information as to the drift of the air over the open sea in any part of the world is of the crudest form, although even that might be of great value.

THE DEVELOPMENT OF AGRICULTURAL RESEARCH AND EDUCATION IN GREAT BRITAIN.

IT was for long a reproach to this country that so little attention was paid to agricultural research and education. The first step to remedy this state of affairs was taken in 1910, when Mr. Lloyd George set up the Development Commission and provided it with funds for the promotion of research and of various schemes and methods calculated to assist the agricultural industry. Out of its funds the Commission in 1911 made a grant to the Board of Agriculture of 50,000*l.* per annum for the carrying out of the Board's scheme to promote agricultural research and education, and this sum was allocated to various institutions and colleges, thereby allowing much-needed extensions of laboratories and staffs. It is a condition of the grant that a report on the work of the institution should be sent each year to the Board, and these reports as published have been duly reviewed in the columns of NATURE.

There is little doubt that this grant saved the agricultural colleges and research institutions from losing their best men. Up to 1910 it was recognised that a good man had little prospect in this country, and must perforce seek for posts overseas, either in some part of the Empire or in the United States. A score of names can be recollected of men who went, not primarily because they wanted to go, but because they saw no alternative. Although a few stayed on, they recognised the risk they ran. Had nothing occurred to justify them, the profession would soon, and deservedly, have acquired a bad reputa-

tion, and few desirable recruits would have entered it.

All this was changed in 1910 with the appointment of the Development Commission, and the thoroughness with which that body did its duty by encouraging agricultural research and education deserves wide recognition. Colleges and research institutions were enabled to build up staffs with adequate technical knowledge and expert in studying agricultural problems. The country has already derived considerable benefit; during the war it must have recovered most of its expenditure as a result of having at its service a body of experts already trained, instead of having to wait until new men could learn the work.

After eight years of its first scheme the Board of Agriculture is clearly satisfied with the results, for it has now decided on a still further development. The Board's proposals involve an expenditure on agricultural research and education, not of 50,000*l.* a year, but of 400,000*l.* a year. Research, it is understood, is to be subsidised at the rate of 100,000*l.* a year; the colleges are to receive 50,000*l.* a year; the remainder is intended for country and other work.

A certain number of men (and presumably of women also) who have distinguished themselves in natural science at the universities will receive scholarships that will enable them to specialise in agricultural science and to fit themselves for appointments at research institutions and agricultural colleges. A scholarship scheme has been in existence since 1911, and useful experience has been gained of its operation. Perhaps the most notable feature of this accumulated experience is the serious responsibility placed on the teacher who nominates a candidate. It has happened that unsuitable men have been put forward by well-meaning sponsors who realised that their candidate was not quite good enough for pure science, but hoped he might do for agriculture. Indeed, one or two schools of pure science are in rather bad odour at agricultural institutions for this reason. Unfortunately agricultural science, while offering excellent careers for men of the proper outlook and calibre, is the blindest of blind alleys for those who are unsuitable.

Given the right type of man, a career will be open to him. At the present time there are some forty permanent research posts at the agricultural institutions. It is proposed (according to the *Times*) to raise this number gradually to 150. The salaries, we learn from another source, will compare favourably with those offered at the universities, the headship of a small department being equivalent to a senior lectureship and that of a large department to a professorship; in addition, the university superannuation scheme is to apply. The work, we know, is of the highest interest and importance.

Agricultural education is also to be developed. There are already in existence a number of agricultural colleges to serve the country—in England and Wales alone there are about twelve, without counting the Scottish and Irish colleges—and they will receive further grants enabling them to develop on more extensive lines.

The work of the colleges is mainly related to the needs of the coming generation of farmers; it is proposed, however, to bring them into closer touch with men at present farming by the establishment of demonstration farms and other organisations calculated to achieve the same purpose.

At the present time the link between the college and the school is not very definite; we have in this country very few schools similar to the Rural High Schools of the United States. Oundle among the large schools, and Dauntsey and Brewood among the grammar schools, have agricultural sides where boys receive the proper training preliminary to an agricultural college course, but there are few places to which a farmer or labourer could send his son if for any reason the long school and college course were not possible. It is proposed to erect more farm institutes where intelligent boys can go for winter courses, and girls can be taught in summer; a certain amount of this kind of work has been done, and its value demonstrated. Finally, there is to be provision for giving short courses to school teachers who will be engaged in the new continuation schools in rural districts.

Although full details are not yet published, sufficient is known to show that the scheme is of the first importance, and the Board of Agriculture is to be congratulated on the bold lines of the proposal. The scheme has yet to be accepted by the House of Commons, and may undergo changes; it cannot be fully discussed until it is officially published in all its details. For the moment the great point for satisfaction is that the Board of Agriculture has shown itself so completely alive to the need for research and education, and has so fully satisfied itself that science can help agriculture. The band of scientific workers who have rendered such devoted service during the probationary period may also be congratulated on the result of their labours.

Some of these workers have themselves issued through the Agricultural Education Association a memorandum on the reconstruction of agricultural education in England and Wales,[1] which is of interest as showing their side, and will be of still greater interest when the Board's scheme is finally issued. The memorandum is very wide in its scope, and deals with rural continuation schools, county work, farm institutes, agricultural colleges, university agricultural education, agricultural research, dairy education, horticultural education, poultry-keeping, co-operative experimental work, experimental and other farms, status of workers, and co-ordination in educational work. The general summary is contained in sixty-two paragraphs at the end, and as it relates largely to matters of detail it cannot well be further shortened. In the main the 1911 scheme is judged to have succeeded, though it now needs consider-

[1] Obtainable from the Secretary of the Agricultural Education Association, Harper Adams Agricultural College, Newport, Salop.

able amplification and, of course, more money. The need is emphasised for more county work, more farm institutes, more experimental farms, and valuable information is given as to the best methods of carrying out the purpose of these various institutions, but no great change is suggested. It is entirely satisfactory to everyone concerned that the men who have had to carry out the scheme should regard it so favourably. The foundations have already been well laid; let us hope the building will be worthy of its purpose.

E. J. RUSSELL.

THE FINANCIAL POSITION OF CAMBRIDGE UNIVERSITY.

THE University of Cambridge in general, and its scientific departments in particular, find themselves in a grave position financially as a result of the diminution of the value of money brought about by the war. Towards the end of last term the heads of the scientific departments presented to the Council of the Senate a statement showing that to provide for the efficient working of their departments on the pre-war scale, without making allowance for any extension of activity, an additional income of 17,000*l.* was required to meet the increased cost of wages and maintenance. They further pointed out that in addition to the higher cost of living a new factor had arisen, in that various departments had to face an increased competition with activities outside the University for the services of the most competent scientific men; and they were of opinion that an average increase of 50 per cent. in the pre-war payments to the teaching staff was required if the University was to continue to command the best scientific talent in the country. This increase of stipends would require an additional income of 15,000*l.*, making 32,000*l.* in all.

In November of last year the acting vice-chancellor received a letter from the President of the Board of Education inviting him to send a statement as to the needs of the University in order that "the Government should obtain a conspectus of the needs of higher education over the whole country." In response to this request the acting vice-chancellor sent a summary of the prospective needs of the University, and in March an informal deputation, consisting of the master of Caius, the president of Queens', the master of Downing, Dr. Stewart, Sir J. Larmor, and Sir W. J. Pope, waited on Mr. Fisher for the purpose of laying before him the financial difficulties of the University.

On April 16 Mr. Fisher sent a letter to the vice-chancellor informing him that the Government would not feel justified in sanctioning a grant to the University out of Parliamentary funds except on the condition that in due course a comprehensive inquiry into the whole resources of the University and its colleges, and into the use which is being made of them, should be instituted by the Government. Subject to the acceptance of this condition by the University, the Government would be prepared to instruct the Standing Committee which is to be formed to advise the Government concerning grants to universities and colleges to submit recommendations with a view to an emergency grant being made to the University during the current financial year to meet the immediately urgent needs of salaries and maintenance. The Government would also be prepared, after the completion of the inquiry, to consider, in conjunction with the University, if it should so desire, the conditions under which a grant designed to meet the permanent requirements of the University might be made.

This letter was communicated to the Senate, and the proposals which it involved were formulated by the Council and submitted for discussion in the Senate on May 13. In the important debate which took place the proposals were supported by a number of the most prominent members of the University, including the provost of King's, Sir J. J. Thomson, the president of Queens', Sir W. J. Pope, and Prof. Sims Woodhead. They were opposed by the master of Corpus, Mr. Whibley, and, in part, by Dr. E. H. Griffiths. The question as to whether the University is prepared to accept financial assistance from the Government under the conditions laid down in Mr. Fisher's letter will probably be submitted to the vote of the Senate in the near future.

The discussion in the Senate was opened by the vice-chancellor with the announcement that a munificent gift had been offered to the University, the British oil companies having agreed to join together in a scheme for endowing the chemical department, the Burma Oil Co., the Anglo-Persian Oil Co., and the Anglo-Saxon Petroleum Co. each offering 50,000*l.*, Lord Cowdray and the Hon. Clive Pearson between them 50,000*l.*, and Mr. Deterding 10,000*l.*, making a total of 200,000 guineas. This generous offer to one of its great scientific departments meets with very high appreciation in the University.

THE GOVERNMENT OF INDIA AND SCIENTIFIC MEDICINE.

SIR LEONARD ROGERS'S recent presidential address to the Indian Science Congress at Bombay is a forcible protest against the long conflict between scientific enthusiasm and official apathy. The benefits conferred on long-suffering humanity by scientific investigation have strangely not sufficed to remove this dull resistance. Twenty years ago the present writer made a note in the visitors' book at the leper station of Almora to the effect that no systematic investigations were being made in India into the terrible disease leprosy. It is true that individual workers here and there in India, among them Sir Leonard Rogers, have carried on researches, but what concerted efforts has the Government of India made towards stamping out the disease, and where are the leprosy laboratories with their staffs of trained investigators? The cause and mode of transmission of elephantiasis and allied conditions

are known, but what has been done towards mapping out the distribution of these diseases, making a survey of the mosquitoes known to transmit them, and eradicating these mosquitoes? Again, are the investigations carried on in India in respect of malaria at all commensurate with the magnitude of the problem? Has kala-azar, one of the deadliest of diseases, been systematically attacked except by the enterprise of commercial companies? We are aware that a few commissions have investigated and reported on the epidemic outbreaks of this disease, but more than that is required, viz. patient, systematic research. Fortunately, this hitherto incurable disease appears to be now readily curable by tartar emetic, and if research can discover the mode of transmission of the disease the possibility of its extermination is great.

Sir Leonard Rogers points out the value of "team" work. No better examples could be given than the researches made through force of circumstances during the war on malaria and dysentery. It is this team work that is required in India, and, indeed, we have one excellent example of it, viz. the work of the Plague Commission. In our indictment of official apathy we had written on the subject of that devastating, widespread disease ankylostomiasis, or hookworm disease, but even as we wrote we learned that the Government of Bengal is instituting a campaign against it. If it be said that medical research is not being neglected in India, that large sums of money have recently been devoted to it, and that tropical schools are being formed in Bombay and Calcutta, we would say that these are good signs, but we still want more proof that those in high places are purged of their ignorance, and that at last the claims of scientific medicine are fully admitted.

J. W. W. S.

NOTES.

THE Croonian lecture of the Royal Society will be delivered on Thursday next, May 29, by Dr. H. H. Dale on "The Biological Significance of Anaphylaxis."

SIR J. J. THOMSON has been appointed by an Order of Council to be a member of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research.

THE PRINCE OF WALES, Sir J. J. Thomson, Master of Trinity College, Cambridge, and president of the Royal Society, and Sir Norman Moore, Bart., president of the Royal College of Physicians, have been elected to the Standing Committee of the British Museum.

THE PRINCE OF WALES will be proposed for election to the Royal Society at to-day's meeting. He will be elected under the rule which provides that a prince of the blood royal may be proposed at an ordinary meeting of the society by any fellow, and may be put to the vote for election on the same day, provided that public notice of such proposal has been given at the preceding meeting.

AT a meeting of the Royal Society held on May 15 the following candidates nominated by the council were elected fellows of the society:—Prof. F. A. Bainbridge, Dr. G. Barger, Dr. S. Chapman, Sir C. F. Close, Dr. J. W. Evans, Sir Maurice Fitzmaurice, Dr. G. S. Graham-Smith, Mr. E. Heron-Allen, Dr. W. D. Matthew, Prof. C. G. Seligman, Prof. B. D. Steele, Major G. I. Taylor, Dr. G. N. Watson, Dr. J. C. Willis, and Prof. T. B. Wood.

THE Cullum geographical medal of the American Geographical Society for the present year has been awarded to M. E. de Margerie, the translator into French of Suess's "Das Antlitz der Erde," and an acknowledged authority upon the physical geography of the United States of America.

MR. W. R. DUNLOP referred in his letter on the cultivation of sponges, published in NATURE of May 8, to the present position of the subject in relation to the Colonial Office. We understand that nothing has been officially decided there in regard to a marine zoologist for the Imperial Department of Agriculture (W.I.), but the subject of sponge culture is engaging attention, and the question of sending a marine zoologist to study sponges in the West Indies will shortly come before a Committee.

ON Tuesday next, May 27, Prof. W. H. Bragg will deliver the first of two lectures at the Royal Institution on listening under water (the Tyndall lectures). On Thursday, May 29, Sir Valentine Chirol will give the first of two lectures on the Balkans. The Friday evening discourse on May 30, at 5.30 o'clock, will be delivered by Sir John Rose Bradford on a "filter-passing" virus in certain diseases. The closing discourse of the session will be given on June 6 by Sir Ernest Rutherford on "Atomic Projectiles and their Collisions with Light Atoms."

THE Research Defence Society has presented to the Home Secretary a protest against the Dogs' Protection Bill. Although the signing of such a document by physiologists may perhaps be regarded as natural, it is noteworthy that we find also the names of all the leading members of the medical profession, many dignitaries of the Church, men of affairs, and members of the legal and literary professions. It is pointed out that the passing of the Bill would be disastrous to the future of medical science in this country, while the interests of national health and efficiency would be seriously prejudiced. The latest report of the Medical Research Committee is referred to as showing the service rendered by physiological experiments, for which the use of dogs is essential.

MR. H. S. BALL, late Assistant Inspector of Mines, G.H.Q., France, has communicated a valuable account of the work of the miner on the Western front to the Institution of Mining and Metallurgy (Bulletin, April, 1919, pp. 1–53). One of the most interesting sections of the paper is that which deals with mine listening instruments. The geophone, which reproduces the sound exactly, magnifies the intensity two and a half times. A single instrument is used when the object is merely to detect the existence and nature of sounds made by enemy miners, and a pair when the direction of the source of sound is required. The two geophones are placed on the ground about 18 in. apart, each connected with an ear of the listener, and they are moved until the sound is reproduced equally in both ears, the direction of the sound-source being then at right angles to the line joining the geophones. Observations were made at the end of a gallery, and, owing to the danger incurred at such a post and to the need for economising man-power, the seismo-microphone came into use, as many as fifty galleries being connected up to a switchboard of a central lis-

tening chamber, situated in some quiet spot behind the mining system. When sounds were heard in any particular gallery a listener was sent there with geophones to investigate. The enemy is known to have used several types of mine listening instruments, but no trace has been found of any instrument for the determination of direction.

ANNOUNCEMENT is made of the death of Gen. Stefanik, who may be better known to astronomers as Dr. Milan Stefanik, formerly attached to the Meudon Observatory. Dr. Stefanik was the son of a Slovak pastor, and about 1905, being then quite a young man, but already a doctor of science of Prague University, joined the Meudon Observatory as pupil astronomer, and, at the invitation of Dr. Janssen, proceeded to Spain with the expedition from that observatory to observe the total solar eclipse of August 30, 1905, and made spectroscopic observations on that occasion. During the succeeding year he pursued spectroscopic investigation of various kinds at Meudon, showing ingenuity in improving apparatus, and made a special study of the infra-red spectrum. In 1906 he went, with others of the staff, to the subsidiary observatory at Mont Blanc, where he continued his study of the infra-red from the point of view of telluric absorption, making his observations from different altitudes on the mountain. In 1910 Dr. Stefanik established at his own expense an observatory in the island of Tahiti to pursue his researches, and was therefore conveniently placed to observe the solar eclipse of April 28, 1911, when the line of totality crossed the Pacific. He made the short journey to the island of Vavau in the Tonga group, where he had for his neighbours the British observing parties under the leadership of Dr. W. J. S. Lockyer and Father Cortie, and, though the weather was not entirely favourable, it is believed that he obtained some successful results. In December, 1911, he was awarded the Wilde prize by the Paris Academy. At the outbreak of the war Dr. Stefanik was in Paris engaged in scientific work, and he at once joined the French Army as a private soldier, refusing a scientific appointment offered him by Marshal Foch. Shortly, however, he accepted commissioned rank, and rapidly passed through all grades to that of general. He met his death at a comparatively early age in an aeroplane accident in a flight from Italy to Bratislava, the capital of his native land of Slovakia.

As already announced, Col. D. Rintoul, senior science master and head of the physics department of Clifton College, died at Clifton on April 21 of pneumonia. Born at Forteviot, Perthshire, in 1862, Rintoul received his earlier education at St. Andrews and Edinburgh; he proceeded to Corpus Christi College, Cambridge, in 1881, and eventually became a fellow of his college. In December, 1885, he was appointed senior physics master at Clifton in succession to the late Prof. Worthington, who had left to become headmaster of the Royal Naval Engineering College, Devonport. With Rintoul in charge of physics and Shenstone of chemistry, Clifton more than maintained its prominent place among public schools for science teaching. Rintoul's own words, "If a teacher is wise he will encourage all independence of thought," best show the principles upon which he acted in school, while his firmness of character, quickness, and directness made his teaching distinctive. From 1904 to 1918 he was a housemaster. Always a keen soldier, Rintoul joined the 2nd Gloucester R.E. in 1888, retiring after some twenty years' service with the honorary rank of lieut.-colonel; he held the Territorial officers' decoration, and on the formation of the T.F. was nominated by the War Office as one of the military representatives on the T.F. County Association. When the late Major H. Clissold left Clifton in 1914 to raise a field company, Rintoul came out of his retirement, and again took command of the school corps, bringing it to a high state of efficiency, and for this service was specially thanked by the War Office. Rintoul's busy life made it impossible for him to do much original research, yet the many novel features of his own laboratory reflected his marked mental alertness and his live interest in all recent developments of his subject. Shortly before his death he gave valuable help to the Secondary School Examination Council. His elder son, Lieut. D. W. Rintoul, R.A.M.C., was killed in Flanders in 1914.

SIR W. RIDGEWAY contributes to the *Quarterly Review* for April an interesting paper on the subject of ancestor worship and the Chinese drama. He remarks that it is not merely triumphs and victories that are the themes of early dramas, any more than they are in the most advanced. They are drawn from appalling catastrophes and striking reversals of fortune, as in the Muharram celebrations of the Shiah Mohammedans, and in many examples from Greece, China, and Japan. There is no need to assume that China borrowed these themes from Greece or Greece from China, as such honouring of the dead is world-wide. Neither in China nor anywhere else did tragedy arise from the worship of seasonal or vegetational abstractions, but in the veneration and worship of the dead.

IN *Folk-lore* (vol. xxix., No. 4) Miss W. S. Blackman contributes an interesting article on the rosary in magic and religion, largely based on the extensive collection in the Pitt-Rivers Museum, Oxford. The use of the rosary, which claims high antiquity in the East, is based on that of knots as mnemonic signs, the highest development of which appears in the Peruvian Quipus. The Mohammedan form is usually assigned to Buddhism; but tradition and passages in the earlier literature point to a primitive type of rosary, such as would not be used if borrowed from a people who already possessed it in a highly developed form. The period of its introduction into Europe is usually fixed as that of the Crusades; but we learn from William of Malmesbury that Lady Godiva, wife of Count Leofric, who died before 1070, had a circlet of gems which she used in reciting her prayers. It seems, therefore, probable that the rosary has been evolved independently at more centres than one from the use of knots as mnemonic records.

THE *Avicultural Magazine* for May contains a temperately worded and convincing plea for the establishment of a bureau of economic ornithology, which, we trust, will be productive of good results. The urgency of the need for such an addition to the Board of Agriculture is, unfortunately, far from being realised, and it is highly probable that any attempt to press this matter would be met with the assurance that the time for such a scheme was not opportune, nor would its cost be justified. We fear that Dr. Collinge, the author of the article, is preaching to deaf ears, but sooner or later even the Board of Agriculture may be induced to listen to his plea.

THE development of the pericardiaco-peritoneal canal in the dogfish (Scyllium) and Acanthias has been re-examined by Mr. E. S. Goodrich (*Journal of Anatomy*, vol. liii., part 1, pp. 1–13, October, 1918). This canal leads in the adult from the pericardial to the peritoneal cœlom, and opens into the latter by paired apertures. Balfour suggested that the canal is a remnant of the wider communication between the two

cavities in the embryo, but Hochstetter (1900) maintained that the early communication between the cavities became closed completely, and that the canal opening from one to the other in the adult is a new formation. Mr. Goodrich shows, with the help of excellent figures, that Balfour's original view is essentially correct, and that Hochstetter was mistaken in his interpretation.

AMONG the Notes from the Laboratory of the Wisconsin Geological and Natural History Survey is one (No. 11, issued December, 1918) by Mr. R. A. Muttkowski on a qualitative and quantitative survey of the fauna, with special reference to the insects, of Lake Mendota, which has an area of about 15 square miles and a maximum depth of 84 ft. That it forms a rich collecting ground is evidenced by striking records, *e.g.* a Myriophyllum plant with seven branches, totalling a length of 4 metres, held more than 15,000 specimens of *Hydra fusca*. Larvæ of *Corethra punctipennis*, which are abundant in the lake, are found in daylight in the bottom mud, where they chiefly hunt their food, but at night they come to the surface. Catches made in the summer of 1916 by means of a dredge showed that the number of larvæ in a square metre of the bottom ranged from 2000 to 18,000. Despite the transparency of the larva and pupa, these are eaten in large numbers by the fish of the lake, perch gorged with these larvæ being frequently found. The larvæ of the Ceratopogonine genera Palpomyia and Probezzia, when grasped in the water, straighten out and become rigid—one of the few cases where aquatic insects feign death in their normal environment. These larvæ are slender and elongate, and also resemble in their colour the filamentous algæ among which they live, but, nevertheless, they are frequent in the stomachs of the lake-fish. The author cannot confirm Prof. Miall's statement that those larvæ of Chironomus which live at the bottom and burrow in mud possess hæmoglobin, while those which live near the surface have colourless blood. He emphasises the absolute lack of any correlation between colour and oxygen-supply.

MR. W. G. CRAIB (Notes from the Royal Botanic Garden, Edinburgh, vol. xi., November, 1918) has investigated the regional spread of moisture in deciduous-leaved trees during the felling season—that is, from late autumn until early spring. The species selected for examination was the sycamore (*Acer pseudoplatanus*), and the results, which are indicated by graphs and coloured diagrams of cross-sections, show that at the beginning of the season the centre of the tree is very wet, and at the end of the season there is a very wet region almost on the outside, while the centre is very dry. Between these two extremes are all the intermediate stages. The processes during the season are interpreted as follows: As the result of the water moving inwards from the outer zones, beginning at the base of the trunk, there is created an area of maximum moisture content, in any given cross-section, at the centre of the trunk. This inward current and the consequent plane of maximum moisture content at the centre gradually extend upwards in the trunk to the topmost region; but before this is reached and the centre of the trunk at the top of the bole has become a region of maximum moisture content, a radial movement has begun at the bottom of the trunk. This radial movement also progresses upwards, and by its means the region of maximum moisture content passes almost to the outside of the trunk, leaving the centre the driest region. The movements upwards and radially, both inwards and outwards, are going on synchronously at different levels in the trunk. The expressions "the sap is down" in autumn and "the sap is up" in spring are, therefore, meaningless; we should say rather "the sap is in" (the centre) or "the sap is out" (near the bark). These results in water-distribution are confirmed by experiments on other trees, and should do much to remove the prejudice against summer felling. The new facts brought to light also raise points of scientific interest as to the explanation of the activities in the tree during the so-called dormant period, or the reasons for the arrangement of the various pits in the tissue-elements.

THE Sub-Committee of the Food Investigation Board has issued an interim report on refrigerator-cars, in which many improvements are suggested which could be carried out on existing cars, and others which could be applied in designing new cars. On the whole, the report reveals an unsatisfactory state of affairs, with divided responsibility falling partly upon the owners of the goods and partly upon the railway companies. Tests were made on several cars, both standing and running, showing that the insulation is not so effective as is desirable; that the deficiency in air-tightness is a serious matter; and that the practice of icing the ice-tanks is altogether inefficient. Another point worthy of note is the fact that the cubic capacity of cars now in use is much in excess of what they can carry when they are charged up to the safe load with frozen produce. This is rather an unfortunate state of things. It is well known that in order to obtain the best results in a chamber containing frozen produce it is desirable that it should be filled and well stowed, whereas in some cases the Committee found quite 35 per cent. of the car-space was vacant. This defect might be remedied by so designing the axles, etc., as to allow the present cars to be loaded to their capacity. The Committee would have pleasure in receiving from railway companies designs for refrigerator-cars embodying its recommendations.

A CORRESPONDENT forwards us a newspaper cutting from South Africa directing attention to the possibilities of the prickly pear (Opuntia, spp.) as a source of industrial alcohol and other products. The plant in question covers thousands of acres of good soil in South Africa, and is a pest to farmers. To utilise it profitably would be a notable achievement in turning a waste product to account. Syrup can be obtained from the plant, the seeds contain an extractable oil, and an official report made some years ago is quoted as indicating that alcohol might be produced from the "tunas" or fruits at a relatively low cost. It may be remarked that the question of producing alcohol from the prickly pear has been carefully studied in Australia; the conclusion drawn, however, was unfavourable. Analysis showed that the total sugar content of the most common Australian species, *Opuntia inermis*, was only 0·6 per cent., and the highest amount of sugar in any of the species examined was but 2 per cent. Distillation experiments yielded alcohol equivalent to only 0·5 per cent. of the weight of the plant used, so that the manufacture was considered unprofitable, and, indeed, scarcely practicable. But the South African prickly pear is said to be much richer in sugar than the Australian product, and this, of course, may make all the difference between success and failure in utilising the plant.

IN the Transactions of the Institution of Engineers and Shipbuilders in Scotland for December last there is published an interesting paper by Mr. W. B. Hird on "Electrical Ship Propulsion." The relative advantages of the various electrical methods of driving the propeller shaft are given, and also the results of trials on ships with electrical gearing. To illustrate the flexibility of the electric drive the author quotes the

claims made for the equipment of the American battle-cruisers. They are designed for a speed of thirty-five knots, and require 180,000 h.p. to be delivered to four propellers running at 250 revolutions per minute. Supposing that one motor out of the eight breaks down, it can be instantly disconnected, and the loss in total power being only one-eighth, the speed would only be reduced by about one knot. For cruising speeds the ship will attain twenty-six knots with only two generating sets and four motors at work, and nineteen knots with one generating set only and four motors in use. At full power the efficiency claimed is 93 per cent. On the other hand, it was pointed out that the electric gear was considerably heavier than the mechanical gear, and its efficiency is about 2 per cent. lower. The author considers that there were spheres of usefulness for both the "geared turbine" and the "turbo-electric system," and that in some cases they might with advantage be used in combination.

SIR DUGALD CLERK read a paper on "The Distribution of Heat, Light, and Motive Power by Gas and Electricity" to the Royal Society of Arts on March 19. He takes as his basis of comparison for heating the amount of fuel consumed per thermal unit available in the gas or electricity, for lighting the amount of fuel consumed per candle-hour, and for motive power the horse-power-hours available per pound of fuel. From the point of view of coal conservation, he concludes that gas-heating should be used. Judging on this basis, there is little to choose between gas and electric lighting, but he is strongly in favour of gas motive power. Sir Dugald Clerk points out that of the coal-gas consumed in the United Kingdom probably 55 per cent. is used for heating, 35 per cent. for lighting, and 10 per cent. for motive power. He calculates that if electricity were used for these purposes 92 per cent. more heat units would be consumed. He concludes that, even assuming that the success of the super-electric stations so much discussed at present were assured, yet a gas service from a coal conservation point of view would be twice as economical. As regards thermal efficiency, this may be taken as correct, but it is unduly disparaging to the super-electric stations. The establishment of these stations would undoubtedly effect immense economies by abolishing many of the present wasteful electrical stations. Electricity was very largely used for driving the machinery upon which the winning of the war depended. It is difficult to believe that gas-engines would have been so successful. The rapidly extending use of electricity for cooking proves that more items than the thermal efficiency have to be taken into account before a just comparison can be made.

SIR ROBERT HADFIELD has sent us a translation of a recent statement by M. Honoré giving some account of the French Steel and Iron Masters' Association. It appears from this that in recent years French ferro-metallurgy has shown a pronounced tendency towards concentration of effort. From 383 in 1875 the number of works dropped to 208 in 1912, while the total iron and steel production increased from 900,000 to 4,900,000 tons. Whereas, therefore, the capacity of the works averaged 2350 tons in 1875, it had been raised to 21,700 tons in 1912. As the works grew fewer in number, but individually stronger, they were led, by reasons of transport, supplies, etc., to group themselves in regions favourable to production. In 1875 pig-iron was manufactured in fifty-seven departments; in 1912 four-fifths of the pig-iron and three-fourths of the steel production had been concentrated in two departments, Meurthe-et-Moselle and Nord. The Steel and Iron Masters' Association dates from 1864. After twenty years it became the Employers' Federation of Iron Masters, the exclusive object of which was the study and defence of the economic, industrial, and commercial interests of the ferro-metallurgical industry. In 1914 the association numbered 252 adherents, representing 97 per cent. of the French production of pig-iron and 93 per cent. of steel. The total capital involved was 1150 million francs, and the number of workmen employed about 200,000, who in 1912 received 400,000,000 francs.

IN a lecture on "The Sudd Reservoir," delivered at a meeting of the Institute of Egypt at Cairo on February 17, Sir William Willcocks reaffirms the claim that the problem of reservoir storage in the Nile Valley for irrigation purposes has been solved by Mr. John Wells and himself in their report on the sudd region of the White Nile. In support of his contention he adduces certain figures to show that, under the conditions prevailing in the Lower Nile, there is a shortage of 6 milliards of cubic metres of water out of the 13½ milliards required annually for cultivation purposes in Egypt. This is after deducting 2 milliards as the capacity of the Aswan Reservoir as it stands. Sir William estimates that the 6 milliards deficiency can be made good from the natural storage supplies in the sudd region at a cost of about 6,000,000*l.*(E.). He also advocates the entire reconstruction of the Aswan Dam at a cost of 3,000,000*l.*(E.), on the ground that the present dam is not high enough and possesses "serious defects and shortcomings." The sudd region has, of course, long been regarded as an unfortunate blemish on the White Nile, both as regards navigation and drainage. It is covered with a dense mass of decayed vegetation, papyrus roots, reeds, and grasses, resembling peat almost in its consistency, and offering an obstruction which on more than one occasion has had to be cut through for something like fifty miles in order to obtain a passage for boats. Sir William characterises it as one of the most wonderful reservoirs in the world. "A score of milliards of cubic metres of water stand well above the level of the flat plain as though they were congealed. It is a veritable glacier at the head of the White Nile, and feeds it as the Himalayan glaciers feed the Ganges."

ONE of the most interesting ships added to the Navy during the war was the seaplane-carrying ship *Argus*, built by Messrs. William Beardmore and Co., Ltd., at Dalmuir. A fully illustrated account of this ship appears in *Engineering* for March 28. There is absolutely no obstruction on the flying-deck, not even funnels, and there is space under this deck for the accommodation and repair of seaplanes. She is, therefore, a floating hangar, the space given up for this purpose being 330 ft. long, 68 ft. wide overall, and 48 ft. clear, with a clear height of about 20 ft., and is of a capacity regarded as sufficient to accommodate twenty seaplanes. Hoists are provided from the hangar to the flying-deck, and cranes are available for lifting the seaplanes from the water on to the hangar-deck. The vessel was laid down originally as a first-class passenger and cargo steamer, and the Admiralty decided in 1916 to have her completed as a seaplane carrier. The navigating bridge, bridge-houses, wireless offices, etc., are placed forward under the flying-deck. The chart-house is capable of being raised above the flying-deck level or lowered to a stowing position under the flying-deck by hydraulic power, and when in a raised position commands a clear all-round view.

MR. F. EDWARDS, 83 High Street, Marylebone, W.1, has just issued a Catalogue (No. 389) of upwards of nine hundred new and second-hand works dealing

with anthropology, folk-lore, archæology, and kindred subjects. Among the items listed we notice a batch of fifty-eight volumes of the Folk-lore Society's publications, comprising the *Folk Lore Record*, the *Folk Lore Journal*, *Folk Lore*, *County Folk Lore*, and "Extra Publications"; a complete set of the Psychical Research Society's Proceedings; Wright's "The English Dialect Dictionary," 6 vols.; Catlin's "North American Indian Portfolio" (coloured illustrations); long runs of the Journal of the Royal Anthropological Institute and of *Man*, and Reports 1 to 28 of the Bureau of American Ethnology. The catalogue is sent free upon application.

THE following are among the announcements of forthcoming books of science:—"The Environment of Vertebrate Life in the Late Paleozoic in North America: A Paleogeographic Study," E. C. Case (*Washington: Carnegie Institution of Washington*); "Psychoses of the War, including Neurasthenia and Shell Shock," Lt.-Col. H. C. Marr; "The Nervous Child," Dr. H. C. Cameron (*Henry Frowde and Hodder and Stoughton*).

OUR ASTRONOMICAL COLUMN.

JUPITER.—Observers of the surface of this planet have remarked that not for many years past has Jupiter presented so many interesting details as it has in the apparition that is now passing away. It has been noticed that the south equatorial belt has been unusually faint and its components extremely narrow, but it has gained redness in some parts, whilst the north equatorial belt has been losing its redness. This apparent transference of colour appears to be a periodic phenomenon. The feature known as the south tropical disturbance, first seen in 1901, the movement of which, especially with reference to that of the red spot, has been observed continuously since that time, became faint in the early months of this year, and in April this marking, together with the hollow in the south equatorial belt, in which the red spot lies, had quite disappeared, whilst the spot itself was seen only by some observers and in favourable circumstances.

NOVA AQUILÆ, 1918.—Observations of the nova of last year that have been already made in the morning sky show that the star is now fainter than sixth magnitude, for it has been estimated to be about 0·1 magnitude fainter than the neighbouring star B.D. +0·4027°, which appears as 6·26 in the Revised Harvard Photometry. A note from the Bergedorf (Hamburg) Observatory in the *Astronomische Nachrichten* of April 7 describes its spectrum about the date April 4 as consisting essentially of three bright lines in the red, yellow, and blue-green, and its appearance in the ordinary stellar eyepiece as a small reddish-yellow image covered by a bluish-green disc. The difference of focus gives a decided parallactic effect, looking slantwise, and the appearance is that of a double star with components of these colours.

"ANNUAIRE DE L'OBSERVATOIRE ROYAL DE BELGIQUE."—The volumes of this publication for the years 1915, 1916, 1917, and 1918 have lately been received. The first was printed and published in 1914 in the ordinary course, but the last three bear the date 1918 on the cover, and the preface to each is signed by M. Stroobant, Chief Astronomer of the observatory, *vice* the Director, the date of signing being 1918 November 11, the day of the armistice. These facts are significant, and the explanation is that the three books were printed in Brussels year by year without the knowledge of the occupying Power during the war, but were not issued because they would have had to be submitted to the enemy censor. The *Annuaire* for 1916, like the earlier volumes of the series, comprises what is practically a complete treatise on descriptive astronomy. There will be found in it definitions, descriptions, tables, photographs of nebulæ, comets, and star clusters, and a history of the recent progress of astronomy. The later volumes are less complete, and much of the information about the current events of astronomy had to be omitted because astronomical publications did not reach Belgium during the war. M. Stroobant, who is to be congratulated on carrying on in such unusual and painful circumstances, is responsible for the preparation, because M. Lecointe, the Director of the Royal Observatory, has been serving in the Belgian Army. It is worthy of remark that Greenwich civil time, which is the official time of the country, is used throughout, and this doubtless was one reason for keeping these volumes from the eyes of the enemy. The preface to the edition for the current year, 1919, which was signed on 1918 November 18, contains the pleasing announcement that, as the country is now liberated, the *Annuaire* will be able to appear in the future unfettered.

SCIENCE AND THE CLASSICS.

THE Classical Association held its annual meeting at Oxford on May 16–17, and Sir William Osler delivered the presidential address on "The Old Humanity and the New Science." Sir William began by referring to the history of the Divinity School, in which the meeting was held. It had been frequented, he said, by Linacre, who, in addition to being a pioneer in medical education, had achieved a great reputation as a scholar. It had known the times when the natural sciences were so much neglected that the belief was solemnly maintained that fossils had been buried in the earth to test man's belief in the omnipotence of the Creator. The last century had witnessed extraordinary developments in scientific knowledge of every sort, and the interest taken in discovery on one hand, and social progress on the other, had rather thrown the old humanities into the background. It might be maintained, from the part played by Science during the war, that its chief result had been to add to the sum of human misery; but, all things considered, such utilisation of discovery could not be fairly used as a reproach against Science; the fault lay in the degradation of the human mind which the horrors of the last five years had brought about. Sir William was rather inclined to subscribe to the opinion that the invention of firearms had been one of the main causes which saved the human race from destruction. But to assure the continued well-being of the race a different kind of education was necessary. The solution of the difficulty would be found in the union of Science with the Humanities. Germany, in which scientific education had been systematically developed, nevertheless had paid far greater attention to the study of the classics than any other modern nation.

The attitude of our modern society towards classical education might be compared with that of ants and wasps, which protect their larvæ, but require from them a return in the form of a honey which they secrete; and if the larvæ do not exude it freely, the V.A.D. wasps will nip their patients' heads to cause a quicker flow. The academic larvæ of to-day were much to blame, and it was for them to see to it that they exude their nectar more willingly. There had been practically no change in the papers set for "Greats" between 1831 and 1919; and, indeed, in 1267 the teaching of the schools was very much as it

is now. Classical education bulked too large in the University, and the unequal distribution gave cause for just resentment. Though biology provided a parallel in the destruction of millions of eggs in order to produce one salmon, and though the Oxford system occasionally produced a man like Ingram Bywater, the feelings and the lost opportunities of the countless others who were destroyed in the process ought to be considered. It would be far better for the average man to infect him with the spirit of the humanities than to waste his time by too much laborious attention to grammatical detail.

The great philosophers of old—Hippocrates, Galen, Theophrastus, Hero, Aristarchus, and others—fertilised Science and went far on the way towards understanding the system of Nature, but in the Middle Ages the thread was broken; Roger Bacon was the only medieval student with a modern outlook, and the loss of connection with the Humanities was a serious set-back to Science.

Modern men of science might well read such books as Lucretius's "De Rerum Natura," in which a great deal of modern discovery had been foreshadowed; and scholars should not hesitate to point this out.

An attempt was being made at Oxford to start a new Honours School of Philosophy in relation to science. This should prevent scientific men from getting lost in the backwaters of premature research. The groundwork of this school should not be limited to modern ideas, but the continuity of the history of Science through all the ages should be grasped. There was a great need of both general and individual reconstruction, and this should be undertaken in the spirit of Hippocrates's maxim, ἦν γὰρ παρῇ φιλανθρωπίη, πάρεστι καὶ φιλοτεχνίη—"The love of humanity is the basis of the love of science."

Loan Exhibition of Early Scientific Instruments.

On May 16 Sir William Osler opened a loan exhibition of most remarkable instruments and manuscripts illustrating the scientific history of Oxford from the fourteenth to the eighteenth century. The greater part of the instruments now shown have never been publicly exhibited before. They have been unearthed in cupboards and corners of libraries of colleges and university departments. They are, for the most part, in their original state and of corresponding historic value.

The two earliest dated Persian and Moorish astrolabes, A.D. 987 and A.D. 1067, lent by Mr. Lewis Evans, form a worthy introduction to a wonderful series of instruments lent by Merton College. One of these is traditionally associated with Chaucer, and another of the Saphea type is considered by Mr. Gunther to have been the instrument left by Simon Bredon either to the college or to its great astronomer, Rede, early in the fourteenth century. The energies of these early astronomers were largely directed to the preparation of astronomical tables, which had a wide circulation, and Oxford was regarded very much as Greenwich is now.

The later astronomical exhibits illustrate the instrumental equipment of the Earl of Orrery, who must have been acquainted with the first members of the Royal Society. Many of his instruments are still in the state in which he left them to Christ Church. His telescopes of 8 ft., 9 ft., and 12 ft. focal length, with many-draw vellum tubes and lignum vitæ lens-mounts by Marshall and Wilson, form a unique series.

There is also a Marshall microscope of 1603 in excellent condition, as well as some magnificent planetaria and other astronomical models by Rowley, the maker of the original orrery.

The slide-rule of 1654 in the South Kensington Museum, described in NATURE of March 5, 1914, by Mr. Baxandall as the earliest known slide-rule, must now yield to an instrument lent by St. John's College, dated 1635. It is in the form of a brass disc 1 ft. 6 in. in diameter engraved with Oughtred's circles of proportion. Would space permit, the series of volvelles or calculating discs showing the age of the moon from manuscripts of the fourteenth and fifteenth centuries, and some early surveying instruments, are worthy of more particular description, as well as many other treasures now shown to the public for the first time. A printed catalogue of the principal exhibits, prepared by Mr. R. Gunther, of Magdalen College, is published by the Clarendon Press, price 1s.

ELECTRIC FURNACES.

THE importance of electro-metallurgy at the present time was made evident at the joint meeting of the Institution of Electrical Engineers and the Iron and Steel Institute on May 8, when six papers were read on electric furnaces. The descriptions given by the various authors related almost exclusively to furnaces suitable for the iron and steel industry, of which there are at present 117 at work in this country, as compared with 287 in the United States and 43 in Canada. The nominal output of the British furnaces was given by Mr. R. G. Mercer as 31,250 tons per month, but, owing to various causes, the actual production was only about 65 per cent. of this amount. It will be seen from these figures that electric steel is now a well-established commercial product, and with the advent of cheaper electric power large developments may be witnessed.

The features common to all electric steel furnaces are (1) the use of alternating current with suitable transformers and (2) the formation of an arc between carbon electrodes above the charge, which plays upon the slag on the surface. It is customary to place one or more electrodes beneath the hearth of the furnace, so that a part of the current may flow through the charge when the hearth becomes hot enough to act as a conductor, the mixing of the molten metal being thereby facilitated. The electrical connections vary according to whether single-, two-, or three-phase current is employed, it being necessary in all cases to obtain a balanced polyphase load on the service lines.

In the two-phase furnace described by Mr. W. K. Booth two main electrodes are used, together with an auxiliary electrode which, at starting, is embedded in the charge, and serves to draw the arc between the charge and the main electrodes. Two other electrodes are located in the hearth, which, when hot, permits current to flow crosswise from these electrodes through the metal to the main electrodes, the auxiliary then being withdrawn. In Sahlin's furnace the electrodes enter at the sides, forming pairs inclined at an angle, the resulting arc being then directed on to the surface of the charge, several pairs, suitably connected, being used in the larger types. A single electrode is placed beneath the hearth. In the furnaces described by Mr. Victor Stobie vertical electrodes are used, the number depending on the size of the hearth, and the distribution being such as to ensure the heating of the whole surface of the charge. The hearth electrodes are stated by Mr. Stobie to be undesirable in large furnaces, though essential in small ones. A special feature of Stobie furnaces is a device for sealing the entrance of the electrode to the furnace, whereby oxidation at this point is prevented. The special electrical connections for obtaining a balanced load constitute the characteristic features of the furnaces dealt with by Mr. J. Bibby and Mr. H. A. Greaves, the former of whom gave

an interesting account of the design of electric reduction furnaces for the production of pig-iron from ore, a process which becomes economically sound when 1 horse-power-year of electrical energy does not cost more than 2·3 tons of coke, and is now coming into extensive use in Sweden and elsewhere. In this country steel refining for ingots and castings and the production of ferro-manganese and steel alloys constitute the chief uses of electric furnaces at present.

The relative merits of amorphous carbon and graphite for electrodes were dealt with in several of the papers read, the balance of evidence being in favour of graphite, which, owing to its superior conductivity, permits of the use of narrower electrodes. Dolomite is generally used to form the hearth, but acid linings are said also to be employed in some cases. In spite of the higher cost of heat produced electrically over the use of fuel, the superior quality of the products, the small wastage by oxidation, and the ease with which scrap may be utilised justify the use of the electric furnace. It is to be hoped that the experience gained with steel will lead to the production of artificial abrasives such as carborundum and alundum in Britain, and also to the development of the higher refractories needed in many metallurgical processes.

CHAS. R. DARLING.

BRITISH OPTICAL RESEARCH.

WE have before us several books and a large number of reprints from various scientific publications, all of which represent work done by members of the scientific staff of Messrs. Adam Hilger, Ltd., since the beginning of the war. We must welcome not only the fact that a British optical firm has realised the value of a considerable staff of highly qualified scientific collaborators, but more particularly the circumstance that this staff is encouraged by the firm in the *publication* of its work, and in thus helping to hasten the recovery by this country of the leading position in applied optics which it undoubtedly held in a rather distant past, but which it had almost completely lost in more recent years, largely through the narrow outlook of a majority of optical firms in seeking only immediate and certain profit and keeping down or totally excluding "non-productive" labour, but also through the failure of our educational institutions to teach real optics capable of application to actual technical problems instead of the transparent sham beloved by examiners and their text-books.

From the practical optician's point of view the most valuable of the publications are probably those by Mr. Twyman, the present head of the firm, which deal with the Hilger interferometer for the correction of lenses and prisms (*Phil. Mag.*, January, 1918, and *Photogr. Journ.*, November, 1918). By directly indicating the residual imperfections of a lens or prism in the form of a contour-map built up of interference-fringes, this instrument enables a skilled workman systematically to remove those imperfections and to perform, without other guidance, the process of "figuring" which hitherto had to be directed by a highly skilled and experienced observer on the basis of repeated tests of the lens or prism by the in- and out-of-focus appearance of a real or artificial star, and which then was an expensive, slow, and uncertain operation. For the present this valuable method is, unfortunately, limited to small sizes owing to the cost and difficulty of producing large plano-parallel plates of the requisite almost absolute perfection.

Mr. Twyman also contributes an instructive paper on the annealing of glass (Trans. Soc. of Glass Technol., vol. i., 1917), which deals more especially with the importance of passing the glass very slowly through a comparatively short range of temperature. In describing methods of fixing this range, and in working out the law according to which the viscosity of the glass increases within the critical range, Mr. Twyman goes decidedly beyond the publications of the Jena works on this subject of "fine annealing."

Two members of the staff, Mr. R. G. Parker and Mr. A. J. Dalladay, describe another valuable innovation in optical precision work, viz. the permanent union of very closely fitting polished glass surfaces by raising them to a very closely gauged temperature at which they become welded together without any distortion which would affect their optical perfection (Trans. Faraday Society, vol. xii., part 1, 1916). In the case of glasses which agree sufficiently closely in their rate of expansion, this promises to prove a very decided improvement on the usual cementing processes.

In an interesting paper to the Physical Society (Proc., vol. xxx., part iii.) Mr. Simeon discusses the accuracy attainable with critical angle refractometers. As is probably widely known, these instruments are now built by Messrs. Hilger, Ltd.

Dr. L. Silberstein, the scientific adviser of the firm, is widely known as an extremely able mathematical physicist. His two books on "The Electromagnetic Theory of Light" and on "A Simplified Method of Tracing Rays" have already been reviewed in these columns. In the collected researches before us we find five additional contributions from his pen to the *Phil. Mag.* A paper on "Fluorescent Vapours and their Magneto-optic Properties" and two on "Molecular Refractivity and Atomic Interaction" are purely theoretical investigations on subjects only remotely connected with technical optics. In a paper on "Multiple Reflections" (November, 1916) Dr. Silberstein gives a very general treatment, by his favourite vectorial method, of the reflection of light at combinations of plane mirrors, more particularly with the view of elucidating the behaviour of the important "central" or "corner-cube" mirrors which have proved so valuable for signalling and range-finding purposes. Finally, there is a paper on "Light Distribution round the Focus of a Lens at Various Apertures" (January, 1918), in which the problem of the spurious disc in the presence of spherical aberration is attacked. One would like to see the subject worked out in a more practically useful form; the example of the phenomena at the paraxial focus of a plano-convex lens which is chosen for numerical treatment is not very interesting, and there is an obvious numerical error in the working out of the "best relative aperture" on p. 47. By the author's own formula (20) this comes out at rather more than twice the stated values, and the results then agree fairly well with everyday experience as to the permissible aperture of plano-convex lenses as used in ordinary eye-pieces and magnifiers. But, apart from this little slip, the matter of real interest to optical designers is the appearance of the image at the point of best concentration of the light, which is easily shown to lie very nearly midway between the geometrical foci of the paraxial and marginal rays respectively, for in this position the maximum difference of phase is only one-fourth of that at either the paraxial or the marginal focus. At the correctly worked out "best relative aperature" the lens of 5·56 cm. radius of curvature chiefly calculated for by Dr. Silberstein has a longitudinal spherical aberration of about 0·6 mm., and the interesting region would therefore be found about 0·3 mm., say 600 λ. from the paraxial focus. It is, therefore, not surprising that the author finds no appreciable change in the light distribution on trying a change of focus of "even" 10 λ. It is greatly

to be hoped that this valuable work will be further developed, as it deals with a matter of the highest importance and interest.

We have finally to notice a most useful reference-book, "Tables of Refractive Indices," vol. i., "Essential Oils," compiled by R. Kanthack, which has just been published by the firm. A glance at the introductory list of 282 references to the widely scattered literature drawn upon in this compilation is alone sufficient to emphasise the value of the little volume.

We shall look forward with great interest to further additions to this first list of the achievements of the scientific staff of Messrs. Adam Hilger, Ltd.

A. E. C.

A NEW BRITISH WHALE.

DR. S. F. HARMER'S report on Cetacea stranded on the British coasts during 1918, published by the British Museum (Natural History), is one of quite exceptional interest to cetologists. Its most important feature is the announcement of the stranding during 1917 of a specimen of the remarkably rare True's whale (*Mesoplodon mirus*). In his report for 1918 this whale was recorded as Cuvier's beaked whale (*Ziphius cavirostris*) from Liscannor, Co. Clare. This was a quite pardonable error, since the skeleton reached the museum in a roughly cleaned condition, and displaying two large terminal mandibular incisors closely similar to those of a Ziphius. When the cleaned skull came to be examined, however, it became evident that a mistake had been made. This is the only male which has yet been recorded, and, so far, but three examples of this animal are known. The first recorded specimen, a female, was taken at Beaufort Harbour, North Carolina, on July 26, 1912, and was described by the late Mr. F. W. True. It now appears that a third example is in the possession of the Galway Museum. This was taken in Galway Bay somewhere about 1899. Some very useful measurements of the skull, a photograph of the mandible, and comparisons between the teeth of the Liscannor specimen and those of other species of Mesoplodon and Ziphius, add greatly to the value of this account. The mandible of Berardius, it may be remembered, bears two pairs of teeth, a pair at the extreme end of the mandible and a pair further back. Dr. Harmer suggests, and he is probably right, that the teeth of Ziphius, *Mesoplodon mirus*, and *M. hectori* answer to the anterior pair, while those of *Mesoplodon bidens* and allied species are homologous with the posterior pair.

Since each succeeding report adds greatly to the value of those which have preceded it, we trust that these annual summaries will long be continued, for they will add immensely to our knowledge of the migrations of the Cetacea of our seas. Already they show that some species are not so rare as they were supposed to be until this investigation was embarked upon.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

EDINBURGH.—A lectureship on the subject of organisation of industry and commerce is to be instituted, the endowment fund having been supplied by subscriptions from members of the following bodies:—Edinburgh Chamber of Commerce, Edinburgh Merchant Company, Leith Chamber of Commerce, Leith Shipowners' Society, and the Institute of Bankers in Scotland.

Prof. Pringle Pattison has intimated his resignation as from September 30 next of the chair of logic and metaphysics.

OXFORD.—Several professorships which have been suspended during the war have now been restored by decree of Convocation. Among these are the professorships of logic, geometry, and experimental philosophy. An election to the latter has already taken place, as previously recorded in NATURE.

The preamble of a statute admitting women as candidates for diplomas in science and other subjects has recently been passed by Congregation.

On May 20 the same body accepted the preamble of a statute introducing many changes in the First Public Examination (commonly known as "Moderations"). Among these is the incorporation as optional subjects in this examination of mechanics and physics, chemistry, zoology, and botany.

THE *Times* announces that the sum of 200,000*l.* is being provided by the Victorian Government to enable Melbourne University to complete its buildings.

APPLICATIONS for the filling of the chair of biology in the University of Melbourne, consequent upon the retirement of Sir W. Baldwin Spencer, are invited by the Agent-General for Victoria, Melbourne Place, Strand, W.C.2. The duties of the new professor will begin in March, 1920.

A WIRELESS PRESS message from New York states that Harvard University has raised a fund of 8000*l.* to found a scholarship, to be known as the Choate memorial scholarship, which will provide for the exchange of students between the American university and Cambridge.

A LIMITED number of free places tenable at the Imperial College of Science and Technology, South Kensington, are being offered by the London County Council to students capable of profiting by an advanced course of instruction. Applications have to be made upon special forms, obtainable from the Education Officer, L.C.C., Victoria Embankment, W.C.2, and returned by Saturday, June 14.

THE University Court of the University of Aberdeen will in July, under the Georgina McRobert foundation, appoint a lecturer in pathology, with special reference to malignant disease. The lecturer should possess special knowledge of pathological chemistry, and will be expected to conduct research and to give instruction in subjects connected with his investigations. Applications for the post must be received on or before June 24.

THE regulations respecting the open competitive examinations (August, 1921) for clerkships (Class I.) in the Home Civil Service have now been published by the Civil Service Commission. The examination will be in two parts. The papers in Section A, which must be taken by all candidates, are:—Essay, English, questions on contemporary subjects, science, translation from one language. These all carry equal marks. In addition, there is a *viva-voce* examination which is valued as equal to three of the foregoing. In Section B a very wide choice of subjects is offered. In this there seems to be a fair balance, and ample opportunity is offered to students of mathematics or science. It is interesting to compare these regulations with the recommendations of Sir J. J. Thomson's Committee. They do not, for instance, require "all candidates to supply evidence of a continuous course of training in science extending over several years." They do offer some encouragement towards the study of the subject, though the extent of this will depend on two factors: reasonable opportunity for the student of science in the essay paper, and the appointment of a representative of science among the *viva-voce*

examiners. The Thomson Committee recommended: "That many permanent posts can best be filled by men selected, not by the ordinary competitive examination, but at a riper age on the ground of high scientific qualifications and professional experience." It is to be hoped that this point will not be overlooked; it is of paramount importance to the Empire.

THE Education Section of the British Association has prepared a full programme for the meeting to be held at Bournemouth. On Tuesday, September 9, Sir Napier Shaw will deliver his presidential address at 10 o'clock, the latter part of the morning being devoted to the consideration of the free-place system, with especial reference to the question of maintenance grants and the tenure of the free-place holders. In the afternoon a discussion upon the teaching of English will take place. On Wednesday, September 10, the morning will be devoted to considering "The Method and Substance of Science Teaching"; several well-known educationists have promised to take part in the discussion, and an interesting debate is expected upon the two reports recently issued by Sir Joseph Thomson's and Sir Richard Gregory's committees. During the Wednesday afternoon a joint meeting with Section F (Economics) will consider the question of "Education in Relation to Business." The future of continuation schools is to be discussed on the Thursday morning, and, in view of the changes which the new Education Act will cause in these, this should prove one of the most interesting features of the meeting; for Thursday afternoon an animated debate upon the relation of humanistic and scientific studies is being arranged. It is hoped that Bishop Welldon will be able to open a discussion upon "Training in Citizenship" on the Friday morning; and in the afternoon of that day the question of private schools will be considered, the latter subject being one of especial interest in towns like Bournemouth. Communications intended for the section should be addressed to the Recorder, Mr. Douglas Berridge, the College, Malvern.

UNIVERSITY Bulletin No. 19 of the University of Illinois is devoted to a pictorial description of buildings, laboratories, and other facilities for instruction and research at the College of Engineering and Engineering Experiment Station of the University. The work of the college includes twelve four-year courses leading to degrees. The feature in which the institution differs most from European practice is the experiment station, an organisation created in 1903 to stimulate engineering education and to promote the investigation of practical problems. Its control is vested in a director, the heads of the departments of the college of engineering, and the professor of industrial chemistry. The researches are chiefly conducted by full-time research assistants, research graduate students, and special investigators engaged for a limited time on single problems. The University maintains fourteen graduate studentships for research, and two have been founded by the Illinois Gas Association. Each carries a stipend of 500 dollars and freedom from fees, and leads to a degree of M.Sc. Half the time of these students is devoted to research, and the remainder is available for study. The station has published 110 bulletins and eight circulars, mainly distributed free. In this pamphlet interesting photographs are given of the buildings, laboratories, libraries, testing machines, mining machinery, arrangement for testing locomotives, electric railway test car, and training quarters for the cadet corps. A department not usually found in engineering colleges, at any rate in so comprehensive a form, is that of ceramic engineering. It deals with the technology of industries concerned with clay, glass, cement, lime, gypsum, and enamelled ware.

IT is satisfactory to observe that serious efforts are being made to provide for the soldiers belonging to the Army of Occupation in Germany reasonable educational facilities—general, scientific, and technical. It is extremely important that men so situated, with probably much leisure time at their disposal, should have opportunities of pursuing their studies and of continuing the experience they have already gained in their former avocations, and even of taking up some new pursuit, where they have the initial gift of artistic expression, so that when they return to civil life they may readily find openings for effective employment. In a recent issue of the *Cologne Post*, a daily paper published in English for the Army of the Rhine, attention is directed to the establishment in the Handels Realschule in Cologne of academic and commercial courses with a wide range of subjects, and to the Army Technical College which it is proposed to open in a well-equipped factory at Siegburg, where arrangements are made by which the apprentice or improver can continue the practice of his vocation; where also men and officers of artistic aptitudes can take up specific arts and crafts; and where men of satisfactory education can pursue their studies so as to qualify them for degrees in engineering or cognate subjects. Stress is laid upon due preparation for such courses and the great value of scientific direction, so that workers shall know not only what to do, but also why they do it. Mere empiricism is discouraged, and a thorough grounding in the science of technical pursuits made a matter of chief moment. There is, moreover, already a science college at Bonn where any soldier desirous of taking up agricultural pursuits can enter upon the study of the science of agriculture and the allied sciences.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, March 28.—Prof. C. H. Lees, president, in the chair.—Sir Richard **Glazebrook**: Metrology in the industries. In opening this discussion Sir Richard Glazebrook traced briefly the early history of metrology. The first application of really accurate measurement to mechanical engineering was chiefly due to Sir Joseph Whitworth, who taught people to make their length measurements with great accuracy and introduced reference gauges. The next step was the use of limit gauges. This greatly simplified the gauging of repetition work. At the time of the Boer War the supplies of ammunition, especially breech plugs of guns, were not interchangeable as obtained from different shops. This led to the formation of the Engineering Standards Committee on Gauges, which tackled the problem of producing accurate gauges with defined limits and tolerance, and by 1914 a certain number of firms had introduced the use of limit gauges. In 1915 the demand for munitions on a great scale brought home the great importance of interchangeability and the need for strict standardisation of gauges. When screw gauges were first tested at the National Physical Laboratory the rejections totalled 75 to 80 per cent.; but after two years this was reduced to about 20 per cent. Now, if we are to maintain our position in peace, the maintenance of interchangeability in engineering manufacture is equally necessary, so that we may manufacture in quantity. Much has yet to be done if we are to keep ahead, and the co-ordination of research with routine testing is vital to the progress of the science.

Aristotelian Society, April 15.—Prof. G. D. Hicks in the chair.—Prof. J. B. **Baillie**: The stereoscopic character of knowledge. In knowledge the mind seeks to become conscious of the individuality of the object in its solid integrity. In the process of knowledge the whole energy of the individual mind is engaged, and not simply one particular function. The ultimate achievement of knowledge is the fulfilment or realisation of the individual mind as a single whole of individuality existing and subsisting in interdependence with a world of equally real individual beings. The view of knowledge as consisting in a mere linear succession of stages which are means to and subordinate to an end is set aside as inaccurate because the end is present in the process from first to last, and because the life of the mind, of which knowing is one mode, grows and maintains itself by the simultaneous co-operation of all its functions in their inseparable unity. Equally inaccurate, it is held, is the view that in knowledge the mind merely represents, reproduces, and copies the real world. As contrasted with these views, it is maintained that knowledge is stereoscopic or realistic in character. It is realistic in the sense that it presents the real in its solid integrity, that it is a vital activity in which the individual mind fulfils its own life, and that it is the consummation in conscious form of the nature of the real world as embodied in man's plane of existence.

Challenger Society, April 30.—Prof. E. W. MacBride in the chair.—E. J. **Allen**: A contribution to the quantitative study of plankton. To determine the number of individual organisms belonging to the smaller Protista which are present in a sample of sea-water, the best method hitherto available has been to subject a small sample of the water to the action of a centrifuge, and then count under the microscope the number of individual cells contained in the deposit. By adding a small quantity (½ c.c.) of the sample of sea-water to be examined to a large quantity (1½ litres) of a suitable sterile culture medium, subdividing into a number (70) of small flasks, and allowing the organisms in these flasks to develop, the author has shown that a very much larger number of unicellular organisms are present than the centrifuge method would lead one to suppose.

Geological Society, May 7.—Mr. G. W. Lamplugh, president, in the chair.—Major R. W. **Brock**: Geology of Palestine. The following formations are recognised:—

QUATERNARY.	Alluvium.	Dunes; Valley and Plains clay, and Silt; Desert Crust.	Heavy volcanic flows, basalts, ashes, tuffs, etc.
	Diluvium.	Terrestrial. Lisan Formation (Jordan-lake-beds).	
		Marine. Upper Calcareous Sandstone and Limestone.	
		Lower Calcareous Sandstone.	
TERTIARY.	Pliocene.	Lacustrine.	
	Eocene.	Nummulitic Limestone.	
MESOZOIC.	Cretaceous.—Upper—Senonian—Danian, Campanian, Santonian		volcanics, basalts.
	Upper—Turonian		
	Upper—Cenomanian.		
	Lower	Nubian Sandstone. Jebel-Usdum formation (?).	
	Jurassic.	On Lebanon and Hermon only.	
PALÆOZOIC.	Carboniferous.	Possibly south-east of the Dead Sea.	
	Cambrian.	Dolomite and sandstone.	
PRE-CAMBRIAN.	Volcanics and arkose.		
	Red granites and porphyries.		
	Grey granites, gneiss, and crystalline schists.		

The structure was shown to be that of a tableland bisected by a great rift-valley (graben), and flanked by a coastal plain. A section was exhibited illustrating East Jordanland acting as a horst; the boundary faults of the Jordan Trench; the unequal sinking of the contained blocks; the western section of the tableland sunken with relation to the eastern, and thrown into an asymmetric anticline, the limbs of which rise in steps through monoclinal flexures or faults.

Optical Society, May 8.—Prof. F. J. **Cheshire**: The polarisation of light. The lecture was illustrated throughout by means of projection apparatus invented and designed by the lecturer, an important feature of the apparatus being the form of polariser in which a modified double-image prism was employed instead of the usual Nicol. It was explained that the 'spar required for this particular prism was only about one-eighth of that required for a Nicol prism of the same aperture.—J. **Rheinberg**: Graticules. Starting with the origin of the term graticules, which are defined as the "measuring scales or marks placed in the focal plane of an optical instrument for the purpose of determining the size, distance, direction, position, or numbers of the object viewed coincidently with the scale itself," the paper discusses in detail the various methods of manufacture in this country and abroad up to the period of the war, which led to the Germans having a practical monopoly of the article except in the case of simple patterns, such as cross-lines and simple patterns without numerals. This is followed by some account of the research work done during the war, which led to the production of graticules by the author, first by grainless photography, and ultimately by filmless photography, enabling graticules to be turned out in large quantities, not only of the kinds hitherto only produced abroad, but also of many new kinds. The optical peculiarities of the various kinds are next discussed, and a chapter deals with graticule design, showing how, with the variety and choice now available, it is necessary to co-ordinate the graticule to the design of the optical instrument and its purpose as a whole. A number of new uses for graticules are put forward, and it is suggested that new applications, some of which have already been initiated, might easily lead to important improvements in many types of optical apparatus.

Zoological Society, May 13.—Prof. E. W. MacBride, vice-president, in the chair.—N. **Taylor**: A unique case of asymmetrical duplicity in the chick.—Lt.-Col. S. Monckton **Copeman**: Experiments on sex determination.

Mathematical Society, May 15.—Mr. J. E. Campbell, president, in the chair.—Prof. G. N. **Watson**: The zeroes of Lommel's polynomials.—Prof. W. H. **Young**: The triangulation method of defining the area of a surface.

MANCHESTER.

Literary and Philosophical Society, April 29.—Prof. G. Elliot Smith, president, in the chair.—Sir Henry **Miers**: Some features in the growth of crystals. Crystals not only change their form during growth by the development of new faces, but also often display a tendency to appear first as needles and then in regular forms, seeming to pass through two stages. Experiments were made by the author many years ago in an attempt to determine the concentration of the solution in contact with a growing crystal, the refractive index being measured by the method of total internal reflection. These experiments led to the conclusion that in a cooling supersaturated solution stirred in an open trough, a sudden change in refractive index takes place at a definite temperature, and that this is due to the sudden appearance of new crystals or to the suddenly increased growth of the crystals already present. Enclosed in a sealed tube and shaken, the solution yields a shower of crystals at this temperature alone, although, for example, in the case of sodium nitrate, it is about 10° below that of saturation. Further experiments on a large

number of aqueous solutions and binary mixtures, such as salol mixed with betol, confirmed the conclusion that a supersaturated solution passes at a definite temperature into a condition (the labile state) in which spontaneous crystallisation can be induced by mechanical means, whereas above this temperature (the metastable state) crystals only grow by inoculation of the solution with crystalline germs.

BOOKS RECEIVED.

Cultural Reality. By Dr. F. Znaniecki. Pp. xv+359. (Chicago: University of Chicago Press.) 2.50 dollars net.

Le Français Enseigné par la Méthode Intuitive et Directe. By Prof. P. Dessagnes. Pp. viii+304. (Paris: Masson et Cie.) 5 francs net.

A Manual of Machine Design. By F. Castle. Pp. ix+351. (London: Macmillan and Co., Ltd.) 7*s*. 6*d*.

The Principles Underlying Radio-Communication. (Radio Pamphlet No. 40, December 10, 1918, Signal Corps, U.S. Army.) Pp. 355. (Washington: Government Printing Office.)

Aquatic Microscopy for Beginners, or Common Objects from the Ponds and Ditches. By Dr. A. C. Stokes. Fourth edition. Pp. ix+324. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 10*s*. 6*d*. net.

Fats and Fatty Degeneration. By Prof. M. H. Fischer and Dr. M. O. Hooker. Pp. ix+155. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 9*s*. 6*d*. net.

Shore Processes and Shoreline Development. By Prof. D. W. Johnson. Pp. xvii+584. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 23*s*. net.

Macmillan's Geographical Exercise Books. Africa. With questions by B. C. Wallis. Pp. 48. (London: Macmillan and Co., Ltd.) 1*s*. 6*d*.

Songs from a Watch-Tower. By R. H. McCartney. Pp. 151. (Chicago and New York: Fleming H. Revell Co.)

Fresh Hope and Health for Hospital Patients and Invalids. By C. Muller. Second edition. Pp. 63. (London: G. Bell and Sons, Ltd.) 2*s*. net.

Biochemical Catalysts in Life and Industry. Proteolytic Enzymes. By Prof. J. Effront. Translated by Prof. S. C. Prescott, assisted by C. S. Venable. Pp. xi+752. (London: G. Bell and Sons, Ltd.) 23*s*. net.

Fresh-water Biology. By Prof. H. B. Ward and G. C. Whipple and others. Pp. ix+1111. (London: G. Bell and Sons, Ltd.) 28*s*. net.

British Museum (Natural History). Studies on Acari. No. 1. The Genus Demodex, Owen. By S. Hirst. Pp. 44+xiii plates. (London: British Museum (Natural History); Longmans and Co., and others.) 10*s*.

A Course in Machine Drawing and Sketching. By J. H. Dale. Pp. vi+186. (London and Edinburgh: W. and R. Chambers, Ltd.) 3*s*. 6*d*. net.

DIARY OF SOCIETIES.

THURSDAY, MAY 22.

ROYAL INSTITUTION, at 3.—Prof. F. Keeble: Intensive Cultivation.

ROYAL SOCIETY, at 4.30.—Prof. W. J. Sollas: The Structure of Lysorophus as Exposed by Serial Sections.—O. Rosenhein: A Preliminary Study of the Energy Expenditure and Food Requirements of Women Workers.—M. Greenwood, C. Hodson, and A. E. Tebb: Report on the Metabolism of Female Munition Workers.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—Dr. S. Chapman: Electrical Phenomena occurring in High Atmospheric Levels.

FRIDAY, MAY 23.

PHYSICAL SOCIETY, at 5.—Lewis F. Richardson: A Form of Knudsen's Vacuum Manometer.—Gilbert D. West: Theories of Thermal Transpiration.—Prof. W. H. Eccles: Demonstration of a Tuning-fork sustained by Thermionic Tubes.

SATURDAY, MAY 24.

LINNEAN SOCIETY, at 3.—Anniversary Meeting.

MONDAY, MAY 26.

ROYAL SOCIETY OF ARTS, at 4.30.—Capt. F. E. D. Acland: A New Prime Mover of High Efficiency and British Origin.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Capt. A. de C. Sowerby: Recent Journeys in Manchuria.

TUESDAY, MAY 27.

ROYAL INSTITUTION, at 3.—Prof. W. H. Bragg: Listening under Water.

ROYAL SOCIETY OF ARTS, at 4.30.—Lt.-Col. the Hon. Sir John McCall: Science and Industry in Australia.

ZOOLOGICAL SOCIETY, at 5.30.—J. T. Cunningham: Result of a Mendelian Experiment on Fowls, including the Production of a Pile Breed.—Miss Kathleen F. Lander: Some Points in the Anatomy of the Takin (*Budorcas taxicolor whitei*).—E. P. Allis: Certain Features of the Otic Region of the Chondrocranium of Lepidosteus, and Comparison with other Fishes and higher Vertebrates.

WEDNESDAY, MAY 28.

ROYAL SOCIETY OF ARTS, at 4.30.—H. J. Powell: Glass Making Before and During the War.

THURSDAY, MAY 29.

INSTITUTION OF ELECTRICAL ENGINEERS, at 2.30.—Annual General Meeting.

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

ROYAL SOCIETY, at 4.30.—Croonian Lecture—Dr. H. H. Dale: The Biological Significance of Anaphylaxis.

ROYAL AERONAUTICAL SOCIETY, at 8.—Squadron-Commander G. M. Dyott: Flying in South America.

FRIDAY, MAY 30.

ROYAL INSTITUTION, at 5.30.—Sir John R. Bradford: A "Filter-passing Virus in Certain Diseases.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—Discussion resumed by Dr. W. Rosenhain on Paper by Dr. W. H. Hatfield: The Mechanical Properties of Steel, with some consideration of the Question of Brittleness.

ILLUMINATING ENGINEERING SOCIETY, at 8.—F. W. Willcox: The Gas-filled Lamp and its Effect on Illuminating Engineering.

SATURDAY, MAY 31.

BRITISH PSYCHOLOGICAL SOCIETY, at 3.30.—F. E. Bartlett and Miss E. M. Smith: Listening to Sounds of Minimal Intensity.—E. Bullough: The Relations of Æsthetics to Psychology.

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

Advertisements and business letters to be addressed to the Publishers

Editorial Communications to the Editor.

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