THURSDAY, AUGUST 31, 1916.

A SURGICAL BOOK FROM THE FRONT

Surgery in War. By Major A. J. Hull. Pp. xv + 390. (London: J. and A. Churchill, 1916.) Price 10*s.* 6*d.* net.

THIS handbook is described in the introduction by Lieut.-Col. E. M. Pilcher, R.A.M.C., as a *résumé* of current practice and experience at the front; and the fact that Sir Alfred Keogh, the Director-General of the Army Medical Service, has written a preface to it stamps it as, at any rate, "semi-official." It has, therefore, an interest apart from its strictly surgical aspect, and although, as Sir Alfred Keogh remarks, "the views expressed therein may not command assent in every quarter," they demand careful and sympathetic consideration.

The author has enlisted the service of several of his colleagues who have had special experience in certain types of cases and have written the sections of the book corresponding to their own particular speciality: Lieut.-Col. Harrison discusses the bacteriology of wounds in war; Dr. Greenfield, the general condition of the wounded and wounds of the abdomen, and he is also responsible for the illustrations; Lieut. Tanner, the treatment of wounds by saline solution; Capt. Snowden, injuries to peripheral nerves; and Lieut. Edwards is responsible for the radiographic section of the book.

The treatment of a wounded man can be considered in three stages. The first is to combat shock and arrest hæmorrhage; the second is the great fight against infection; while the third is the effort to restore the damaged part to its normal function and the injured man to his normal health.

For the first of these stages the author strongly advocates the free use of morphia given in full doses—that is to say, until the patient is well under its influence and his pain has been materially subdued. This treatment will meet with fairly general approval. It is interesting to note that the Service affection for initial-letter abbreviations has reached even to the morphia bottle: the dose recommended is I.M.H. gr. $\frac{1}{4}$.

The author is not in favour of stimulants, and it is possible that in this he is regarding shock from an ultra-academic point of view. It is hard to define exactly what is meant by shock, and it is quite possible that a treatment which is not suitable for "shock" as defined, for example, by Crile may be quite a good one for a wounded man. It may be easy to draw laboratory distinctions between shock and collapse, but it is not easy to say where one begins and the other ends when confronted with what one of our statesmen so aptly calls a "heap of bloody rags."

Injection of saline solution is not recommended "unless there has been hæmorrhage," as its effects are transitory. This remedy is of course often disappointing in its results, but it would be a great pity if so simple a method of treatment were discredited. It is not easy to say how much blood a man has lost, and unless the saline injection be excessive in amount, it is hard to see what harm is done, especially if the other methods of relieving shock be adopted as well.

The warning on p. 30 against keeping a patient too long on a restricted diet is very much to the point: this error is probably a survival of the ancient doctrine of "starving a fever." A patient, however, who, in addition to prolonged physical fatigue and mental strain, has to combat a severe suppuration lasting often for weeks or even months requires as generous a diet as he can digest and assimilate.

The second phase of the surgeon's work is the struggle against infection, and in this connection the author is a strong supporter of the "strong salt" or "salt-bag" treatment, and equally opposed to the use of chemical antiseptics. To quote from p. 66: "I have found the results of treatment by hypertonic solution superior to any antiseptic treatment. . . . The ordinary antiseptics, iodine, boric fomentations, peroxide of hydrogen, and alcohol dressing, have appeared to me decidedly inferior to the saline treatment. The strong antiseptics—for example, pure carbolic—have not been used in my wards."

This quotation is an ample explanation of the author's distaste for antiseptics. Iodine is so readily rendered inert by albuminous material as to be practically useless for a discharging wound; boric acid is a feeble germicide, and its main value is the prevention of secondary infection; while peroxide of hydrogen and alcohol must, from their physical properties, exert a very transient influence.

In an earlier section the author quotes the results of treating wounds with strong antiseptics early in their course, and sums up strongly against them. The evidence which he quotes of twenty-seven cases treated with pure carbolic acid—he does not say exactly how—is not very satisfying.

The whole subject of the disinfection of wounds by chemical antiseptics has been argued with an enthusiasm which has at times almost carried with it a sort of "odium theologicum." This is, however, merely an indication of the sincerity of the protagonists. There are undoubtedly many wounds which it is impossible to disinfect, if for no other reason than that the patient is unable to bear the severe operation which would be necessary, in order to open up the remote recesses of the wound and apply the antiseptic, until the infective process has gained too firm a hold for it to be stamped out. There are times, too, when the necessary *personnel* and equipment for such treatment are not available, and this must be so; but there are wounds which can be cleaned surgically, and there are occasions when opportunities for carrying this out are present, even if on rare occasions.

There is a solution commonly called "Lister's strong lotion," which consists of 5 per cent. carbolic acid containing 1/500th part of perchloride of mercury. This can be applied freely and thoroughly to wounds, and in some cases is successful in disinfecting them, even when bone has been

involved. But it must be allowed some time to act, and must be applied thoroughly to every part of the wound, not neglecting to remove foreign bodies and provide for the due drainage of the wounds. Further, it and all other antiseptics must be applied early, since when the wound is actually suppurating they are of little value, and in such cases the patient's own resisting power, aided by drainage, irrigation, artificially induced lymph discharge, or other methods of removing the bacterial toxins, is the main factor ensuring his recovery.

The author is almost as much opposed to the use of hypochlorous acid and its salts. He only makes mention of "Eusol," which has not the valuable property of hypochlorite of soda—namely, of dissolving sloughs, which of itself aids materially in facilitating drainage. Those who have seen stinking wounds become sweet very rapidly under the application of this group of disinfectants, or have seen wounds of the mouth treated with Chloramine T, will feel that these substances deserve stronger commendation.

In the sections of this book devoted to the third phase of the surgeon's work there is less disputable matter. In operations the use of local anæsthesia, supplemented if necessary by a general anæsthetic, is advocated, and for the treatment of the various groups of injuries excellent and definite rules are laid down, one of the best sections being that on injuries of the peripheral nerves.

The book is illustrated with a number of simple drawings of splints and apparatus, which might perhaps be amplified in a succeeding edition, showing more exactly the details of their use. The mass of compound fractures which has come for treatment has resulted in the invention of numerous, ingenious, practical devices for their fixation, and for a surgeon to avail himself of these, it is necessary that he should have exact working details—for example, how to take the appropriate measurements, and also, in the case of more elaborate apparatus, where to procure the same. There is also an interesting series of skiagrams taken by Lieut. Edwards, the majority of which show bullets in various situations in the body. Might it be suggested that some of these plates, which for the most part give no guide to the practical surgeon, could be replaced with advantage by photographs of the various splints as fixed to actual patients?

THE WORTH OF CHEMISTRY.

Chemistry in the Service of Man. By Prof. Alexander Findlay. Pp. xiii+255. (London: Longmans, Green and Co., 1916.) Price 5*s.* net.

THIS book is based upon a course of lectures delivered in 1915 by the author to the United Free Church College at Aberdeen. As a teacher of chemistry Prof. Findlay rightly considered he could do no more useful service than to give his hearers, who would otherwise have little opportunity of becoming acquainted with such matters, some information concerning what the science of chemistry has been able to accomplish in the "uplifting" of mankind and in promoting its material well-being.

Although originally addressed to a Scottish audience, the author, in the selection and arrangement of his subject-matter, has been guided by other considerations than the purely utilitarian. His hearers, as a body, were presumably sufficiently enlightened to appreciate the philosophic vein which runs through the method of its presentation, and were able to set a proper value on his attempts to elucidate the abstract principles he sought to inculcate. His purpose was to recount not merely "the manifold ways in which chemistry has revolutionised life and has contributed, on the material side, to a civilised existence," but also to indicate "some of the principles which underlie chemical change and some part of the contribution which chemistry has made to our knowledge of the constitution of matter." In this happy blending of the philosophic and purely scientific with the utilitarian and material the book may be said to fulfil the ideal of what such a work should be. The author treats his themes with the dignity and reverence which, as a teacher imbued with the true spirit of science, he feels instinctively they merit. The doctrine is sound and accurate, and is set forth in sufficient fullness for the immediate purpose of exposition. At the same time the lay reader, for whom of course the book is mainly intended, will not be wearied or his interest weakened by technicalities or discussions of purely abstract principles. The tactful manner in which Prof. Findlay has managed to steer a middle course in this respect is a characteristic feature of his work. Moreover, he has not been unmindful of the signs and portents of the times. They have afforded him ample material for a lay-sermon, which he has not failed to drive home. The appearance of such a book at the present juncture is therefore most opportune.

The work opens with an exordium in which the province and scope of chemistry, both as a science and an art, are clearly and succinctly defined. It presents, as might be anticipated, no special features of novelty to the trained chemist, but it is well written, and is a good illustration of Prof. Findlay's power of lucid exposition and clear thinking. In a few comprehensive statements he traces in broad outline the developments of the conception of the atomic constitution of matter; the gradual recognition of its various elemental forms, and of the distinction between elements and compounds; the perception that the form of energy with which chemistry is specially concerned acts in accordance with definite laws, and that it is a science of quantitative relations capable of rigorous mathematical treatment. On the basis of this preparatory ground-work he proceeds to illustrate and explain, in about a dozen chapters, some of the most important achievements of the science, each chapter dealing with a specific subject or group of correlated subjects, such as Combustion and the Production of Fire; the Chemistry of Illuminants; Energy, Fuel and Explosives; Cellulose and Cellulose Products;

Velocity of Reactions and Catalysis; Fixation of Atmospheric Nitrogen; Glass, Soda, Soap; Electricity and Chemistry; the Colloidal State; Molecular Structure; and Synthetic Chemistry.

The mere enumeration of the titles of the several chapters will serve to show the range and method of treatment of the subject-matter of the book. Prof. Findlay, it will be observed, carried his hearers, and will carry his readers, far beyond the stock subjects of ordinary lecturers on the utility of chemistry. He has not hesitated, in fact, to deal with some of the most recondite problems of modern science, and has given amongst his illustrations many of the most striking and characteristic achievements of the present time. In so doing he has acted wisely. He has not only added thereby to the interest and merit of his book, but he has conferred upon it a measure of permanency which it might otherwise not possess.

The work is a distinct and valuable addition to the popular literature of science, and it is well worthy of a place in the library of every secondary school. No more appropriate gift-book to the youthful tyro could be given, for it is admirably calculated to awaken the aspiration and quicken the enthusiasm of the boy or girl who has any latent faculty for science. Even if it does not impel them towards a scientific calling, it will at least furnish them with a stock of facts and ideas which cannot but tend to widen their intellectual horizon and enlarge their mental outlook. If books of this kind were more generally read and digested we should have less cause to complain of that apathy which has hitherto characterised even the cultured classes in this country in regard to the claim of physical science to be an essential part in the scheme of our national education.

T. E. THORPE.

ECONOMIC GEOGRAPHY.

Commerce and Industry. By Prof. J. R. Smith. Pp. viii+596. (New York: H. Holt and Co., 1916.) Price 1.40 dollars.

THIS book is for the most part an abridgment and rearrangement of the matter composing the same author's "Industrial and Commercial Geography," reviewed in NATURE of February 26, 1914 (vol. xcii., p. 707), though this fact is disguised, to some extent, by the titles given to the sections and chapters. Part i. is entitled "The United States," but the chapters are, for the most part, the same, even in title, as those which come under the general heading, "Industrial Geography," in the earlier and larger work, but with the omission or transference to another part of the book of paragraphs which do not properly come under the head of "The United States." The second part is entitled "Foreign Countries," and here comes in most of the new matter; but even here so much is made up of paragraphs derived from the source just indicated that it requires a very close comparison of the two volumes to ascertain how much altogether is new. A third part is entitled "World Commerce," and this is entirely composed of chapters abridged from the corresponding chapters of either part i. or part ii. of the "Industrial and Commercial Geography." A statistical appendix is added, containing tables transferred from the body of the earlier work, brought up to date where necessary, in addition to a few others, these latter including elaborate and useful international comparisons.

From the account just given it will be understood that though the title of the present volume does not profess to offer us a geographical text-book, the contents are even more geographical in form than those of its predecessor. Different countries, or sometimes regions, are the subjects of the chapters in the part, comprising just 200 pages, bearing the general heading "Foreign Countries." In the arrangement of these chapters, as well as in the allotment of space to the different countries, the American point of view is naturally dominant. The first six chapters are devoted to American countries outside the United States, and take up one-fourth of the space given to the whole of this part. The descriptions of countries are necessarily brief. They do not go into details of regional geography, but everywhere they show the author's well-known penetrating intelligence. They are admirable summaries from the viewpoint indicated in the title of the book. They provide teachers with much food for thought as to the geographical causes explaining or contributing to explain the actual state of industrial and commercial development and course of trade, as well as those which afford grounds on which to base reasonable estimates for the future. And in this respect the text is well supplemented by illustrations (many new to this work) of striking significance.

One defect of the larger work is illustrated in this book also. The author does not seem to be a very good proof-reader. On p. 132, title of illustration, we have "countries" for "counties"; p. 476, "Cerea" for "Ceará"; p. 480, "Massamedes" for "Mossamedes"; p. 482, "Beiro" for "Beira." In the last table of the book, a reproduction of that given on p. 100 of the earlier work, the obvious mistake of "1·65" for "16·5" as the percentage of protein in sirloin steak is repeated. In the legend to the wheat map of Russia on p. 400 one is obliged to ask, 1 per cent. of what?

G. G. C.

OUR BOOKSHELF.

Geodetic Surveying. By Prof. Edward R. Cary. Pp. ix+279. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1916.) Price 10*s.* 6*d.* net.

UNDER the title of "Geodetic Surveying" this book deals with the determination of positions of points with the aid of which topographical surveys can be controlled and combined to form a consistent whole. The methods described are those which have been developed by the Coast and Geodetic Survey of the United States, and their publication in the present work provides a convenient

summary of much that has been published in the reports of the survey.

Primary, secondary, and tertiary triangulations are included, the permissible triangular error in the first of these being put at 3″ and that of tertiary triangulations at 15″. The measurement of base lines is fully described, and examples are given to show how various sources of error are eliminated. Invar tapes of 50-metres length are used exclusively for base measurement in all grades of work, and a precision of 1 in 2 million is found to be attainable. The cost of such measurements is given as 20*l.* per kilometre on the average, rising to 30*l.* in some cases. The tape is usually supported in the centre and at each end, but in windy weather two additional intermediate supports are advantageously employed. The observation of horizontal angles is fully dealt with, and the reduction of the results is explained and illustrated by well-selected examples. A short chapter deals with the subject of map projections, and as this branch of the subject had to be so superficially dealt with, references to works which treat of it more completely might with advantage have been added.

Two appendices are devoted to the determination of time, longitude, latitude, and azimuth, and to the method of least squares as required by the surveyor. The whole forms a very useful and convenient manual of advanced surveying based on American requirements, but it will be welcomed also by surveyors in British colonies, where much work of this character has still to be done, as it will suggest methods which may suit the cases there occurring. H. G. L.

The Birds of Britain: Their Distribution and Habits. By A. H. Evans. Pp. xii+275. (Cambridge: At the University Press, 1916.) Price 4*s.* net.

MR. EVANS'S name is a sufficient guarantee of accuracy, and this little volume, intended primarily for schools, calls for no adverse criticism. The considerable advances in our knowledge of British birds which have been won and "consolidated" during the last twenty years or so have all been taken account of, with due caution as to the present tendency to discover innumerable local forms and to recognise plenty of sub-species. In point of method Mr. Evans adopts a new plan; he deals with the birds according to their families, giving a separate section to each family, but not to each species. In this way the learner gets a better idea of the British bird-world as a whole, and of the several departments of it, than he could have done from the older books, where the interest was concentrated on the individual species. No doubt those older books, with their pleasant talks about the ways of a species, will always be both welcome and necessary; but this one has a value of its own, and is at the present moment the only cheap handbook which is fully up to date. The illustrations are the least attractive part of it, and much space might have been saved for the letterpress by the omission of some photographs by which nothing seems to be gained.

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.*]

On Fizeau's Experiment.

IN two papers published in the Proceedings of the Amsterdam Academy (vol. xvii., 445, 1914; vol. xviii., 398, 1915) an experimental investigation concerning Fresnel's convection-coefficient for light of various colours was described. The main object of my repetition of Fizeau's experiment, in the improved form introduced by Michelson, was to decide between the expressions for the convection-coefficient given by Fresnel and by Lorentz. As a review of the papers mentioned has appeared in NATURE (vol. xcvi., 430, 1915), I may be permitted to give here a short account of further progress. It may suffice to recall that my results were largely in favour of the Lorentz expression with the dispersion term. For the wave-length 4500 Å.U. the difference between the two expressions under consideration amounted for water to quite 5 per cent. The probable error of the experimental result was estimated at somewhat less than 1 per cent.

The weak point of my investigation is the determination of the velocity of the running water at the axis of the tubes. This velocity was deduced from the mean velocity combined with the ratio of the mean velocity to the velocity at the axis. The most trustworthy measurements available at the time gave for this ratio 0·84, and this number was adopted. A direct measurement of the velocity at the axis would have been preferable, but only lately have I succeeded in devising an (optical) method for this purpose. Small gas bubbles introduced into the running water are illuminated by a very intense, narrow beam along the axis of the tube. A small window in the wall of the tube permits the inspection of the brilliant bubbles in a rotating mirror. From the inclination of the paths of the bubbles, as seen in the mirror, and the constants of the apparatus, the velocity is deduced at once. Direct tests proved the trustworthiness of the optical method.

Applying this method (Amsterdam Proc., vol. xviii., 1240, 1916) to my original apparatus, the window being at the prism end of the arrangement, unexpected results were obtained. The velocity actually observed by the optical method not only differed from the formerly accepted value of the velocity at the axis by several per cent., but by reversing the flow of water its value (at the same window) appeared to change by quite 10 per cent. Nothing short of a measurement of the velocity at a number of points of the tubes and for both directions of the water current became necessary. For this purpose a Pitot tube, *verified by the optical method*, was made use of. The results were further confirmed by the determination of the velocity distribution over the cross-section of the tubes at a few places. Evidently one cannot speak of *the* velocity at the axis, as its value changes in a rather complicated manner along the tube. A detailed description will be published shortly in the Proceedings of the Amsterdam Academy. The average mean value of the velocity at the axis comes out 550·8 cm./sec. This is only ½ per cent. smaller than the value accepted in my principal paper. The conclusions there given remain unchanged, but they are now arrived at very directly, all verifications of water-meters and the determination of the ratio

of mean velocity to velocity at the axis being avoided. The formula for the displacement of the interference fringes must henceforth be written with a factor $\int_0^l v_{max} . dl$, instead of the simple product $v_{max} . l$. Finally, the value of the ratio of the mean velocity to the velocity at the axis may now be calculated. We obtain 0·844. This number is not, however, a physical constant, but a constant of my apparatus.

Only quite recently have I become acquainted with the extremely important and exhaustive work done at the National Physical Laboratory, published by Drs. Stanton and Pannell in their memoir on similarity of motion in relation to the surface friction of fluids. From their data I find for the often mentioned ratio 0·82, when the values of maximum velocity and diameter of the tubes in my case are substituted. Their observations were made, however, after the passage of a length of pipe varying from 90 to 140 diameters, sufficient to enable any irregularities in the distribution of the velocities to die away. In my repetition of Fizeau's experiment this condition was, of course, largely departed from, so that there is no conflict between the results.

Amsterdam, August. P. ZEEMAN.

THE NEWCASTLE MEETING OF THE BRITISH ASSOCIATION.

JUDGING by the number of members who have already intimated their intention to be present at the meeting of the British Association in Newcastle-upon-Tyne, which, as previously announced, will open on Tuesday, September 5, and close on Saturday, September 9, and taking into account the numbers who have enrolled locally, an attendance of about 1200 is expected. The intention is to hold a purely business meeting—a meeting in keeping with Newcastle in particular and the world in general.

The general title of the President's address, which Sir Arthur Evans will deliver in the Town Hall on the Tuesday evening, is "The Cradle of European Civilisation."

The work of the sections will commence on the Wednesday morning, and so far as can be ascertained at present the following are the programmes:—

Section A (Mathematics and Physical Science). The title of Prof. Whitehead's address to Section A is "The Organisation of Thought." The address is a brief examination of the nature of scientific thought. The crude immediate experience of Nature is contrasted with the refined scientific conceptions and with the exact deductions of applied mathematics. The problem considered is, "How do these two sides of scientific knowledge fit together?" Two discussions have been arranged, one on gravitation, to be opened by Mr. E. Cunningham, and the other on osmotic pressure, to be opened by Prof. A. W. Porter. Papers to be read are:—"The Partition of Numbers," by Major P. A. MacMahon; "The Measurement of Time," by Prof. H. H. Turner; "X-Ray Spectra of the Elements," by Sir E. Rutherford.

On the Friday of the meeting the section will divide into departments of (*a*) General Physics, (*b*) Cosmical Physics, and (*c*) Mathematics. In (*a*) Prof. W. M. Hicks will deal with "Can the Frequencies of Spectral Lines be represented as a Function of their Order?" Dr. R. T. Beatty is to read a paper on "Measurement of the Energy in Spectral Lines"; Prof. J. C. McLennan on "Ionisation Potential"; and Dr. S. Chapman on "The Kinetic Theory of Gases." Communications to Department (*b*) are "Efficiency of Sun-spots in relation to Terrestrial Magnetic Phenomena," by the Rev. A. L. Cortie; and the Report of the Seismology Committee. Department (*c*) is to consider:—"Oscillating Asymptotic Series," by Prof. G. N. Watson; "Suggestions for the Practical Treatment of the Standard Cubic Equation," by Prof. R. W. Genese; and "On a New Method for the Solution of Quartic Equations," by Mr. P. Burton. By way of explanation of the section devoting its main attention to problems which may seem remote from those especially in the nation's thoughts at the present time, it is explained that much of the work now being done by members of the section is of a confidential nature, and that it is considered undesirable to discuss such subjects as, say, aviation or optical problems, on which it would be impossible to speak freely without indiscretion.

In the presidential address to Section B (Chemistry), Prof. G. G. Henderson proposes to give a short account of the chief developments in chemical technology during the last quarter of a century, and then to deal with the future prospects of the chemical industry in this country. The papers to be read before Section B are:—"The Future of the Organic Chemical Industry," by Mr. F. H. Carr; "The British Coal-tar Colour Industry in Peace and War," by Mr. C. M. Whittaker; "The Preparation of Chemicals for Laboratory Use," by Mr. W. Rintoul; several short papers on iron and steel problems by Dr. J. E. Stead; and "On the Stepped Ignition of Gases," by Prof. W. M. Thornton. There will be joint discussions with Sections A, C, and G.

In Section C (Geology) there will be papers read on "Local Geology," by Prof. G. A. Lebour; "The Old Red Sandstone Rocks of Kiltorcan, Ireland," by Prof. T. Johnson; "Description of a Plexographic Model of the South Staffordshire Thick Coal," by Mr. W. Wixham King; "The Acid Rocks of Iceland," by Mr. Leonard Hawkes; "The Petrology of the Arran Pilchstones," by Dr. Alexander Scott; "The Carboniferous Succession in North Cumberland," by Prof. E. J. Garwood; "The Permian of North England," by Dr. D. Woolacott; "Geological Characters of Glass Sands," by Dr. P. G. H. Boswell; and "Some Geological Aspects of Moulding Sands," by Dr. Boswell. There is to be a joint meeting with Section B on "Coal and Coal Seams, with Special Reference to their Economic Uses." The section will also hold joint meetings with Section E and Section K.

Prof. MacBride's address to Section D (Zoology) will take the form of a review of our progress during the last twenty years in elucidat-

ing the laws governing the development of the germ into the adult animal. Some of the lantern-slides to be shown will illustrate the results already obtained by Prof. MacBride in the salt-water tanks in the Imperial College of Science, where for some years he has been perfecting his arrangements for rearing marine animals. The papers to be read before the section are:—"Bitharzia," by Dr. R. T. Leiper; "Further Materials for a Graphic History of Comparative Anatomy," by Prof. F. J. Cole; "Some Points of Bionomic Interest observed during the Visit of the British Association to Australia," by Dr. F. A. Dixey; "The Exploitation of British In-shore Fisheries," by Prof. W. A. Herdman; "The Coastal Fisheries of Northumberland," by Prof. A. Meek; "The Further Development of Shell Fisheries," by Dr. James Johnstone; "The Scheme of Mussel Purification of the Conway Fishery," by Dr. A. T. Masterman; "The Scales of Fishes and their Value as an Aid to Investigation," by Prof. A. Meek; "Some Notes on the Determination of the Age of Fishes by their Scales," by Dr. A. T. Masterman; "Review of the Fluctuations of the Herring, Mackerel, and Pilchard Fisheries off the South-west Coasts in the Light of Seasonal Variations of Hydrographical Factors," by Dr. E. C. Jee. On Friday morning four papers are to be dealt with, viz. "Amœbæ in Relation to Disease," by Dr. Pixewell-Goodrich; "Notes on the Amœbæ from the Human Mouth," by Dr. T. Goodey; "The Flagellate Protozoa associated with Diarrhœa and Dysentery," by Dr. Annie Porter; "War and Eugenics," by Mr. Hugh Richardson. In the afternoon of Friday the section will visit the Dove Marine Laboratory at Cullercoats.

In Section E (Geography) there is to be a discussion on political frontiers, to be opened by Sir T. H. Holdich, and the following papers are to be dealt with:—"France—a Regional Interpretation," by Mr. H. J. Fleure; "Generalisations in Human Geography," by Mr. G. G. Chisholm; "The Weddell Sea," by Dr. W. S. Bruce; "The Adriatic Problem," by Dr. R. W. Seton-Watson; "Salonica: Its Geographical Relation to the Interior," by Mr. H. C. Woods; "Recent Exploration in the Japanese Alps," by the Rev. Walter Weston; "Nepal, the Home of the Gurkha," by Mr. A. Trevor-Battye. The section on the Friday will hold joint meetings with Sections C and E.

The general title of Prof. Kirkaldy's address to Section F (Economics and Statistics) is "Thoughts on Reconstruction after the War." He will refer to the economic condition and industrial changes resulting from the war, and then attempt a forecast of the industrial future and make some suggestions as to how we may prepare ourselves industrially to meet the changed conditions at home and abroad. The section will give the greater part of the time to the consideration and discussion of the reports of the investigations which have been going forward during the year. These subjects were reported upon last year at Manchester, and were felt to be of such importance that all the investigations were continued. The first three reports, "Industrial Harmony," "Outlets for Labour," and "The Effect of the War on Credit, Currency, and Finance," are being published in one volume, and will be a continuation of last year's volume on "Credit, Industry, and the War." The papers to be read before Section F are:—"Land Settlement," by Mr. Christopher Turner; and "The English Historical Method in Economics—Rent," by Mr. T. B. Browning.

It is understood that Mr Gerald Stoney, in his address to Section G (Engineering), will deal with various subjects of vital importance at the present moment. The section will hold a joint meeting with Section B (Chemistry) and consider the subject of "Fuel Economy." The papers to be read are:—"Standardisation and its Influence on the Engineering Industries" (with a foreword by Sir John Wolfe Barry), by Mr. C. le Maistre; "The Calculation of the Capacity of Aerials, including the Effects of Masts and Buildings," by Prof. G. W. O. Howe; "The Influence of Pressure on Ignition," by Prof. W. M. Thornton; "Some Characteristic Curves for a Poulsen Arc Generator," by Mr. N. W. McLachlan; "Pressure Oil Film Lubrication," by Mr. H. T. Newbigin. The section will also receive the reports of the committees on Complex Stress Distribution, Engineering Problems affecting the Future Prosperity of the Country, and Gaseous Explosions.

In Section H (Anthropology) Dr. R. R. Marett will devote his presidential address to the subject of "Anthropology and University Education," in the course of which he will supplement the address delivered to the section in 1913 by Sir Richard Temple on the need, from an imperial point of view, of an applied anthropology. Dr. F. B. Jevons will deal with the disputed question of the exact boundary in primitive culture between practices regarded as religious and liturgical and those considered to belong to the domain of magic and sorcery. Prof. Ridgeway will explain the origin of the actor, with probably special reference to pre-classical times in Greece and the neighbourhood. Prof. Keith will discuss the question of whether the British facial type is not changing. There will be a description given by Mr. and Mrs. Scoresby Routledge of the expedition to Easter Island in the Pacific, with the latest explanation of the mysterious stone statues on that island, which has been inhabited by Polynesians, who elsewhere have been workers and carvers in wood rather than stone. It is believed that this expedition may have solved the mystery. Papers will be read on the Roman wall by Prof. Haverfield, and on Early Christian monuments in Northumbria by Mr. Collingwood. On the Friday there will be a discussion on the cultures of New Guinea and the New Hebrides, and a paper, by Prof. Sollas, on a sub-crag flint implement. Dr. Marett will narrate the story of recent archæological discoveries in the Channel Islands. Dr. Fraser will continue the account of the excavations in artificial islands in the lochs of the

Scottish Highlands. Miss Czaplicka will relate her experiences during a winter and a summer spent among the tribes of Arctic Siberia, a paper which, illustrated by a unique series of lantern slides, will throw much light on the culture and beliefs of the Tungus and other tribes, and, in a second communication, will deal with the physical types of these tribes. Finally, Miss Freire-Marreco will deal with personal experience as an element in folk tales.

In Section I (Physiology) Prof. A. R. Cushny will deal in his presidential address with the analysis of living matter through its reactions to poisons. He proposes to discuss how far the reaction to drugs may be utilised to test for the presence of different kinds of living matter. The papers to be considered by the section are:—"Report on Chloroform Apparatus," by Prof. A. D. Waller; "Effect of Pituitary Extract on the Secretion of Cerebro-Spinal Fluid," by Prof. W. D. Halliburton; "Arginine and Creatine Formation (Further Investigations)," by Prof. W. H. Thompson; "The Properties required in Solutions for Intravenous Injection," by Prof. W. M. Bayliss; "The Secretion of Urea and Sugar by the Kidney," by Prof. P. T. Herring; "The Effect of Thyroid-feeding on the Pancreas," by Dr. Kojima. There will also be a discussion upon the action of poison gases, inaugurated by Sir Edward Schäfer.

The subject of Dr. A. B. Rendle's presidential address to Section K (Botany) is unusual in that it will deal with the application of botanical work to economic uses. It is believed that the circumstances, especially the conditions which will obtain after the war, call for an effort on the part of the botanist to meet problems which will then be pressing. The papers to be read before the section include:—"Leaf Architecture," by Prof. F. O. Bower; "The Botanical Study of Coal," by Dr. Marie Stopes; "On *Rhynia gwynne-vaughanii*," by Dr. R. Kidston and Prof. W. H. Lang; "Are Endemics the Oldest or the Youngest Species in a Country?" by Dr. J. C. Willis; "Geographical Distribution of the Composite," by Mr. J. Small; "Survey Work near Bellingham," by Miss Charlotte Measham; "On the Distribution of Starch in the Branches of Trees and its Bearing on the Statolith Theory," by Miss T. L. Prankerd. In addition there will be a lecture by Sir J. Stirling Maxwell on "Afforestation," and a number of reports on various problems; there will also be a discussion on the collection and cultivation of drug plants.

In Section L (Educational Science) the programme will be devoted to three main topics: the position of science in secondary and higher education, the reform of the primary school, and the normal performances of school children. Papers on primary school reform will be read by Mr. J. G. Legge, Prof. T. P. Nunn, and Prof. J. A. Green, and the discussion will be opened by Mr. Crook, president of the National Union of Teachers. Next day Mr. J. Talbot will deal with science teaching in public and grammar schools, and will be followed by the Rev. H. B. Gray on "The Relative Value of Literary and Scientific Subjects in a Course of General Education"; Principal Hadow on "Science Teaching in the Universities"; and Dr. E. F. Armstrong on "The Value of Science in Industrial Works." On the subject of "The Place of Science in the Education of Girls" Miss M. E. Marsden and Dr. Mary H. Williams will read papers. At the meeting on the Friday, held jointly with the Psychological Sub-Section, Prof. J. A. Green and Mr. C. L. Burt are to open a discussion on "Normal Performances of School Children at Different Ages."

In Section M (Agriculture) the presidential address to be given by Dr. E. J. Russell will be a discussion of the methods by which crop production can be increased. The following papers will be read:—"British Forestry, Past and Future," by Prof. W. Somerville; "The Utilisation of Forest Waste by Distillation," by Mr. S. H. Collins; "Soil Protozoa and Soil Bacteria," by Mr. T. Goodey; "Climate and Tillage," by Mr. T. Wibberley; "Economy in Beef Production," by Prof. T. B. Wood and Mr. K. J. J. Mackenzie; "The Relation of Manuring and Cropping to Economy in Meat Production," by Prof. D. A. Gilchrist; "The Composition of British Straws," by Prof. T. B. Wood; "Losses from Manure Heaps," by Dr. E. J. Russell and Mr. E. H. Richards; "The Fixation of Nitrogen," by Mr. E. H. Richards. There will also be a discussion on motor cultivation, and another on ensilage.

As already announced, several sections are arranging excursions. In this connection it may be mentioned that Section M proposes on the Tuesday to visit the Northumberland County Council Farm at Cockle Park; on the Wednesday Lord Allendale's Farm will be inspected; on the Thursday the woods near Lintz Green will be visited, where H.M. Woods and Forests Department has a plant in operation for the distillation of waste wood; and on the Friday there will be an opportunity to inspect general types of local farming in Durham.

Section H also is arranging to meet the Cumberland and Westmorland Archæological Society on the Thursday and visit the Roman wall. Papers relevant to this visit are to be read by Prof. Haverfield and Mr. Collingwood on the evening of Wednesday, September 6. In view of the local interest and the fact that leading archæologists, including the President, are to take part, it is proposed that the meeting be held in the Lecture Theatre of the Literary and Philosophical Society.

Another engagement for the Wednesday evening is that of an informal reception and conversazione, which will be held in the Laing Art Gallery and Museum. The Right Hon. the Lord Mayor of Newcastle has very kindly consented to welcome the guests. Not only will this function provide a common meeting-ground for the members, but it will also give them an opportunity of viewing the special loan collections which have been formed by the Laing Art Gallery Committee in connection with the Association's visit.

SCHOLARSHIPS AND THEIR RELATION TO HIGHER EDUCATION.[1]

THE Board of Education has recently issued an interim report from the Consultative Committee on the reference made to the Committee early in 1913. The inquiry was interrupted by the war, but its resumption a few months later has furnished material for the present document, which contains a discussion of many subjects deserving attention by men of affairs no less than by teachers and professional educationists. The original reference was as follows:—

To consider the existing provision of awards—whether by local education authorities, by the governing bodies of secondary schools, universities, and colleges, by the trustees of endowments or otherwise—for assisting pupils (other than those who have declared their intention to become teachers in State-aided schools) to proceed from secondary schools to universities or other places of higher education; and to report how far such provision is adequate in character, extent, and distribution, and effective in meeting educational needs, and what measures are necessary and practicable for developing a system of such scholarships and exhibitions in organic relation to a system of national education.

This is a fairly wide reference, and since it is true, as observed in the report, that "no educational problem of any magnitude can be isolated," it seems obvious that the whole ground cannot be covered in an interim report. The Committee, therefore, has confined its attention to the needs of industry and commerce in connection with scholarships to be held at universities and other places of higher education. The sub-committee charged with the investigation sat on fourteen days and examined twenty-nine witnesses.

The main object of the scholarship system, which is almost peculiar to this country, is to assist the student who has shown promise and is at the same time in need of pecuniary help. Properly administered, it may be expected to afford encouragement to learning and to assist in the provision of useful public servants. But, however obvious it may be to the majority of the public that such a system is desirable, the expenditure of larger sums of money on its further extension has not been without opponents. The late Sir William Ramsay, for example, was one of those who thought it advisable to subsidise teachers and teaching institutions with the object of increasing efficiency and reducing fees, rather than to add to the pecuniary resources of the student. This was probably in part connected with his known objection to examinations, and recalls to mind one of the chief difficulties connected with any scholarship scheme—namely, the problem, at present unsolved, as to the best mode of selection.

This question naturally receives considerable attention from the Committee, and alternative methods of award are discussed in connection with scholarships from secondary schools to universities. The Committee is there led to the conclusion that no practicable method of award can be suggested which does not mainly depend on competitive examination. But in the succeeding paragraphs it proceeds to consider the importance of the adjuncts to examination derived from the school record and the opinion of teachers, the *vivâ-voce* examination of selected candidates, and in the case of science candidates the attested laboratory note-books, since laboratory examinations admit a large element of luck. But when all precautions have been observed, the marks gained in an examination must be chiefly given for *knowledge* already acquired, and most examiners of experience would admit the great difficulty of estimating justly the *capacity* of candidates to deal with unfamiliar problems and the probability of their success in research.

In this connection it is well to look with special attention, not only at the best candidates, but here and there at some of the worst. It is unnecessary to quote here the famous cases of men who have risen to eminence after an unsatisfactory career at school. The boy supposed to be dull is sometimes merely not interested in the conventional school subjects, and lives in a world of his own. There are probably few of this kind among candidates for scholarships, but there should be a constant look-out for them on the part of the schoolmaster and some means devised for giving help and encouragement if needed.

The report before us raises in the mind of the reader a great many questions besides those connected with the creation, award, and distribution of scholarships. It leaves, for example, the old confusion between education and instruction uncorrected, or rather, if possible, further beclouded. It discusses briefly but suggestively the demand for what is called equal opportunity. It points out that it is impossible, and undesirable to attempt, to give higher education to all, and it justly points out that

the public interests demand that none shall waste his time and the time of others by schooling or training at the public expense unless he or she has proved that such training is likely to be advantageous. . . . It will be economical to give more training to the highest talent and less to the inferior or mediocre.

Then, again, it appears that there are persons among the witnesses before the Committee who are prepared to find in the "public schools" the great impediment to educational progress. It is therefore well that the Committee should remind such persons, in the words of the report, that

the public schools have a great tradition; a tradition of character, a tradition of manners, a tradition of physical excellence, a tradition of self-government. They do, in fact, supply the boys of the country with more than half the higher secondary education that they receive. It would be wasteful to weaken their vigour and independence.

The Committee itself goes so far as to express the opinion that "it is desirable in the national interest that after the war the public schools should devote more energy to scientific and prac-

[1] Interim Report of the Consultative Committee on Scholarships or Higher Education. [Cd. 8291.] (London: Wyman and Sons Ltd. 1916. Price 4½*d*.

tical training." This, however, must not be taken to mean technical instruction in applied science, or the position of physical and natural science as an integral part of a truly liberal education will be seriously imperilled. How far the old universities themselves should be encouraged to deal with the technological aspects of science is an open question. The report states that "the subjects for which either Oxford or Cambridge, or both, may be regarded as offering special advantages are: Classics, history, mathematics, pure science. The modern universities should be better, as a rule, for students desirous to pursue commerce, applied science, technology." All this has its bearing on the source, the pecuniary value, and the tenure of scholarships to be held in the universities.

The Government has already appointed a Committee of the Privy Council for Scientific and Industrial Research and an Advisory Council to survey the field and propose schemes to this committee. In connection with research, the importance of continuing scholarships for a fourth or fifth year is indicated in the report. After the rather obvious remark that "the good researcher is rare," reference is made to the qualifications of women in this direction. "One of our witnesses," it is said, "has spoken unfavourably of women as researchers, at any rate in chemistry; but in our opinion experience does not point to any such general conclusion. Judgment should come later, after a full trial of feminine capacity in this direction." With this sentiment we heartily agree, notwithstanding the impression that the experience of teachers of chemistry and physics up to the present generally supports the view of the witness referred to. The independent research accomplished by women, to judge by published work, has been chiefly in connection with biological subjects.

The Committee has drawn up a series of General Conclusions, followed by a number of definite Recommendations. Among the general conclusions the report contains the following passages, with which most readers will agree:—

> The system of scholarships at every grade of education should be judged from the point of view of national needs. . . . The exceptional needs of the nation are at the present moment, and will be for some time to come, rather on the scientific and technological side than on the literary side. . . .
>
> The first need is the wider recognition, especially by employers, of the benefits that can be obtained by the employment in industry, agriculture, and commerce of men trained in science—in all grades, but especially for directive and advisory posts.
>
> Secondly, the most useful thing that can be done without any great increase in the means at our disposal is to encourage research in existing institutions after graduation. The prolongation of scholarships in suitable cases is one means that is available; other means fall within the province of the Committee of the Privy Council.

Improved and extended places of higher technical and scientific instruction as well as improved secondary education are needed, and as the universities, colleges, and schools are strengthened and the number of workers increases, so an increase in the supply of scholarships will become necessary. It appears to be admitted on all sides that we must be prepared after the war for a great increase in the cost of education in all departments. The Committee makes an estimate of the cost of the additional scholarships and other forms of endowment recommended in the report. The amount of their estimate, 339,500*l.* a year, cannot be regarded as excessive, but it will probably be prudent to begin with moderation and to be satisfied with additional endowments in proportion as the expense seems to be justified by experience.

The recommendations of the Committee are as follows:—

> We recommend for the consideration of the Board of Education, and of those local education authorities which have power to grant scholarships from secondary schools to universities and other places of higher education, and of other authorities so far as they may be concerned:—
>
> *General Principles.*
>
> (1) That, in framing schemes for scholarships, the following ends be kept in view: the training of men and women according to their capacity that they may serve the needs of the nation in the manner for which they are best fitted; the reward of merit and the encouragement of learning; and the provision of equal educational opportunity: the furtherance of industry, agriculture, and commerce being regarded as a principal need of the nation, and higher education being regarded as a means to this end among others.
>
> (2) That, for the furtherance of higher scientific and technological education, scholarships from secondary schools to universities and the highest scientific and technical colleges be still accepted as the principal means.
>
> (3) Nevertheless that, as supplementary and subsidiary means to the same end, scholarships from secondary schools to senior technical schools and technical colleges, from senior technical schools to universities and other places of higher education, from evening classes and works-schools to technical colleges and universities, be also granted on a suitable scale.
>
> (4) That a certain proportion of scholarships to places of higher education should be granted to candidates who show merit under scientific and mathematical tests alone, without any test of general education beyond an examination in the English language.
>
> (5) That the matriculation tests at the universities be modified so as to admit to full university privileges scholars who, having obtained their training by part-time or discontinuous instruction, have been selected by the tests indicated in recommendation (4), and are able to satisfy the university authorities that they are fit to take advantage of university instruction in science or technology.
>
> *Aid Required from Government.*
>
> (6) In proportion as the provision of higher secondary education is extended, improved, and used, the provision of scholarships by local authorities to universities will need to be correspondingly increased.
>
> The provision of such scholarships for women needs immediate increase.
>
> But, in order to hasten the extension of higher secondary education—especially for boys—we venture to suggest that a substantial grant-in-aid be made at

the earliest opportunity for strengthening the higher parts of selected secondary schools, or that some similar expedient be adopted for the same purpose. For this purpose we suggest as a beginning the sum of 100,000*l.* a year.

We recommend :—

(7) That the State provide maintenance grants to enable selected scholars to continue their secondary education from the age of sixteen to that of eighteen or nineteen. For this purpose we consider that 90,000*l.* would be required in the third year.

(8) That the State provide about 250 scholarships every year for students from secondary schools who intend to pursue scientific or technical subjects at the universities. That these scholarships be allotted to the several universities and awarded by the universities. We estimate the cost of this provision at the annual sum of 67,500*l.* Should the second alternative recommendation in (26) below be adopted, a further sum of about 10,000*l.* would be needed for the additional cost of such of these scholarships as may be held at Oxford or Cambridge.

(9) To encourage local authorities to develop their schemes of scholarships from secondary schools to the universities, and with special reference to increased provision of scholarships for women, we recommend that a special grant-in-aid of 25,000*l.* be made.

(10) For scholarships to the universities from senior technical schools, and for candidates who have obtained part-time instruction in scientific and technical subjects while pursuing their vocation, we recommend for the present that the annual sum of 27,000*l.* be granted.

We recommend :—

(11) That, on the application of a scholar and on the recommendation of some professor who is willing to undertake his or her training in scientific or technological research, the prolongation of a scholarship for a year after the conclusion of a degree course be favourably considered, and the cost of such a system be defrayed from national funds.

(12) That after such prolongation for one year the scholarship be capable of prolongation for another year on the certificate of the professor that the scholar shows aptitude for research, and is willing to pursue research under his guidance in some specified branch of science or technology, the cost being met from national funds.

We consider that for the purposes of recommendations (11) and (12) the annual sum of 20,000*l.* would be sufficient at the inception, and we recommend that in so far as these prolongations are defrayed from national funds the regulation of such prolongations be entrusted to a Central Committee nominated by the Board of Education.

Value of Scholarships to Universities.

We recommend :—

(13) That the value of a scholarship to a university granted by the Government or by a local authority be 60*l.*, and that all university fees and dues be defrayed in addition by the Government or the authority, except in the case of scholars who also hold a scholarship at Oxford or Cambridge or some other emolument.

(14) That the sum payable annually by virtue of the scholarship be withheld or reduced if the Government or the local authority be satisfied that the scholar or his parents or his guardians can themselves afford to defray the whole cost, or part of the cost, of his university education.

Duration of Scholarships.

(15) That the normal duration of a scholarship to a university be three years, subject to residence, good conduct, and satisfactory reports on the scholar's work.

(16) That (subject to the same conditions) the scholarship be prolonged for one year when the normal university course for that scholar is four years.

(17) That a scholarship to the university once awarded by a local education authority should not be dependent on the continued residence of the holder or his parents or guardians in the area of the awarding authority.

Methods of Award of Scholarships to Universities.

(18) That every local authority offering scholarships from secondary schools tenable at a university entrust to some university the award of such scholarships. That Government scholarships be allotted to the several universities and be similarly awarded.

(19) That such award be made accordmg to the responsible judgment of a board of about five awarding examiners, after consideration of the marks allotted and the reports made by the examiners in the several subjects, after interviewing selected candidates, after such further scrutiny of the written work as may seem to the board desirable, and after weighing in cases of doubt such further evidence as may be made admissible by the regulations.

(20) That evidence of general education up to an adequate standard be required as a qualification for appointment to scholarships from secondary schools to universities.

(21) That a serious test in English be imposed on all candidates in such competitions, and be taken into account in the award of scholarships.

(22) That subjects be grouped for purposes of examination according to some reasonable principle so as to discourage excessive specialisation on the one hand, and heterogeneous study on the other.

(23) That the examination be designed to encourage an adequate breadth of study, but that nevertheless the boards of examiners have full discretion to recognise either exceptional merit and promise in one subject, or general excellence over a wider range, as they think fit.

(24) That, in view of the special need of encouragement for scientific and technological studies, scholarships be awarded somewhat more readily to candidates who intend to pursue such studies than to others.

(25) That no examination for scholarships from secondary schools to universities be regarded as satisfactory in which more than two hundred candidates are examined in one batch.

(26) We recommend to the attention of the local authorities the practice of the London County Council in awarding senior scholarships without further written examination to those who have won open scholarships by the award of the colleges of Oxford and Cambridge; and to the colleges of Oxford and Cambridge we recommend that they should seek powers to grant a proportion of scholarships on their own foundations to such Government or county scholars as, having received the grant of a scholarship by the award of a board of examiners acting for some university, have (without further examination) proved to the satisfaction of the college that they would benefit by education at Oxford or Cambridge.

Or, as an alternative, that all scholarships to Oxford and Cambridge, whether granted by the Government or by a local authority, or by a college so far as college statutes permit, shall be of such value as to cover all strictly necessary expenses of residence, maintenance while residing, and education, subject to the provisions of recommendation (14) above.

PROF. W. ESSON, F.R.S.

IN William Esson, Savilian professor of geometry since 1897, Oxford loses one who has done much for it. A Scot whose family came South in his boyhood, there was the air of a viking about him, and few who looked upon his magnificent beard during most of the sixty-one years of his university life were not conscious of a radiation of vigour as from the North. Born at Dundee in 1838, he was educated first at Inverness, and then at Cheltenham Grammar School. In 1855 he became Bible clerk of St. John's College, Oxford. Here he obtained two second classes (1856, 1858) in classics, and in mathematics carried all before him, gaining first classes in 1856 and 1859, and the junior and senior mathematical scholarships in 1857 and 1860. In 1860 he became Fellow of Merton and mathematical tutor. He was also tutor or lecturer for various periods at Magdalen, Corpus, Worcester, and Hertford. Enormous as have been his services to Merton and to the university as financier and man of business, and real as have been his achievements in geometrical and mathematico-chemical investigation, the writer and others put first his leadership in college mathematical teaching. In the 'sixties and 'seventies there were two classes of mathematical students in Oxford—those who blessed the Providence which had put them under him, and those who envied the others.

When Prof. Sylvester's health began to fail in 1894 Esson became deputy Savilian professor of geometry, and after three years he succeeded Sylvester in the chair. He lectured most on the comparison of synthetic and analytic methods in geometry. With such subjects his not very numerous publications in pure mathematics have been concerned. They are above all things incisive. Probably he was prouder of his only semi-mathematical work on chemical—or, as he was always very careful to say, *chymical*—change. This was done largely in concert with Mr. A. G. Vernon Harcourt, and expounded in the Philosophical Transactions for 1864, 1866, and 1895. The work secured him the Fellowship of the Royal Society as early as 1869. Among the little jokes in which he delighted was one that in 1897 the Savilian professorship of *geometry* passed from a poet to a *chymist*.

Though as professor he became Fellow of New College, he was bursar of Merton till he died. For very many years he served the university as a curator of the university chest; and here his loss will be keenly felt. His great administrative powers were used for the good of the university in matters directly associated with university studies, and not in finance only. For about fifteen years, ending in 1913, he was chairman of the Board of the Faculty of Natural Science. He was a visitor (and secretary) of the university observatory.

Until a few months ago his natural force seemed in no wise abated. But his last surviving son went down with H.M.S. *Russell*, and his strength then began to fail.

PROF. S. B. MCLAREN.

LIEUT. S. B. McLAREN, professor of mathematics in University College, Reading, met his death on August 14 on the Western front, where he was serving with a signalling company of the Royal Engineers.

McLaren was of Scottish parentage. A son of the late Rev. W. D. McLaren, of Melbourne, he was born in Japan, but most of his early life was spent in Australia. After a distinguished career at the University of Melbourne, he proceeded to Trinity College, Cambridge, of which he became a major scholar. He was third wrangler in 1899, gained a first class in Part II. of the Mathematical Tripos in 1900 and the Isaac Newton studentship in 1901. He continued in residence at Cambridge until 1903, when he accepted a position at Bristol University College, whence in 1906 he proceeded to Birmingham University as assistant-lecturer in mathematics. Shortly before his appointment to the professorship of mathematics in University College, Reading, he had shared with Prof. Nicholson the Adams prize at Cambridge.

The outbreak of war found McLaren in Australia with the British Association, acting as a secretary of Section A, and back with his parents and among his earlier friends. During the return voyage he was fired with an enthusiasm to offer his services to his country, and he employed his time on board in learning signalling, and on arrival joined the signalling company organised by a colleague, Major Pearson, of University College, Reading. He saw several months of active service before receiving the wound which only a few days later proved fatal. He was fearless and intrepid on the field, and carried out his duties tirelessly and with a disregard for his personal safety which was at once an inspiration to his men and the concern of his brother officers.

McLaren's published work, which was characterised by originality and a fine boldness of conception, related particularly to the mathematical treatment of the phenomena of radiation and of gravity. Shortly before he gave up his academic work he was engaged in writing upon the magneton, and he considered that he had obtained results of value. But his interest in mathematical physics is not adequately gauged by his published work. He was a diligent worker and thinker, contrary, perhaps, to the impression of the casual acquaintance, and he sought strenuously for a basis upon which to build. His interest in philosophy was part and parcel of his regard for the fundamental things. All who have been associated with him will regret the cutting short of a promising career and the loss of a simple, sincere, and genial friend. W. G. D.

NOTES.

THE terms of reference, and the constitution, of the two committees appointed by the Prime Minister to inquire into the position of science and modern languages respectively in the system of education in Great Britain have now been announced. The membership of the committees suggests that the Govern-

ment wishes each of these subjects to be considered chiefly from the point of view of education as a whole; for the particular interests of science and modern languages are represented by a few members only. The terms of reference and constitution of the Science Committee are as follows:—To inquire into the position occupied by natural science in the educational system of Great Britain, especially in secondary schools and universities; and to advise what measures are needed to promote its study, regard being had to the requirements of a liberal education, to the advancement of pure science, and to the interests of the trades, industries, and professions which particularly depend upon applied science; Sir J. J. Thomson (chairman), the Rt. Hon. F. D. Acland, Prof. H. B. Baker, Mr. Graham Balfour, Sir William Beardmore, Bart., Sir G. H. Claughton, Bart., Mr. C. W. Crook, Miss E. R. Gwatkin, Sir Henry Hibbert, M.P., Mr. William Neagle, Mr. F. G. Ogilvie, C.B., Dr. Michael Sadler, C.B., Prof. E. H. Starling, Mr. W. W. Vaughan; secretary, Mr. F. B. Stead, H.M. Inspector of Schools. Owing to unforeseen circumstances Lord Crewe finds that it will not be possible for him to act as chairman of the committee, as previously announced.

THE terms of reference and constitution of the Modern Languages Committee appointed by the Government are as follows:—To inquire into the position occupied by the study of modern languages in the educational system of Great Britain, especially in secondary schools and universities, and to advise what measures are required to promote their study, regard being had to the requirements of a liberal education, including an appreciation of the history, literature, and civilisation of other countries, and to the interests of commerce and the public service; Mr. Stanley Leathes, C.B. (chairman), Mr. C. A. Montague Barlow, M.P., Mr. E. Bullough, the Rt. Hon. Sir Maurice de Bunsen, Mr. A. G. Coffin, Dr. H. A. L. Fisher, Mr. H. C. Gooch, Mr. J. W. Headlam, Mr. L. D. Holt, Dr. Walter Leaf, Dr. G. Macdonald, Mr. A. Mansbridge, Mr. Nowell Smith, Miss M. J. Tuke, Sir James Yoxall, M.P.; secretary, Mr. A. E. Twentyman. In considering the provision of scholarships, bursaries, etc., the committees are requested to take into account the interim report of the consultative committee of the Board of Education on this subject.

LORD MONTAGU OF BEAULIEU, in a speech at Bury St. Edmunds on August 23, gave some interesting particulars of Germany's new super-Zeppelins. These are said to have a capacity of 2,000,000 cubic ft., giving a total lift of about 60 tons. Their length is 780 ft., speed 65 miles per hour, and the engines develop more than 1500 horse-power. (The original figure given was 15,000, but this was an error, and has since been corrected.) These figures are a little surprising, but there seems to be no reason why such an airship should not be satisfactorily designed, especially after the experience which Germany has had with the older types. It would appear that these super-Zeppelins are intended for offensive operations, rather than as scouts for the fleet, for which latter purpose the existing types are of sufficient capacity. If this is the case, our anti-aircraft defences will need to be as efficient as we can make them. Raids by means of rigid airships have introduced a new problem for the gunnery experts to solve, for a Zeppelin at 10,000 ft. altitude, and moving at 60 miles an hour on a dark night, presents an exceedingly difficult target, and the small number of hits scored up to the present is not surprising. However, a great deal is being done to deal with this new situation, and it is to be hoped, as Lord Montagu said, that the super-Zeppelins will not achieve the results which our enemies seemingly anticipate.

SIR ERNEST SHACKLETON is losing no opportunity of attempting to rescue his stranded comrades on Elephant Island. Last Saturday he sailed from Punta Arenas on his fourth attempt. This time his vessel is the *Yelcho*, a small Chilian steamer which towed the *Emma* 240 miles south of Cape Horn in the last unsuccessful attempt at rescue. The *Yelcho* does not appear to be well suited for the task before her, but, failing such a ship as the *Discovery*, now on her way out, one vessel is little better or worse than another, and success or failure depends entirely on the ice conditions. In this respect there is some prospect of September proving better than July or August. If Elephant Island is clear of ice, the *Yelcho* should return to civilisation early in September with the explorers on board.

WE regret to announce the death, on August 27, at sixty-three years of age, of Dr. C. T. Clough, district geologist of H.M. Geological Survey, Scotland.

THE twenty-seventh annual general meeting of the Institution of Mining Engineers will be held at Glasgow on September 14–15. The institution medal for the year 1915–16 will be presented to Dr. W. N. Atkinson, in recognition of his investigations in connection with colliery explosions and coal-dust.

SIR CHARLES H. BEDFORD has been appointed general secretary of the newly constituted Association of British Chemical Manufacturers. The business of the association is for the present being carried on at the offices of the Society of Chemical Industry, Broadway Chambers, Westminster.

THE Toronto correspondent of the *Times* states that the Naval Service Department in Ottawa has received the following message from Dr. Anderson at Nome respecting the Stefansson expedition:—"Starkerson has reported that Stefansson is safe on north-west coast, where he was reported on May 7. The *Polar Bear*, *Mary Sachs*, and *North Star* are safe."

CAPT. A. R. BROWN, formerly science master at Buckhaven High Grade School, and 2nd Lieut. H. Watson, mathematical master at Ormskirk Grammar School, have both been killed in action. Capt. Brown was educated at Airdrie Academy and Glasgow University, where he graduated M.A. and B.Sc., and he was a fellow of the Royal Society of Edinburgh. 2nd Lieut. Watson was educated at Burnley Grammar School and Manchester University, where he graduated with first-class honours, obtaining his degree of B.Sc. in 1907. Before going to Ormskirk he held the position of mathematical master at the Technical Institute and Secondary School, Salford.

DURING the early hours of August 16 an earthquake was felt at Ancona, Pesaro, Rimini, and other places on the north-east coast of Italy. The shock seems to have been strongest at Rimini, where several houses were wrecked, though buildings were also damaged at Pesaro, twenty miles to the south-east. All three places lie within well-defined seismic zones, but, while the earthquakes of the Pesaro and Ancona zones are usually of a local character, those of the Rimini zone (and especially the earthquakes of 1672 and 1875) are often felt over a wide area. According to the *Times* of August 17, seven earthquakes were recorded at Shide on August 16, originating in northern Italy or in Austria.

THE autumn meeting of the Iron and Steel Institute will be held at the Institution of Civil Engineers on September 21 and 22. The following papers are expected:—"Some Properties of Ingots," H. Brear-

ley; "Influence of Heat-Treatment on the Thermo-electric Properties and Specific Resistance of Carbon Steels," Prof. E. D. Campbell; "Heat Treatment of Eutectoid Carbon Steels," Dr. H. M. Howe and A. G. Levy; "Steel Ingot Defects," J. N. Kilby; "Manganese Ores of the Bukowina, Austria," H. K. Scott; "Influence of Elements on the Properties of Steel," Dr. J. E. Stead; "Notes on (*a*) Nickel Steel Scale, (*b*) on the Reduction of Solid Nickel and Copper Oxides by Solid Iron, (*c*) on Effect of Blast-furnace Gases on Wrought Iron," Dr. J. E. Stead; "Use of Meteoric Iron by Primitive Man," G. F. Zimmer.

WE regret to notice that Sir Richard Biddulph Martin, the chairman of Martin's Bank, died on August 23, in his seventy-eighth year. Sir Richard Martin was not only an eminent banker and one of the founders of the Institute of Bankers, but also gave much time during his long and active life to the work of charitable and social undertakings, and of more than one scientific society. Of the Fishmongers' Company he was twice Prime Warden, and represented the company on the Executive Committee of the City and Guilds of London Institute. He had held the office of treasurer of the Royal Statistical Society of London since 1875, the longest period of office of any treasurer since the foundation of the society, and was elected to the presidency in 1906. He always exhibited the warmest interest in the welfare of the society, and was a regular attendant at council and ordinary meetings until increasing lameness in recent years rendered attendance almost a physical impossibility. Sir Richard was also keenly interested in the work of the Royal Anthropological Institute, of which he was a vice-president, and in that of the Royal Geographical Society.

A RECENT article by Dr. Saleeby on "Armoured Men," published in the *Daily Chronicle* of August 7, gives some particulars as to the construction of the "soup-plate" helmet with which British troops are now provided. It is really a double structure. It is first a soft cap, bounded all round its edge with thick rubber studs—now made hollow for greater resilience. This cap has a double lining of felt and wadding, so that even if the helmet be pierced at point-blank range the scalp is guarded from the steel. Upon this padded cap is poised the casque of steel. The interval between the two serves for ventilation. The steel used is that discovered some twenty years ago by Sir Robert Hadfield, and known as manganese steel. The helmet weighs 2 lb., and is said to be bullet-proof to a Webley automatic pistol at five yards' range. Every helmet now supplied to the troops is proof against a shrapnel bullet, forty-one to the pound, with a striking velocity of 750 ft. per second. To prevent the surface from acting as a mirror it is sanded and roughened. The helmet is fixed with an adjustable strap under the chin, and its rim is blunted so as to avert injury to the temples of the next men's heads in the close company of the trenches. The pitch of the helmet is made as low as possible. Dr. Saleeby finally urges that the protection of similar steel should be now applied to other vital parts of the body. It is estimated that this would cause an addition of not more than 4 lb. to the weight carried by the soldier, and that this addition could be compensated by the temporary reduction of other equipment, at least when the soldier is storming positions held by the enemy.

THOSE who are interested in iconography will welcome the paper by Prof. Flinders Petrie on "Early Forms of the Cross from Egyptian Tombs," published in part iii. of *Ancient Egypt* for 1916. The numerous examples illustrated are taken from tombs of the fourth and fifth centuries B.C. As persecution increased in Egypt there arose a tendency to disguise the forms of the symbol, so that it should be recognisable only by the initiated. Prof. Petrie disregards the so-called Tau cross, represented in some dictionaries as having come from Egypt. He says that he has never seen it represented or described there, and he does not understand why Egypt has been regarded as its source. On the other hand, he has no doubt of the Egyptian origin of early crosses found in Great Britain and Ireland, though most of these have the long form which, probably with the object of disguise, was at an early period abandoned in Egypt and replaced by that of the square shape.

PROF. M. CAULLERY'S introductory "exchange" lecture at Harvard on "The Present State of the Problem of Evolution" is published in *Science* of April 21 last. He surveys broadly, in this discourse, the progress of biological speculation from the beginning of the nineteenth century, pointing out that some recent interpretations of heredity tend to bring the concept of evolution into line with the "evolutio" of pre-Lamarckian philosophers. With these interpretations Prof. Caullery admits imperfect sympathy, and promises his hearers "support of a transformism more or less Lamarckian." From this introductory lecture they may look forward to a stimulating course, and Prof. Caullery's graceful tribute to American workers in biology—from Louis and Alexander Agassiz to E. B. Wilson, Loeb, and Castle—must have been welcome to his hearers at Harvard.

ON the other hand, Dr. Chas. B. Davenport, writing in the *American Naturalist* (l., No. 596, August, 1916) on "The Form of Evolutionary Theory that Modern Genetical Research seems to Favour," expresses belief in "internal changes chiefly independent of external conditions" as furnishing the effective agency in development. He adopts Bateson's suggestion of a primitive germ-plasm with highly complex constitution, from which factors ("genes") have become split off and lost in the course of ages, thus giving rise to new forms of life. Yet Dr. Davenport does not absolutely exclude environmental influence. "There is some evidence," he admits, "although not as critical as might be wished, that the germ-plasm is not beyond the reach of modifying agents."

THE last meeting of the session of the Zoological Society of London was held on August 16, Dr. Henry Woodward being in the chair. The report laid before the meeting was most gratifying, since it showed that the number of visitors to the Gardens from January 1 to July 31 showed an increase of 14,619, as compared with the corresponding period of 1915, while the receipts during the same period showed an increase of 733*l*., as compared with the corresponding period of last year. The number of new fellows admitted also showed an increase. Among the most noteworthy additions to the society's collection during the month of July were a pair of Fennec foxes, *Vulpes zerda*. This species is the smallest existing member of the Canidæ, and is found not only all over the Sahara, but extends also into south-western Asia.

A REPORT of considerable value and interest appears in the *Meddelelser fra Kommissionen for Havundersøgelser* on "Marking Experiments with Turtles in the Danish West Indies," by Dr. Jos. Schmidt. Four species are found in this area—the leathery, loggerhead, hawksbill, and green turtles—and the author gives a brief but extremely useful summary of their breeding habits, supplemented by some excellent figures of newly hatched specimens of each species. The

leathery turtle and the loggerhead have no great commercial value, but their eggs are taken in large numbers. The green turtle, however, for its meat, and the hawksbill for the sake of its horny shields, which form the "tortoiseshell" of commerce, are subjected to a heavy toll, young and adults alike being taken. The green turtle is happily enabled to lessen the strain of this persecution in that it lays its eggs so near the margin of the sea that all traces of their whereabouts are obliterated by the wash of the tide. Since the Danish West Indies have recently been purchased by the United States it is to be hoped that stringent protective measures will speedily be devised and enforced, for it is evident that otherwise the extermination of these colonies is within measurable distance.

IN a "Note on the Economic Uses of Rosha Grass, *Cymbopogon martini*, Stapf," published in the "Indian Forest Records," Mr. R. S. Pearson points out that this grass exists in two forms, known to the natives as "Motia" and "Sofia." The two forms appear to differ morphologically only in the fact that in the Motia grass the leaf blade makes a wider angle with the culm than is the case in the Sofia grass. The distribution of the two forms also differs considerably, Motia growing in isolated clumps on bare hot slopes, whilst Sofia occurs on low ridges and in shady nullahs often as a dense crop. The chief difference between the two forms lies, however, in the characters of the essential oils they contain, Motia grass yielding "palmarosa oil," containing as much as 90 per cent. of free and combined geraniol, whilst the Sofia form yields the so-called "ginger grass oil," containing only about half as much geraniol. The note states that experimental cultivation of the two forms has now been undertaken at Dehra Dun by Mr. R. S. Hole with the view of determining their botanical relationship.

THE Journal of the Society of Siberian Engineers (Tomsk, March, 1916) directs attention to the backward state of Russian agriculture in the matter of the employment of artificial fertilisers, and emphasises the vital necessity of reform in this direction. In contrast with other countries it is pointed out, among other things, that Russia does not yet possess a single factory for utilising atmospheric nitrogen in the preparation of fertilisers, though she has ample supplies of raw material and water-power.

AN interesting instance of untutored native ability is reported from Tomsk in the Journal of the Society of Siberian Engineers (January, 1916). In the Ochansky district a self-taught farm labourer, Kazymov by name, working on the model of the American machines, made a horse reaper of a very simple type, weighing only 400 lb., and capable of being worked easily by one horse. The local council, on hearing of this, considered it sufficiently important to warrant official investigation, and appointed a special committee for that purpose. After inspecting the machine the committee came to the conclusion that although of very primitive construction it is suitable for the work and might with some trifling technical alterations be widely adopted, seeing that it is superior to the factory-made machine in lightness and in suitability for the small "one horse" farmer. The price of the Kazymov reaper may be estimated approximately at 8*l*.

THE distribution of cyclonic precipitation in Japan is the subject of a paper by Messrs. Terada, Yokota, and Otuki in the Journal of the College of Science, Tokyo, vol. xxxvii, art. 4. The paper is partly a statistical investigation of the influence of land and water in modifying the rainfall from 1905 to 1915, but contains also an attempt to analyse the factors that determine the unsymmetrical distribution of precipitation. These the authors group as (1) thermal and planetary, which depend on latitude; (2) thermal and geographical, which depend on the prevalence of sea or land; (3) hydrodynamical and topographical, caused by the ascending air current. The whole discussion is somewhat hypothetical, and would be more profitable were the data more numerous.

THE eruption of Mauno Loa which took place last May is briefly described by Mr. H. O. Wood in the Weekly Bulletin of the Hawaiian Volcano Observatory (vol. iv., No. 5, 1916). Fume-columns were first noticed at 7 a.m. (or 5.30 p.m., G.M.T.) on May 19. At 8 a.m. the crown of the cloud had reached a height of not less than 20,000 ft. above the mountain profile, but by noon the rush of fumes had almost ceased. A small amount of lava was ejected at the time of this outburst. Shortly after 11 p.m. on May 21 another and greater flow began from a source lower down the slope, at an altitude of about 7000 ft. on the south-south-west slope of the mountain. Hundreds of very slight tremors were registered during these days at the Volcano Observatory on the north-eastern slope of Kilauea, though only three or four were strong enough to be felt in the neighbourhood of the observatory.

THE August number of the Proceedings of the Physical Society of London completes vol. xxviii. The seven papers included in it cover seventy pages, and are of exceptional interest. Mr. G. D. West deals with the effects of the residual gas in measurements at low gas pressures of the pressure due to radiation. Miss Humphrey and Dr. Hatschek show that the viscosity of a liquid having small solid particles in suspension increases more rapidly than the aggregate volume of the suspended matter, and depends on the rate of shear. Capt. Phillips describes a form of mercury jet interrupter by means of which he has investigated the conditions which determine the smooth working of the interrupter. Dr. P. E. Shaw and Mr. C. Hayes describe a magnetometer of the torsion balance type a million times as sensitive as any previous instrument. Dr. S. W. J. Smith discusses the relation between the original migration experiments of Hittorf and the recent ones of Mrs. Griffiths, which have given somewhat different results. Dr. Allen shows that Ratnowsky's recent theory of the process of fusion is incorrect, and Dr. Chatley describes the present position of the attempts to explain cohesion and shows that it must be regarded as the difference between the attractive and repulsive forces between molecules.

THE sixth annual report of the Road Board has just been issued. The amount of new work sanctioned has been reduced greatly, but the Board has continued to supervise the construction and maintenance of new roads required for military purposes, and this work has extended considerably. An account of the method of testing surfaces by rotary machine is included. The machine consists of a revolving frame supported on wheels running on a circular test path at any desired speed—not exceeding seven miles an hour for steel tyres. Each of the eight wheels is independently driven by electromotors. The usual load per inch width of tyre has been about 470 lb. Since wetted surfaces can be tested to destruction sooner than dry surfaces, the wet test has become the standard of comparison. A room temperature approaching that of summer has generally been maintained, since bituminous materials soften and show the least resistance to deformation during the summer months. After the test track has been laid, the

machine is started and run on the new surface with a gradually increasing load until about 4000 to 6000 tons per yard of width have rolled over it; this is called the consolidation period. The test proper is then commenced, and the machine is run at a rate of about 2200 tons per yard of width per hour. In most cases with good materials a well-laid surface remains smooth and polished until about 200,000 tons per yard of width have rolled over it. About this stage wave-like markings begin to appear; these gradually extend until at 400,000 tons the surface becomes considerably waved and the vibration is excessive. The test is then considered complete. The results of four tests with mexphalte and aztecphalte are included, and are of interest as showing that considerable difference in the durability may be caused by the method of laying and by the workmen employed.

WE have received a booklet entitled "Economical Dishes for War-time," by Miss Florence A. George (Messrs. Cornish Bros., Birmingham, price 6*d*.). It contains a number of useful recipes for the preparation of economical meat and vegetable dishes and sweets. A brief introduction deals with the food requirements of the body, and at the end some hints are given on the management of gas-stoves.

THE following books are in the press for inclusion in the "Cambridge Technical Series" of the Cambridge University Press:—"Experimental Building Science," vol. i., J. Leask Manson; "Alternating Currents," W. H. N. James; "Development of English Building Construction," C. F. Innocent; "Naval Architecture," J. E. Steele; "Chemistry and Technology of Oils and Fats," F. E. Weston and P. J. Fryer; "Physics for Engineers," J. Paley Yorke; "Chemistry of Dyeing," Dr. L. L. Lloyd and M. Fort.

OUR ASTRONOMICAL COLUMN.

BRIGHT DISPLAY OF AURORA BOREALIS ON AUGUST 27.—A fine exhibition of Aurora Borealis was observed by Mr. W. F. Denning at Bristol in the early morning of Sunday, August 27, between the hours of 2 and 4 G.M.T. Shafts of light were first observed at about 2h. 15m. ascending amongst the stars of Ursa Major and Draco, and reaching considerable altitudes. Changes affected the appearances at short intervals, the streamers would fade away and new ones form, while the invariable disposition of the whole was to move quickly from the west to the east side of the north point. Some of the more conspicuous streamers were particularly recorded as they passed over certain stars, and the mean rate of motion across Ursa Major was found to be 15° in three minutes.

The active region seemed to extend from as nearly as possible N.W. to N.E., but the N.W. and N. showed the greatest abundance of streamers; in the N.N.E. there was a succession of faint bands of light rising upwards to the left of Auriga. Many of the rays observed in the N. region could be faintly traced to altitudes of 70°. The phenomenon was watched until 3.45, when the sky had regained its normal appearance, and twilight had become strong in the north-east.

DISTRIBUTION OF THE POLES OF PLANETARY ORBITS.—Prof. H. C. Plummer recently found that the mean pole of the orbits of the minor planets was situated at a distance of 53′ from the pole of the ecliptic, in longitude 16·7°, and he was led to investigate its relation to the poles of the major planets (*Monthly Notices*, R.A.S., vol. lxxvi., p. 378). A diagram showing the relative positions of the poles revealed several features of interest, to which no special attention had previously been directed. It thus appeared: (1) that the poles lie three by three on five lines; (2) that the pole of each orbit, with the exception of Neptune, lies on two of these five lines; (3) that each line contains the orbital poles of two adjacent major planets. Prof. Plummer found it difficult to believe that this was merely a chance arrangement. Prof. J. B. Dale has since directed attention to further interesting features of the polar diagram (Roy. Ast. Soc., June). On measuring the inclinations of the five lines to the line drawn from the pole of the ecliptic in the direction 315°, he obtained the following results:—

(1) Earth—Mars—Mercury,	$3^\circ = 82^\circ - 79^\circ$.
(2) Earth—Uranus—Venus,	$31^\circ = 82^\circ - 51^\circ$.
(3) Uranus—Jupiter—Saturn,	$82^\circ = 82^\circ$.
(4) Mars—Jupiter—Neptune,	$136^\circ = 82^\circ + 54^\circ$.
(5) Mercury—Venus—Saturn,	$161^\circ = 82^\circ + 79^\circ$.

The directions of the five lines can thus be expressed very closely by the formulæ, α, $\alpha \pm 2\beta$, $\alpha \pm 3\beta$, where $\alpha = 82^\circ$ and $\beta = 26\frac{1}{3}^\circ$.

The diagram also shows that there are several pairs of lines joining poles which are nearly parallel. There is apparently nothing in the theory of the secular perturbations of the nodes and inclinations of the planetary orbits which would lead to the expectation of such definite relations, or to the continuance of these relations if they did exist at a given time, but Prof. Dale considers it almost incredible that the should be purely accidental. He inclines to the view that these remarkable relations may indicate the action of other forces, such as might be due to a resisting medium, in addition to the gravitational forces.

SOLAR VARIABILITY.—For the more precise study of the distribution of radiation of different wave-lengths across the sun's disc, the observing station of the Smithsonian Institution at Mount Wilson has been provided with a tower telescope having a concave mirror of 12-in. aperture and 75-ft. focal length. A description of this instrument, together with some of the observational results for 1913 and 1914, has been given by Messrs. Abbot, Fowle, and Aldrich (Smithsonian Miscell. Collections, vol. lxvi., No. 5). Spectro-bolometric measurements were made at seven different wave-lengths, namely, 3737, 4265, 5062, 5955, 6702, 8580, and 10,080. The new results agree closely with those obtained at Washington in 1907, so far as the two series are comparable, and the curves of intensity distribution show in a very striking way the greater uniformity of the light across the disc as the wave-length increases. There were, however, slight, but significant, differences between the mean results for different years, a greater contrast of brightness between the centre and edge occurring in 1907 and 1914, as compared with 1913, taken as a standard; that is, in years when the solar constant was high the solar contrast was greater than usual. Besides the long-period change, there were small changes of contrast from day to day, correlated with short-period fluctuations of solar radiation; for this type of variation increase of solar radiation was attended by *decrease* in the contrast between the edge and centre of the disc. The authors are thus led to consider that there are two causes of change existing in the sun: (1) the increased effective solar temperature accompanying high solar activity, producing increased radiation and increased contrast; (2) the varying transparency of the outer solar envelopes from day to day, increased transparency resulting in increased radiation but decreased contrast.

MINERAL PRODUCTION OF CANADA.

THE preliminary report on the mineral production of Canada during the year 1915 has just been issued by the Canadian Department of Mines, and it is satisfactory to find that upon the whole the output shows a marked improvement upon the previous year. Amongst the metals the only decrease to be noted is in the production of silver, which amounted to 28,401,735 ounces, as against 28,449,821 ounces in 1914, so that the decrease is quite insignificant, and is less than the decrease in 1914 below 1913; it will be found that Canada contributes just about 13 per cent. of the world's total silver production. The gold output for 1915 was 916,076 ounces, as against 773,186 ounces in 1914; it may be noted that only about one-third of the gold production now comes from alluvial, and that although the production is less than it was when it was mainly derived from the easily-won alluvials of the Klondyke, the output is now increasing steadily. The copper output for 1915 is more than 102½ millions of pounds, constituting a record for Canada, and showing an increase of 35 per cent. as compared with the previous year.

Nickel is not being smelted in Canada on any scale worth mentioning, the bulk of the Canadian nickel production being exported to the United States and to Great Britain in the form of matte; the estimated quantity of nickel was 68 millions of pounds, again constituting a record, and being an increase of 50 per cent. on 1914. Seeing that Canada is the world's chief producer of nickel, it is a matter for regret that Canadian nickel refineries have not yet been established, and it is to be hoped that the Commission appointed last year to investigate this matter may find some effective means of rendering Canada independent in this respect.

The production of pig-iron in 1915 was 913,717 tons, an increase of 16⅔ per cent. above that of 1914, whilst the total steel output amounted to 1,020,335 tons, an increase of 23 per cent.; it is interesting to note that this item includes 5626 tons of steel produced in electric furnaces. Of the non-metallic products, by far the most important is coal, of which the output, 13,209,371 tons, shows a small decrease, namely, about 3 per cent., below that of the previous year. It may be added that the decrease in Portland cement and other structural materials, which was so marked a feature of the 1914 returns, has continued in 1915. Whilst all the above returns are stated as provisional, it is very rare that the final returns, when completed, differ in any important respects from those given in the preliminary reports.

NEW ASPECTS IN THE STUDY OF JUNGLE LIFE.

A VERY realistic description of the abundance and variety of animal life in the tropics is given by Mr. C. W. Beebe in *Zoologia*, vol. ii., published by the Zoological Society of New York. Mr. Beebe has had a wide experience of jungle-life in many lands, and hence his latest experiences in Brazil have the greater value, though his stay there was confined to a few days in the neighbourhood of Para. Abundance of species and a relative fewness of individuals, he remarks, are pronounced characteristics of any tropical fauna. This was abundantly confirmed during the trip now under discussion. He quickly discovered that more was to be obtained by watching particular trees which afforded special attractions in the form of vividly coloured fruit than in aimless wandering. From one such tree during the space of a week of intermittent watching he obtained no fewer than seventy-six species. His notes were not confined to birds.

Some of Mr. Beebe's most interesting observations are indeed those which relate to arachnids, insects, and the great land-snail, Strophocheilus, which was apparently eagerly sought by kites. His notes on *Acrosoma spinosa*, an exceedingly spiny, gaudy spider, the lurking place of which was in the centre of its web near the ground, will probably provide material for controversy as to the value of "warning coloration." "Its scarlet, yellow, and black coloration," he remarks, "seemed to indicate an unsavoury mouthful, and it was correspondingly slow to take alarm." But as it "hung upside down the brilliant colours of the upper side of the body [were] . . . completely hidden. When the creature was alarmed it dropped to the ground. . . . The moment it touched land it slipped under a leaf. . . . When caught in the hand it at once turned upon its back and feigned death." Thus no use whatever seems to be made of the "warning coloration"; on the contrary, the utmost care seems to be taken to conceal these tokens of inedibility. A "protectively coloured" species, *Epeira audax*, lived much more closely up to its traditional behaviour. When alarmed it would leave its web and seek safety by clinging to "mossy or lichened bark," with which its coloration harmonised so completely that "the eye had to search carefully to rediscover it each time it sprinted to safety."

Just before leaving a brilliant idea struck Mr. Beebe, and one which it is to be hoped will henceforth be followed, wherever possible, by all who visit the forests of the tropics. Filled with regret at leaving the scene of so many wonders, he suddenly bethought him to fill a bag with four square feet of jungle earth, and this was examined minutely with a lens while on board ship on the voyage home. For days and days the search went on, the captures being sorted out and placed in spirit. An amazing wealth of life was thus obtained, remarkable for its variety of form and coloration. The latter aspect again raises interesting problems concerning the precise significance of coloration. Among the captures thus made were representatives of two genera of ants new to science. There can be no doubt that important discoveries in regard to the animal life of jungle earth would accrue if this example of Mr. Beebe's were generally followed in the future. W. P. P.

EYESIGHT AND THE WAR.[1]

(1) *The Army Sight Test.*

AS the subject of refraction is our text this evening it is only meet that we should remember the enormous debt we owe to Donders, the great Dutch ophthalmologist, the centenary of whose birth will be celebrated in Holland as soon as the war is over.

One of the subjects that Donders threw light upon was myopia, or short-sight. In his classical work on refraction, published in 1864, he showed that the myopic eye was the over-developed eye, the too long eye, contrasted with the under-developed, the hypermetropic, or too short, eye.

Now myopia has been the *bête noire* of the War Office for very many years—thousands of young men, otherwise eligible, have been rejected for the Army because of myopia. The myope is useless without his

[1] Abstract of a Friday evening discourse at the Royal Institution delivered on June 9, by Dr. Ernest Clarke.

glasses, and the War Office has, up to the present, set its face against the wearing of glasses. The reasons which existed formerly, although, of course, quite inadequate now, were that we had a very small Army, and a sufficiency of officers and men could always be counted on, besides which, this small Army was mostly employed abroad, and then chiefly in the tropics, and lost or broken spectacles could not easily be replaced.

Not only must a myope wear glasses for distance, but he must wear them for near work—that is, *always*. It was the old treatment of wearing them for distance *only* (because he could see so well without them for near work) that we now know was the cause of the increase of the myopia, an increase which sometimes led to complete blindness.

When a myope does any near work without glasses he converges unduly; this means excessive pull on the internal recti muscles, which in their turn pull on the tunics of the eye, which leads to the eyes lengthening antero-posteriorly, which means that the eye becomes more short-sighted. This increase of myopia again causes more convergence, and so a vicious circle is produced.

(Lantern slides were here exhibited showing the harmful changes produced in high myopia, viz. atrophy of the choroid and retina, hæmorrhages at the macula, and retinal detachment.)

If the eyes are thoroughly tested under atropine or homatropine and the full correction given to be *worn always* they are thus made normal, undue convergence ceases, as the work can be held further from the eyes, and the ciliary muscle is made to work normally, and the progress of the myopia is stayed. Out of 532 myopes watched by me over a period of five years, all of whom were fully corrected, only *four* progressed to any appreciable extent.

In the Army we can get rid of the difficulty of replacing lost or broken glasses by having an oculist and one or more working opticians attached to every "centre" with a register of the glasses worn in that centre, and once we have this as part of the Army equipment we can replace an effete sight test, which judges only the uncorrected vision, by the Continental plan of estimating the value of a man's vision when corrected.

By the accompanying table we see that the highest amount of myopia we allow is about 2·5 D., whereas abroad 6 or 7 D. pass easily.

A strong argument showing the inadequacy of our present system is that men will pass in easily who, from the visual point of view, may be far worse than those rejected. A high hypermetrope, for instance, at twenty, will pass the present test easily, but some years later he has to use up the whole of his accommodative power in correcting his distant vision, and later still he even loses the power of correcting this, and so he must have glasses for distant and near vision, whereas the myope of 5 or 6 D., or more, will be able to read without glasses when he is a hundred years old!

It is true that at present a portion of the scheme suggested above is being adopted, but we want to see it in its entirety and for all time, and that in future the wearing of glasses will never be considered a disability in the Army.

Although myopia is the chief visual cause that keeps men out of the Army, high hypermetropia and astigmatism also do so, and the majority of cases can be made absolutely normal with suitable glasses.

(2) *Eyestrain.*

We now pass to the important subject of *eyestrain* as it affects our soldiers.

There are three chief causes of eyestrain:—(1) Low errors of astigmatism; (2) low anisometropia; (3) small want of balance in the external muscles of the eye.

(1) *Astigmatism.*—Large errors take care of themselves. The craving for distinct vision leads the possessor to have the error properly corrected, but he is generally totally unconscious of the presence of a small error, as the ciliary muscle, by producing an astigmatism of the lens—the inverse of that of the cornea—corrects it, with the result that his vision is so perfect that he is quite annoyed with the physician he is consulting for some functional nerve trouble, if he suggests that the eyes are at fault. It should be remembered that there is not a single *functional* nerve trouble that may not be caused by eyestrain. The great prevalence of astigmatism is shown in the

Table showing the Visual Standards for Recruits in the Chief European Armies.
(Paterson and Traquair.)

—	Amount of short-sight (myopia) allowed.		Standard of corrected vision.		Remarks.
	Combatants.	Non-combatants.	Combatants.	Non-combatants.	
GERMANY	6·5 D. For Landsturm no limit if standard of corrected vision attained.	—	1/2 in better eye. Other eye may have minimal vision. For Landsturm vision = 1/4. If one eye has vision = 1/2 the other may be blind.	—	Vision with glasses (corrected vision) counts.
AUSTRIA	6 D.	Above 6 D. no limit if standard of corrected vision is attained.	Group 1, 1/2 in each eye. Group 2, 1/2 in one; 1/4 in other.	1/4 in one; 1/10 in the other.	Vision with glasses counts.
FRANCE	7 D.	Above 7 D. no limit if standard of corrected vision is attained.	1/2 in one eye; 1/20 in the other.	1/4 in one eye; 1/20 in the other.	Vision with glasses counts.
ITALY	7 D.	—	1/3 in each eye, or 1/12 in one eye if the other has 1/1 (full vision).		Vision with glasses counts.
GREAT BRITAIN	No amount specified, but according to vision required highest amount possible is about 2·5 D.	No amount specified, but according to vision required highest amount possible is about 2·5 D. in better eye and 3·5 D. in worse eye.	No correction allowed for general service. Uncorrected vision must be 1/4 in each eye, or 1/4 in the right eye with 1/10 in the left.	Uncorrected vision must be 1/4 in better eye, 1/10 in worse eye. The better eye may be the left.	Vision without glasses counts. For home service, garrison service, and garrison service abroad glasses are allowed within unspecified limits.

accompanying table, where, out of 5000 eyes, 4303 were found by me to be astigmatic :—

2500 individuals whose sight after correction was normal and who had no disease of the eyes.	1. Same refraction in both eyes. (657)	*a* Emmetropia (see Presbyopia below) ...		9
		b Hypermetropia ...		63
		c Myopia		22
		d Astigmatism	Hypermetropic	438
			Myopic ...	113
			Mixed ...	12
	2. Refraction different in the two eyes (Anisometropia)			1843
				2500
5000 eyes (as above)			Emmetropia	56
			Hypermetropia	425
			Myopia	219
			Astigmatism	4303
				5000

Of the 2500 individuals 961 were presbyopic, and only 9 of these were emmetropic.

(2) *Low Anisometropia.*—When the difference between the two eyes is small, impulses can pass from the brain to one ciliary muscle to correct this defect. In the above table, out of 2500 individuals, no fewer than 1843 had "odd" vision.

(3) *Want of Balance between the External Muscles.*—When small in amount impulses can pass to one muscle to preserve the balance and so avoid diplopia.

In all these instances of eyestrain this extra work means an enormous unnecessary waste of nerve energy going on all the waking hours, and it becomes imperative to stop this waste in all cases where a large amount of nerve energy has already been lost, which occurs from the effects of *high explosives* on our soldiers.

At the time of the explosion the "wind pressure" is so great that I have recorded a case[2] where, without being hit by any foreign body, an eye was completely destroyed through detachment of the retina by wind pressure. This wind pressure is followed by a high vacuum, which may be so great that in one case I saw at the King George Hospital the eye had been evulsed. Such effects show how the soldier's nervous system can suffer. Nerve energy is lost—as after a bad railway collision—"virtue" is knocked out, and it becomes imperative to conserve all the energy that is left, and we must therefore remove the eyestrain if it is present. At the King George Hospital our resident ophthalmic medical officer, Dr. Harwood, is keenly alive to the ill-effects of eyestrain, and almost miraculous have been some of the cures by simply putting the invalid into glasses. The neurasthenia following head injuries can often be cured in the same way, and we had one very marked case as an example of this. The man, aged thirty-eight, was hit on the head while lying in his dug-out at Gallipoli by a wet sand-bag falling 8 ft. He was not rendered unconscious, but could not stand or walk. After about six weeks he was admitted into the King George Hospital. His symptoms all the time had been inability to stand or walk, constant headache and giddiness, inability to read or even look at the light, with rather sluggish memory and mental faculties—no treatment had succeeded. Dr. Harwood put the eyes under atropine, when there was an immediate improvement. He was given glasses correcting 0·25 astigmatism in one eye and 0·37 in the other. Within a few hours of getting the glasses he was reading, and within a week he could stand and walk, and his headache and giddiness had disappeared.

[2] *Medical Press and Circular*, December 29, 1915.

In many cases where wounds had remained sluggish, the nerve energy required for the healing processes being used up by eyestrain, a suitable pair of glasses immediately proved a remedy.

When there is a want of muscle equilibrium the correction of the astigmatism generally removes it, and in bad cases of head injuries, when testing the patient was impossible, Dr. Harwood has obtained excellent results by simply bandaging up one eye. The testing has to be very carefully done, always under a cycloplegic, and the ophthalmometer is a most invaluable instrument for estimating the astigmatism, even 0·12 D. being recorded.

(The ophthalmometer and its working were here explained.)

(3) *Presbyopia.*

We have been reviewing the effects of the war on combatants; we now turn to the effects produced on those of us who are disqualified by age to take an active part.

We have been considering defects of the eyes due

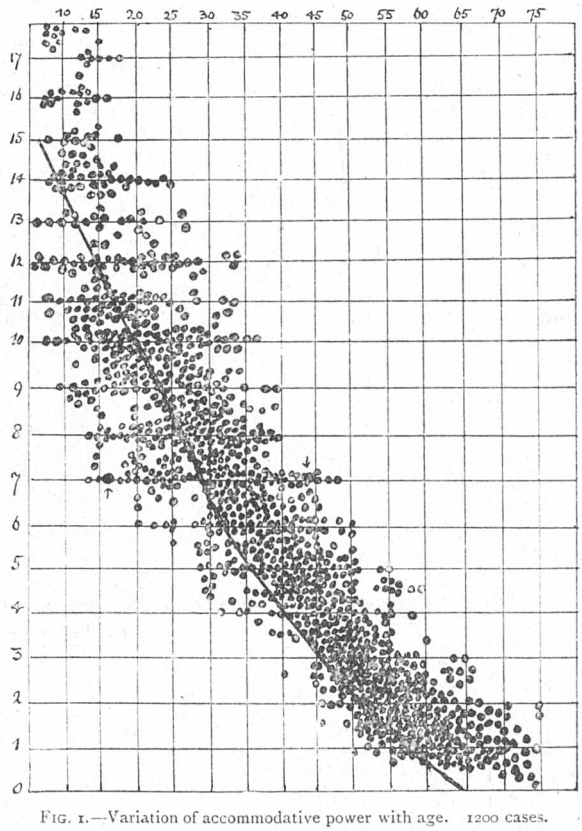

FIG. 1.—Variation of accommodative power with age. 1200 cases.

to their shape, and have seen how prevalent these defects are; yet some eyes (it is true very few) are normal. Now there is a defect that attacks *all* eyes if the individual lives long enough, viz. presbyopia, or old sight. It may not be manifest, and the individual may be quite unconscious of it, but nevertheless no eye, after about the age of forty-five, escapes it. It is a senile change, and is, as Donders observed, no more a disease than is grey hair.

At the beginning of life the crystalline lens is nothing more than a little bag of semi-fluid jelly. By making the lens thicker we can focus for near objects. This is done by the ciliary muscle, and chiefly by that portion of the muscle which surrounds the lens and acts like a sphincter. Tscherning's theory of the accommodation which states that the lens is squeezed

by the circular portion of the ciliary muscle and made to bulge in the centre explains all the clinical phenomena, which the old theory (Helmholt's) failed to do. The aberration which the central bulging would cause at the margin of the lens is masked by the contraction of the pupil, which always accompanies normal accommodation; thus the accommodative power depends rather on the "squeezability" of the lens than the power of the muscle. Now this "squeezability" of the lens becomes less as the lens tissue becomes firmer. I have known in a young child the accommodative power to be as much as 20 D., whereas it is rare to find anyone above forty-five with an accommodative power higher than 4 or 5 D. Donders gave us a diagram showing the gradual loss of accommodative power through age, *i.e.* through the sclerosing of the lens, but he only examined 150 cases, and included in these some latent hypermetropes, so that he reckoned the accommodative power per age lower than it really is.

The diagram (Fig. 1) was prepared by me from 1200 cases, all of which were first made normal by correcting their defects. Donders's *mean* line is marked, and it is seen that it coincides practically with my minimum line from the age of thirty. From my table the presbyopic point may be said to be arrived at between ages forty-five and forty-eight; in other words, the emmetrope, or those made emmetropic by correction, must at that age have increased help for near work.

Age	Minimum	Mean	Maximum
7–10	9	14	18
10–15	7	12	18
20	6	10	14
25	5·5	9	13·5
30	4 5	7·5	12
35	4	6·5	10
40	2 5	5·5	8·5
45	2	4	7
50	1	3	6
55	0 75	2	5
60	0·50	1·75	4
65	0·50	1·5	3
70	0·00	1	2

In the above table made from my diagrams there is seen to be a great difference between the maximum and minimum. What is the cause of this difference? If a person has more accommodative power than the average it means that he is younger than his years, and if less, older.

Among the many causes of premature senility, which a lessened accommodative power implies, the following are the chief:—

(1) *Alimentary Toxaemia.*—As amply shown by Sir William Arbuthnot Lane. In these cases I have found the lens to be a very delicate index.

(2) *Eyestrain.*

(3) *Worry, Anxiety, Sorrow, and Overwork.*—This war has hastened the onset of presbyopia, and increased it rapidly in those already presbyopic, throughout England, and probably throughout Europe. The only preventive treatment is peace, but until that comes we should conserve all the nervous energy we have and not waste it.

Intestinal toxæmia should be removed by the surgeon or physician. Eyestrain should be prevented; if there is any defect besides the presbyopia (and it must be remembered that simple presbyopia is very uncommon, only about 1 per cent. of presbyopes) it must be corrected, and the invisible bifocal glasses, which correct the distant vision in the upper portion and the reading in the lower, give the best result. If two separate glasses are worn they are not changed when they should be. The presbyopic period is just that time of life when it is most important to conserve all possible nerve energy. Responsibilities, worries, and anxieties are probably at their maximum, and we have not yet reached the callousness of old age!

Finally, for our own sakes and also for those around us, we should not make the most of our troubles; we should not go out to meet them, nor let "to-day's strength bear to-morrow's loads."

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE Board of Education has issued a circular (961) stating that with a few alterations the Regulations for Technical Schools, etc., in England and Wales (Cd. 7996) will continue in force for the school year 1916–17. The special regulations for grants in aid of instruction for men serving with the colours are withdrawn, as it appears from the returns of the work done during the past winter that there is now little demand in camp for classes of an educational character.

THE Weardale Lead Company is establishing two mining scholarships, each of the annual value of 60*l.*, in connection respectively with the Royal School of Mines and Armstrong College, Newcastle-upon-Tyne, with the object of combining university training with a year's practical work calculated to advance a student in the knowledge of mining engineering. The scholarships are to be known as the "Richardson" and the "Cameron," after two directors of the company.

THE first award of the annual prize of 40*l.* founded by the Earl of Cromer, and administered by the British Academy, for the best essay on any subject connected with the language, history, art, literature, or philosophy of ancient Greece, will be made before the end of 1917. The competition is open to all British subjects under the age of twenty-six years on October 1, 1917. Intending competitors must send the title of their proposed essay to the Secretary of the British Academy, Burlington House, Piccadilly, on or before December 1, 1916. The essays on approved subjects must reach the Academy by, at latest, October 1, 1917.

THE current issue of the *Reading University College Review* is concerned almost exclusively with the affairs of the college. It includes the sixth revised list of present members of the staff, past and present students, and present servants of the college who are serving with the Forces or in the French Army. The numerous notes which begin the review serve as an excellent record of the various developments in the activities of the college. Among these, the extension of domestic training may be mentioned. A scheme has been sanctioned for a diploma course in domestic subjects extending over two years, and for a certificate course extending over one year. The aim of these courses is to train girls of good secondary education to manage an institution, household, or home with practical efficiency and intelligence. Instruction in poultry-keeping has been inaugurated, and the work of the department of horticulture is being extended.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, August 14.—M. Paul Appell in the chair.—C. **Richet**: The conditions which influence the average monthly deviation of the birth-rate. In countries with a high birth-rate (more than 350 per 10,000) the mean monthly deviation of the birth-rate

is more than double that of countries with low birth-rate.—E. **Esclangon**: The sound of gunfire and zones of silence. The detonations arising from the sudden expansion of gas at the mouth of the gun and from the explosion of the shell, even of the largest calibre, are inaudible at about 30 kilometres, and the author concludes that the sounds heard at distances of 50 to 200 kilometres from the front are due to the waves set up in the air by projectiles moving with initial velocities greater than the velocity of sound.—L. **Bouchet**: The electric expansion of solid insulators in the sense normal to an electrostatic field. The changes of length were observed by an interferential method for glass, ebonite, and paraffin. Calculations based on Maxwell's equation for the pressures normal to the field agree well with the experimental figures for paraffin wax, but are not in accord with the results for ebonite and glass.—R. **Ledoux-Lebard** and A. **Dauvillier**: Theoretical and experimental researches on the bases of radiological dosimetry.—Ed. **Lesné** and M. **Phocas**: The presence of living and virulent micro-organisms at the surface of projectiles enclosed in cicatrised tissues. Experiments with bullets extracted from healed wounds demonstrate the reality of latent microbism.

New South Wales.

Linnean Society, May 31.—Mr. A. G. Hamilton, president, in the chair.—T. G. **Sloane**: Carabidæ from the Upper Williams River, N.S.W. In December, 1915, a party of naturalists, organised by Mr. W. J. Enright, of West Maitland, visited the part of the Mount Royal Range known as the Barrington Tops—a basalt-capped plateau, 5000 ft. above sea-level, from which the Barrington, Allyn, Paterson, and other rivers take their rise. The route followed was north-west from Dungog, along the Williams River; after the level of 3500 ft. is reached, the track keeps to the summit of the narrow ridge dividing the valleys of the Williams and Allyn Rivers, until, beyond the source of the Williams, Barrington Tops are reached, distant about 37 miles from Dungog. *Fagus moorei* is the predominant tree in the brushes at 4100 ft. and upwards. In one locality, near the southern source of the Barrington, at about 4800 ft., *Eucalyptus coriacea* was plentiful. Collecting was carried on in six localities, four of them above 4000 ft., and two much below. Representatives of forty-six species of Carabidæ were obtained, and have been identified, of which nine, and two varieties, are described as new. Eighteen species, all of which are known from the coastal districts between Sydney and the Clarence River, were found to occur below the level of 4000 ft. Specimens of twenty-eight species were collected above this level, mostly members of typical eastern Australian genera. The most striking is a remarkable species, doubtfully referred to Trichosternus, which appears to be more closely allied to certain New Zealand species than to any known Australian species. Another notable species is *Agonochila ruficollis*, Sl., hitherto known only from the forests of south-western Australia; but this is closely allied to a Tasmanian species, and to *A. binotata*, White, from New Zealand.—H. J. **Carter**: Description of a new genus and three new species of Tenebrionidæ from Barrington Tops, N.S.W. A genus, with the facies of Cryptodus, and presenting some resemblance to Asphalus, Pasc., with one species, and two species of Cardiothorax, are described as new.—The late Dr. A. **Rutherford**, with notes by E. **Jarvis**: A new scale-insect affecting sugar-cane in New Guinea. A new species of Aulacaspis, different from either of the two known Australian species, is described.

BOOKS RECEIVED.

Highways and Byways in Galloway and Carrick. By the Rev. C. H. Dick. Pp. xxix+536. (London: Macmillan and Co., Ltd.) 6*s*. net.

Bacon's Large-Scale Map of the British Battle Front. (London: G. W. Bacon and Co., Ltd.) 6*d*. net.

Smithsonian Institution Bureau of American Ethnology. Bulletin 62. Physical Anthropology of the Lenape or Delawares, and of the Eastern Indians in General. By A. Hrdlička. Pp. 130. (Washington: Smithsonian Institution.)

Domestic Science. By C. W. Hale. Part ii. Pp. x+300. (Cambridge: At the University Press.) 4*s*. net.

Field and Laboratory Studies of Crops. By Prof. A. G. McCall. Pp. viii+133. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 3*s*. 6*d*. net.

American Civil Engineers' Pocket Book. By M. Merriman and others. Third edition. Pp. ix+1571. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 21*s*. net.

Parks and Park Engineering. By Prof. W. T. Lyle. Pp. viii+130. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 5*s*. 6*d*. net.

Earth Pressure, Retaining Walls, and Bins. By Prof. W. Cain. Pp. x+287. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 10*s*. 6*d*. net.

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

Advertisements and business letters to be addressed to the Publishers.

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