THURSDAY, DECEMBER 7, 1916.

ALTERNATING ELECTRIC CURRENTS.

(1) *The Principles of Electrical Engineering and their Application.* By Prof. Gisbert Kapp. Vol. i. Pp. xii+356. (London: Edward Arnold, 1916.) Price 18*s.* net.

(2) *A Treatise on the Theory of Alternating Currents.* By Dr. Alexander Russell. Vol. ii. Second edition. Pp. xiv+566. (Cambridge: At the University Press.) Price 15*s.* net.

(3) *Alternating Currents in Theory and Practice.* By W. H. N. James. (Cambridge Technical Series.) Pp. vii+353. (Cambridge: At the University Press, 1916.) Price 10*s.* 6*d.* net.

THE progress of electrical knowledge and invention is so rapid and the ground covered so extensive that the trend of its literature is for the most part in the direction of books or monographs on special departments of it written by experts. On the other hand, as the existing complete treatises become antiquated or too bulky by additions, the necessity arises for rewriting the subject from a more modern point of view.

(1) The aim of Prof. Kapp's book, the first volume of which is before us, is to furnish the engineering student with a couple of volumes wherein the principles and modern practice of electrical engineering are treated compactly, yet completely, with reference to the needs of the engineer rather than to those of the physicist. Although, for the sake of distinction, we divide engineering into various branches, engineers of all kinds are constantly called upon to use applied electricity in various ways. Thus, a mechanical engineer may have to put up a three-phase motor to work a pump, or a civil engineer may have to lay out an electric tramway system. Hence no one practising any branch of engineering can afford to be ignorant of the principles and methods of electrical engineering. A very commendable feature of Prof. Kapp's book is that the purely mathematical aspect of the subject is kept well under restraint. Such mathematics as is used rarely goes beyond simple algebra or a simple differentiation or integration. This is a distinct advantage, as most engineering students are rather repelled by a book which bristles with mathematical symbols. Again, the verbal explanations are clear and terse, whilst the diagrams have a refreshing air of originality and have not done duty in other books.

The volume under review deals with general principles, and is divided into fifteen chapters. The first six comprise the discussion of electric conduction and resistance, its measurement, and the electrical measurement of current and voltage generally. It would have been better if the connections of the two types of plug Wheatstone's bridge, viz. the series and dial patterns, had been more fully illustrated and described. In the description on p. 20 of the "Thompson double bridge" the name should be "Thomson," as the late Lord Kelvin was, prior to his peerage, Sir William Thomson. The name is correctly spelt in a previous section on the Thomson-Varley bridge.

The chapter on potentiometric measurements contains much useful information. It seems, however, to be forgotten that the writer of this review was the first person to suggest "setting the potentiometer" by means of a standard cell of known voltage and a divided potentiometer wire, so as to make it a direct-reading instrument. Curiously enough, this method was first described by the writer in a now extinct paper called *Industries* in July and August, 1886, which at that time was edited by Prof. Kapp.

In the section on standard cells (p. 31) the name "Carhard" is a misprint for "Carhart."

Chap. v., on the distribution of continuous currents, contains some valuable information not commonly given in text-books. The analogy between an electric main tapped off at various intervals and a beam loaded at intervals with weights is very instructive, and the application of the same graphical method of solution is suggestive.

Chap. vii. introduces the reader to the principles of electrostatics, and although there is nothing of the nature of great novelty in it, the facts are well set out. Prof. Kapp defines the electrical capacity as the quotient of charge and potential difference. We think that the definition is better given in the form that the capacity is measured by the charge required to raise the conductor to unit potential when all other surrounding conductors are at zero potential.

In some of the formulæ given for capacities the student may perhaps be puzzled by the custom of writing *ln* for $\log_e$ or the natural logarithm, and *lg* for $\log_{10}$, especially when the letter *l* appears, as in formula 66 on p. 116, in the same expression for the length of the conductor. Also the decision to employ ϵ for the dielectric constant is not a happy one. This Greek letter has for ages past been consecrated to denote the base of the Napierian logarithms, viz. 2·71828, etc.

Chap. viii., on applied electrostatics, contains much valuable matter of a practical kind, especially on the subject of cable insulation. Chaps. ix. and x. deal with the subject of magnetism and electromagnetism in an interesting manner. There is on p. 162 another little misprint in a proper name in a reference to "Hatfield's" manganese steel. This should, of course, be "Hadfield." Chap. xi. covers elementary electrodynamics, and the information given is kept well in touch with practice, as, for instance, in the remarks on p. 223 on the method of reducing the time constant of motor field circuits. On p. 208, second line, "Lenze's law" should be "Lenz's law."

The last chapter, xv., discusses alternating currents, and gives in compact form most of the necessary information. Altogether the book is one which can be strongly recommended, and we shall look forward with interest to the second volume as likely to contain much of great value

drawn from Prof. Kapp's large practical experience in electrical engineering. The printing and get-up of the book are all that could be desired.

(2) Dr. Alexander Russell's book is of a more theoretical and mathematical character, and is the second edition of the second volume of a treatise on the theory of alternating currents. It appeals therefore to an advanced student or designer who is not averse to full mathematical treatment. A valuable feature of the book is the list of references to other works and papers given at the end of each chapter. The book consists of twenty chapters, covering the full theory of alternators, transformers, induction motors, commutator motors, rotary converters, and electric power transmission by alternating currents. Chap. iii. comprises a very complete discussion of Fourier's theorem and the practical methods of determining the constants in the Fourier expansion. Although chiefly of interest to the pure mathematician, the electrical engineer has frequently occasion to enter this field of analysis. Nevertheless, if much of it has to be done, as in the analysis of tidal curves, then some mechanical means, such as Lord Kelvin's harmonic analyser, would be used.

A very important application of pure mathematics is dealt with in chap. xix., viz. the discussion of the properties of hyperbolic functions and their application in the problem of the long-distance alternating-current power transmission. No electrical engineer concerned with this subject can afford to be ignorant of these modern methods.

Chap. xiv gives a good account of the general theory of induction motors, and chap. xvi of the commutator motor. In this connection we confess we should like to have seen included the theory of Goldschmidt's frequency-raising alternator, now of importance in wireless telegraphy. It has been treated by Pupin as a particular case of asymmetrical rotors in unidirectional magnetic fields. Also another subject of interest in close connection is the use of pairs of static transformers for raising frequency by means of unsymmetrical flux in the cores. The question of the efficiency of this method of frequency raising needs discussion.

It would have been an advantage to include some general description of extra high frequency alternators, such as those of Alexanderson and the method of frequency raising by alternators in cascade suggested by MM. Latour and Béthenod. Nevertheless, the book as it is is a work of the greatest value to all concerned with alternating-current working, and no advanced student should neglect it.

(3) The third book on our list is of a less ambitious type, but is intended to provide within very moderate compass for the needs of students in universities and technical colleges whose mathematical knowledge is of restricted range. To each chapter is appended a series of examination questions and numerical examples, with the answers in many cases added. The diagrams and illustrations are in most cases new and well selected.

The chapter on switchgear and protective appliances for high-tension transmission is a particularly useful one, and the diagrams are extremely instructive. The plates at the end showing the modern types of switchgear and panels for handling large currents are valuable.

The book strikes us as very well adapted for second-year students in the electrical engineering departments of our colleges, and as a text-book, from its moderate size and yet thoroughly practical character, it will be popular. It is one of the excellent books in the Cambridge Technical Series edited by Mr. P. Abbott, and the fact that it is printed at the Cambridge University Press is a sufficient assurance that its typography and illustrations are of the very best.

J. A. FLEMING.

THE INFLUENCE OF INTERNAL SECRETIONS ON SEX CHARACTERISTICS.

The Sex Complex: A Study of the Relationships of the Internal Secretions to the Female Characteristics and Functions in Health and Disease. By Dr. W. B. Bell. Pp. xvii+233. (London: Baillière, Tindall and Cox, 1916.) Price 12*s.* 6*d.* net.

DR. BLAIR BELL belongs to that limited group of medical men who resort to the experimental laboratory to extend and verify their means of diagnosis and treatment of clinical conditions. He has given us, under the title "The Sex Complex," observations made in the course of a prolonged inquiry into the nature of the secondary sexual characters of the human body—more particularly the normal and abnormal manifestations of sex in woman. His work will appeal to all who are trying to unravel the obscure and delicate manner in which the sexual system is developed and balanced. From prehistoric times mankind has been familiar with the effects of castration; the effects which followed that operation gave rise to the belief that the sexual characteristics of the male, both mental and bodily, were determined by the testes, while, conversely, feminine characters depended on the ovaries.

The chief aim which Dr. Blair Bell has in view in his present work is to prove that sexual characterisation is the manifestation of a complex glandular system of which the sex-glands form only a part—a system which includes all the glands of internal secretion—the pituitary, the pineal, the thyroid and parathyroids—the thymus, and suprarenal bodies. The normal development of male and female characters depends on the interaction and co-operation of all the members of this complex glandular system; it is in a disturbance of the balance of the various members of the glandular system that Dr. Blair Bell seeks for a rational explanation of the sexual disorders to which so many modern women are liable. Beyond doubt the method of investigation which the author has adopted is one which promises a

scientific basis of treatment for disorders which are as common as they are obscure.

For a number of years we have possessed definite evidence that the pituitary gland plays a part in the maintenance of sexual life and in the production of the sexual characters of the body. Dr. Blair Bell has carried out a prolonged series of experiments on the pituitary body. His most definite results were obtained by compressing or cutting the stalk of the pituitary gland; in such cases the dogs operated on manifested all those characters which clinicians are familiar with in certain patients. Sexual appetite is lost; the genital glands atrophy; there is an abundant deposit of fat all over the body; the bones become long and slender. He also places on record the notes of a very instructive case—that of a young woman who began to develop certain male characters in face and voice. It was found that her ovaries were of a complex type; in their cortex were true ova, situated in normal follicles; in the centre of the ovaries the tissue assumed a testicular structure, although spermatozoa were not present. It is the examination of such cases which shows how complex are the factors which go to the differentiation of sex. Dr. Blair Bell emphasises the influence of the glandular products on the mental life of the individual. His final conclusion is: *Propter secretiones internas totas mulier est quod est.*

VIGNETTES OF FRIENDS.

Memories. By Edward Clodd. Pp. xi+288. (London: Chapman and Hall, Ltd., 1916.) Price 10*s.* 6*d.* net.

MR. CLODD is well known to readers of NATURE as one who has most successfully introduced the discoveries and generalisations of various departments of science to innumerable readers—old and young. In the course of a long and active life he has made friends with a remarkable number of noteworthy people, being richly endowed with the "genius for friendship." One has only to look through the table of contents of his "Memories" to see how the sympathy of the author reaches out to very diverse types, and there is scarcely a name on the list which does not stand for pre-eminence in literature, art, or science. There are constant references to the pleasant Whitsuntide gatherings under Mr. Clodd's hospitable roof at Aldeburgh, where kindred spirits, but of diverse aptitudes, exchange ideas on all imaginable subjects when eating, smoking, walking, or cruising with their skipper-host in the *Lotus*. To some extent the book is a series of reminiscences of talks on such occasions. The fragment of his own autobiography that Mr. Clodd gives as a sort of preface is interesting reading, and affords a clue to the particular direction of his intellectual activity.

Most of the "Memories" are very short—like lantern-slides thrown on a screen to be rapidly replaced by others. Little is said about Thomas Henry Huxley, but in this case the reader should refer to the author's biography of the biologist. The jottings on Herbert Spencer do not depict the philosopher in a very agreeable light. Concerning Henry Walter Bates we read: "No word of mine can convey the charm infusing the memory of so rare a soul as that which dwelt in Bates. . . . There was a wonderful freshness in all that he said, and a wonderful magnetism in the way he said it." The brief account of Joseph Thomson indicates how much was lost by the early death of a brilliant traveller. The few remarks on Paul B. du Chaillu are of interest, as his early work was erroneously discredited. Andrew Lang has been described as having a "touch of superciliousness in his manner," but Mr. Clodd says "the aloofness was only skin-deep . . . those who came to know him longest learned to appreciate him most. . . . Sometimes he gave offence by the tone of his reviews, the temptation to banter being too great to be resisted. But he bore no malice; and they who submit their wares to the critic must not be too squeamish over the verdict." Samuel Butler "was of the *genus irritabile*. . . . As Chauncey Depew said: 'When once you've stood on your head, the public won't let you stand on your feet.' The truth of this was Butler's irritating experience." The appreciations of Grant Allen, George Meredith, and George Gissing are among the best things in a book replete with shrewd, kindly criticism.

A. C. HADDON.

OUR BOOKSHELF.

Cours d'Hydraulique. By Prof. J. Grialou. Pp. vi+549. (Paris: Gauthier-Villars et Cie, 1916.) Price 20 fr.

THIS volume is designed for the use of advanced students; it embodies the third-year course of lectures delivered by Prof. Grialou at the Lyons Central School. Much of it, naturally, is ground covered by the generality of text-books on the subject, but there are also special sections on particular problems, such as the application of cylindrical co-ordinates to the motion of turbines, the loss of head due to abrupt variation of pipe section, fluid resistance, etc.

Prof. Grialou's treatment is rigorously mathematical, and he explains that he has endeavoured throughout to make constant use of general equations, whether applicable to "perfect" liquids or to liquids characterised by viscosity. He considers that the study of hydraulics has acquired too empirical a character, and that this should be rectified by adhering as closely as possible to theoretical principles.

We certainly agree with him in the desirability of directing the attention of students to the lack of scientific precision in many hydraulic formulæ, but this is in order that too great a degree of accuracy may not be assigned to the numerical results which they give. The conditions attach-

ing to hydraulic flow in actual practice are such as to render unavoidable a dependence to a greater or less extent on data derived from observation rather than on the predictions which might be based on the behaviour of a perfect liquid.

The book deals with hydrostatics and hydrodynamics as well as with the field of phenomena more strictly known as hydraulics. Wave theory and tidal action are also touched upon. It will thus be seen that the purview of the volume is fairly extensive, with the consequence that the treatment, in parts, is unavoidably sketchy, but, as a whole, it gives a fair presentment of a subject which is beset by many complexities.

One cannot help wondering why such important scientific works in France are published in paper covers, and why it is left to the reader laboriously to cut the pages. B. C.

The Origin of Finger-Printing. By Sir William J. Herschel, Bart. Pp. 41. (London: Oxford University Press, 1916.) Price with paper covers, 1s. net.

WHEN Sir Francis Galton issued "Finger-Print Directories" in 1895 he inscribed the volume to Sir William J. Herschel, Bart., in the following words:—"I do myself the pleasure of dedicating this book to you, in recognition of your initiative in employing finger-prints as official signatures, nearly forty years ago, and in grateful remembrance of the invaluable help you freely gave me when I began to study them." And now, in the year 1916, fifty-eight years after he lighted "upon a discovery which promised escape from one great difficulty of administration in India," Sir William Herschel tells the story of how our modern system of identification by means of finger-prints was born in the magistrates' court at Jungipoor, on the upper reaches of the Hooghly. In his dedication to Sir Edward Henry, Commissioner of the Metropolitan Police, Sir William writes as follows:—"I am offering you this old story of the beginnings of finger-printing, by way of expressing my warm and continuous admiration of those masterly developments of its original applications, whereby, first in Bengal and the Transvaal, and then in England, you have fashioned a weapon of penetrating certainty for the sterner needs of justice."

There can be no doubt that England has given the world the most perfect system of identification—identification of an individual by means of his or her finger-prints. The method was initiated by Herschel; it was developed and created into a system by Galton; it has been perfected and applied by Henry. Nor should it be forgotten that it was on the initiative of Mr. Asquith, when Home Secretary in the Liberal Administration of 1892–95, that the method found an early recognition at Scotland Yard. All who are interested in the use and significance of finger-prints will feel grateful to Sir William Herschel for placing on record the first steps of an important development.

LETTERS TO THE EDITOR.

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Robert Recorde.

THE reference to the (probably) unique record of a great Welsh man of science in the Notes columns of NATURE (November 2) well illustrates the uncertainty of the data of (even scientific) fame, and the subtle comparison of the latter to the river which submerges merit and floats mediocrity to its destination. It may now be well affirmed that the writer of the Notes paragraph, or the correspondent of the *Western Mail*, or Mr. Arthur Mee in his luminous appreciation in the *Nationalist* of May, 1909, or even the myriad-minded Mr. Lloyd George himself, has done far less than full justice to the achievements of Robert Recorde. Nor has any of them duly underscored the fact that he was a member of our medical profession (M.D. Cantab.), in an age, too, in which the pioneers of the "advancement of science" were mostly disciples of Æsculapius. Accordingly, inquiring readers may well be reminded that Robert Recorde scored a unique series of "firsts" in the very generation in which England tore off the swaddling-clothes of "authority" and stepped boldly forward to grasp the banner of intellectual empire (1510–58), and which exactly preceded that of Francis Bacon, the so-called "Father of Modern Philosophy," of which he knew so much less than little, but regarding the probable value of which he preached with something resembling prophetic inspiration.

Let the reader who would estimate the value of popular reputation now remember that not only was, as we have just been reminded, the great Cambrian man of science the first to "use the sign = to denote equality," and the first who wrote in English on arithmetic and geometry respectively, and to treat the doctrine of "the sphere" in the same language; he was also the discoverer of the method of extracting the square root of multinomial algebraic expressions; his "Whetstone of Witte" was the first English book to use the signs + and −; and he was "the first Briton (in all probability) who adopted the system of Copernicus"—a system which (*horribile dictu*) Francis Bacon remained, in the following generation, permanently unable to comprehend, just as he could neither understand nor accept the *circulation of the blood*, although he had been "puddering in physicke all his life," and his medical adviser was William Harvey himself! His "Urinall of Physicke" survives as one of the valuable rarities of medical literature, and contains many observations which could be utilised to save the latter-day bacteriological pathologist much trouble—and invention! And not only was he a pioneer in mathematics, physics, and medicine, he also was, as we learn from the "Dictionary of National Biography," "deeply skilled in rhetoric, philosophy, polite literature, history, cosmogony, astronomy, astrology, physic, music, mineralogy, and every branch of natural history." No wonder that he found no time to thimblerig for a knighthood (but this was long before the degrading Baboo-Yahoo and Blunderboar-Bulephant creations), or that he died in gaol—not for manslaughter, but for debt. JOHN KNOTT.

Royal College of Surgeons, Dublin,
November 10.

Luminous Centipedes.

WITH reference to the paragraph in NATURE of November 23 (p. 233) on luminous centipedes in France, it may be of interest if I mention that these were very frequent in the neighbourhood of Albert and Fricourt in the autumn and winter months a year ago. They appeared to be *Geophilus electricus*, which I had often seen glowing, particularly on mild, damp evenings in late autumn, in Surrey lanes, and sometimes on garden paths in London suburbs.

As the troops marched across the damp grassland to and from the trenches by night, the spots of phosphorescence on the ground at their feet were taken for glowing match-ends, though one might occasionally hear a man from the country refer to them as "glow-worms." I have more than once known an officer get seriously perturbed when troops were marching across a danger zone and the glowing points on the ground seemed evidence that the men were disobeying the "no smoking" order which had been passed along the column!

Luminous centipedes were also to be found in the trenches themselves. (Sergt.) F. M. ROBERTS.

Sutherlands Auxiliary Hospital, Reading, November 27.

Searchlights.

SEARCHLIGHTS are now so common that it may be of interest to record that, as might have been expected, the beam shows the presence of polarisation, if it is viewed through a Nicol prism, the line of sight through the prism being perpendicular to the direction of the beam. On rotating the prism, the part of the beam viewed changes its intensity in such a way as to show that the light reflected from it is polarised in a plane passing through the length of the beam and the eye of the observer. The best results occur, of course, when the haze reflecting the beam is thin in character, its particles being small. In such cases the light nearly disappears for a suitable azimuth of the Nicol. C. T. WHITMELL.

Invermay, Hyde Park, Leeds, December 1.

Columnar Ice-Crystals.

AFTER the recent frost a thin layer of gravel became separated from the rest on the paths here (in the park), and on examination was found to be supported by columnar ice-crystals resembling basalt or sal-ammoniac in formation.

The columns were vertical and parallel, closely packed together and of uniform length (about one centimetre).

I should be glad if some reader would kindly explain this (to me) remarkable uniformity.

A. E. LARKMAN.

County School, Merthyr.

AGRICULTURE AND THE WHEAT SUPPLY.

THE present high price of food has directed attention to the urgent need for increasing the production of wheat in this country so that we may be less dependent than at present on foreign supplies. Prior to the outbreak of war the official statistics showed that we were producing only about one-fifth of the wheat we consumed. As the war came in August our home-grown supply was at its maximum, and the Board of Agriculture was able to issue a reassuring report as to the quantities in hand. But the shortage of available shipping has so affected the amounts of imported wheat that the demand has exceeded the supply, and in consequence prices have risen.

The production of wheat on a large scale in this country is by no means a simple matter. There are, broadly speaking, three factors, soil and climate, economic conditions, and labour, each of which has to be considered separately.

The most fundamental way of increasing the amount of wheat is to increase the yield per acre, and this can be done by either (*a*) improving the soil conditions, or (*b*) introducing new varieties capable of better growth than those already in use.

The improvement of soil conditions is brought about by increasing the supply of plant nutrients, *i.e.* artificial fertilisers, by cultivation, and in other ways. Before the war the world's consumption of artificial fertilisers was increasing more rapidly than the supply, so that prices were going up; this was particularly true of nitrogenous fertilisers. During the war farmers have had a demonstration of the value of artificial fertilisers, which will probably lead to a larger consumption after the war. The whole trend of the activities of the educational and advisory staffs of the agricultural colleges and other institutions is in this direction. The newer agriculture in other countries also calls for more fertilisers: Japan, Australia, India, Africa, and Java are all importers of artificial fertilisers from Europe. It seems reasonable to anticipate, therefore, a considerable increase in the consumption of these fertilisers provided the supply is forthcoming, and one of the most important and most hopeful problems for the future is to ensure these supplies.

Better cultivation of the land requires better implements, but, above all, a better understanding of what cultivation does to the soil. Research in this direction is in hand at Rothamsted and elsewhere, but considerably more work is wanted on the study of implements and better opportunities for testing them.

The production of new varieties is another method by which yields may be increased. Soil and climatic conditions are capable of only a certain degree of modification, and it is clearly an advantage when the plant-breeder can meet the soil-improver half-way and produce a new plant better adapted than the old ones to the conditions actually obtaining. The work of the newer school of botanists seems full of promise in this direction; Prof. Biffen at Cambridge has already done a good deal, and the move of the Botanical Section of the British Association in appointing a special committee to consider this matter is a welcome sign of their intention to attack an important and highly interesting problem.

Another method for increasing the amount of home-grown wheat is to increase the area devoted to wheat either by taking in more land or by displacing some other crop already grown. Increasing the area of land is a favourite suggestion, but one fraught with numerous difficulties. The non-technical tourist walking over Dartmoor or

Bagshot Heath is very apt to ask why this land is not reclaimed and made to grow crops. The question is not a new one. Whenever war has come prices have gone up, and in the old days, when there was less regard than now for public rights, people did not hesitate to enclose any land they thought suitable. The result is that our present waste lands have already been picked over several times, and therefore only the least desirable are left. Some of the land reclaimed in older periods of high prices has gone out of cultivation and could be brought back, but not all of the wastes are suitable, even if the very troublesome questions of public and other rights could be solved. A survey is badly needed of the wastes of the country; there are no statistics giving the information needed, and the loose talk about millions of acres of reclaimable land does not forward matters.

A more promising direction is to displace other and less valuable crops by wheat. Of these the most suitable is grass. Mr. Middleton recently showed that the German farmer feeds 70 to 75 people per 100 acres, while the English farmer feeds 40 to 45 only. It is not that the German gets so much more per acre, but that he has two-thirds of his land in arable and only one-third in grass; while in England only one-third is arable and two-thirds is grass. Now grassland only produces about one-half as much food as arable. Many suggestions have been made for breaking up grassland. From the theoretical point of view this course is eminently sound. Unfortunately, there are grave economic objections. Grassland involves so little risk that it serves as a useful counterpoise to the larger risks of arable farming. It is of no use disguising the fact that farmers are not breaking up their grassland, and they meet every appeal with the statement that they cannot afford to do so. Various ways of meeting their difficulty have been suggested, but as they are mainly political they need not be discussed here.

This leads up to the economic factor. The farmer grows wheat for profit and not for pleasure, and when he is presented with a scheme for increasing his yield his first question is, "Will it pay?" There is a limit set by soil, climate, and the plant itself, beyond which growth will not go. Our average wheat crop is 32 bushels; a good farmer will look for 40, in specially good seasons he may get 50, but 60 bushels would represent a crop he had heard about but probably never seen. There being this limit to the amount producible, the main economic factor becomes the selling price. This is complicated by the circumstance that wheat takes many months to produce, so that a rise in price does not induce a corresponding increase in the supply unless there is good reason to suppose that the increase will recur when the new crop is ready. Thus wheat is now 78*s*. per quarter, but this circumstance is not so powerful an incentive to an increase in area as it looks, because the wheat sown now will not be ready for sale until October or November, 1917, by which time the price may be down to 30*s*., or even less. On the other hand, a run of low prices is a powerful deterrent for a long time. For years after the low prices of the early 'nineties farmers were very shy of growing wheat, and even up to the time of the war they were always afraid that low prices might come back.

Lord Milner's Committee proposed to overcome this difficulty by guaranteeing a minimum price to farmers, and thus using a supply even though in particular years the arrangement might involve a charge on the national finances. It is argued that in this case the community would be better off than it is on present lines, where prices sometimes fall very low and sometimes rise considerably higher. Of course, such a guarantee on the part of the community would involve a corresponding obligation on the part of the farmer, and the precise adjustment of these obligations affords scope for considerable political ingenuity.

The labour question is partly, but not entirely, bound up with the question of cost. The gross return per acre obviously fixes the amount of money the farmer can afford to spend on the crop, and of this only a portion can be allotted to labour. So long as the work is done, it is immaterial to the consumer whether labour's share goes to few or to many. From the labourer's point of view, however, this is very important; and as he does not like low wages, and as, further, he can often get much higher pay on the railway or other work, no small difficulty has arisen on farms where the efficiency of the labourer is low, and where, therefore, a good many labour-hours are required to produce an acre of crop.

This difficulty can be met by increasing the labourer's efficiency and so reducing the number of labour-hours. Machinery can be made to help in two ways: by doing a given piece of work with fewer men and by doing it in less time. In either case the labourer gains more money, unless the machine swallows up the whole. It is certain that considerable possibilities are opened up here. To take a single instance: On an ordinary farm the ploughing of an acre of land takes one man and two horses a whole day, or on some soils it needs a man, a boy, and three horses. In the writer's district the usual rate of pay for such work is about 3*s*. for the man, and normal prices and yields would not justify much more. But with a motor-plough one man can plough three or four acres per day. The cost of the implement is more than that of a plough and two horses, so that more has to be allowed for interest and depreciation. But there is still a sufficient balance left to justify the payment of a higher wage to the man, and therefore to induce him to remain on the land.

It is impossible to foretell the extent of the revolution caused by the internal-combustion engine. It has given us motor-cars and aeroplanes, and thus revolutionised travel by land and by air, and now it is being applied on the farm. For the moment it is being treated as if it were a strange kind of horse, and simply hitched on to the old horse implements. But it is conceivable

that some new kind of implement altogether is needed in order to get the best out of this engine. Experiments are sadly needed on this problem. None of the agricultural experiment stations are taking the matter up at present because of the cost and other difficulties, but it needs to be done.

None of these difficulties are insuperable; the various research institutions which now exist in this country can attack the technical problems with considerable hope of success. The economic problems, however, require different treatment; above all they require to be approached from the point of view of the business man rather than from that of the party politician.

The first thing needed is to decide the importance of home-grown food: whether it is vitally important to the community or simply highly desirable. If it is only desirable, things can be left as they are, because agencies are already at work that will take the farmer so far as he feels disposed to go with present high costs of production and the risk of a slump in prices in 1917. If, on the other hand, a large supply of home-grown food is vitally important, then our present methods must be modified so as to aim at maximum-crop production regardless of possible low prices in 1917. At present the farmer is invited to bear the whole of this risk, and with the best will in the world many feel that he cannot do so; it is lack not of patriotism, but of capital that bars the way. The remedy might, and possibly would, involve making agriculture a controlled industry, but, at any rate, it would enable big unified schemes of crop production to be put into operation.

E. J. RUSSELL.

THE JEWELRY TRADE IN WAR-TIME.

THE jewelry trade is very largely one of luxury, and consequently serves as an extremely sensitive indicator of the kind of weather the barque of State has encountered. In the bright days of prosperity people are apt to buy jewels: in the dark days of adversity they are no less apt to sell or pawn them. It is not surprising that at the outbreak of war even the most optimistic of jewellers were filled with the gloomiest forebodings as to the fate the future held in store for their business unless hostilities were soon brought to a satisfactory close. The war has, however, lasted far longer than was anticipated at the beginning by all save a few with exceptional depth of knowledge, and it is possible now to ascertain how far those forebodings were fulfilled.

The question, "What is the state of the jewelry trade in days of war?" may, as regards the United States and, to some extent, Great Britain, be answered from the report on the "Production of Precious Stones for the year 1915," which, as in former years, has been contributed to *Mineral Industry*[1] by the well-known gem-expert, Dr. G. F. Kunz. The answer agrees with what is within common knowledge. The exceptional prosperity which the war has brought to areas engaged in the manufacture of munitions is reflected in the trade in precious stones done there. Thus, we read that in May, 1916—Dr. Kunz does not adhere rigidly to the year with which he is supposed to deal—upwards of five million dollars' worth of precious stones were imported into the United States—nearly three times the amount in the corresponding month of the previous year; in fact, all records were broken, even for the "boom" period of 1906.

Again, as regards our own country, it is stated:—

> It is worth noting as one of the curious effects of the war in London trade that the present demand for cheap diamond rings, such as are sold by East End jewellers, is phenomenally large. This is due to the exceptionally high wages earned by many British workers in the special industries, and also to their inclination toward free spending of their money. On the other hand, the demand for the larger diamonds has fallen off in England, since the wealthy classes have suffered a very considerable decline of income, due to industrial derangement and, above all, to heavy taxation. In Birmingham also the trade in low-priced diamond rings is exceedingly brisk.

Whether the picture thus outlined is strictly true for Great Britain as a whole we question. We believe that there is a great shortage of labour, not only owing to the requirements of the Army, but because so many of the skilled workers have been drafted into factories, their training having been found to fit them for many of the delicate operations in the manufacture of munitions. Nevertheless, the jewellers will perhaps go so far as to admit that things are very much better at this stage of the war than might have been anticipated beforehand.

Since diamonds are of such great importance for working the hard steels largely used in munitions, stringent precautions are taken by Great Britain to prevent stones, either cut or rough, from falling into hostile hands. Dr. Kunz prints the guarantees, to the effect that the diamonds will not be exported, directly or indirectly, to any country at war with Great Britain, which before the release of the package in question have to be signed before the British Consul-General by importers into the United States.

The report consists of two parts, each of about the same length, the first dealing with general points, and the second with particular species of precious stones. We notice in the former many interesting or curious points in addition to those already referred to. Thus, we are told that before the war much attention was being given in Paris, Vienna, and Berlin to colour-harmony in the wearing of jewels; apparently not in London—are we therefore to infer that a lower degree of taste prevails there? The lozenge-shape of cutting so popular for emeralds has been applied to diamonds with good results. The famous gem-district at Pala, San Diego County, California, has yielded magnificent crystals of rubellite weighing as much as 2 to 4 lb. each. Dr. Kunz boasts that the United States to-day possesses greater collections of precious stones than any other nation, and

[1] Vol. xxiv., pp. 591–613, 1916. (New York: McGraw-Hill Book Company, Inc.; London: Hill Publishing Co., Ltd.)

instances the collections in the American Museum of Natural History at New York, the Field Museum at Chicago, the National Museum at Washington, the New York State Museum at Albany, the Golden Gate Museum at San Francisco, and the Public Museum at Oakland. It is certainly an extensive list, but possibly the collections in London and Edinburgh will, for real scientific interest, bear comparison with any of them.

As an indication of trade conditions it is mentioned that the demand for diamonds has increased so much that by February of this year the Diamond Syndicate had advanced the price for rough stones about 40 per cent., and of cut stones between a carat and 5 carats in weight about 21 per cent. Small stones under a carat in size were scarcely affected, no doubt in order to meet the competition of the stones, which are nearly always small, from the fields in what was German South-West Africa. It is stated that many diamond-cutting establishments have been opened in London by Belgian refugees.

The omission of ruby from the species of precious stones considered is significant; we believe its fortunes as a gem have been severely affected by the comparative success of the synthetic stone. Sapphires, on the other hand, have prospered, and prices have risen. The trade in the Queensland stones appears to have been brought to a standstill by the war, because all the stones were cut in Germany. Hitherto comparatively little in detail has been known of the famous emerald mines in Colombia; it is interesting, therefore, to learn that a careful survey of the district has recently been published by Dr. J. E. Pogue.[2]

STATE AID FOR SCIENTIFIC RESEARCH.

AT the Institution of Civil Engineers on Friday last, December 1, the Marquess of Crewe, Chairman of the Committee of the Privy Council for Scientific and Industrial Research, with members of the Committee and of the Advisory Council to the Committee, received a deputation from the Board of Scientific Societies. Sir J. J. Thomson, president of the Royal Society, in introducing the deputation, referred to the functions of the board, which had been formed to promote co-operation between those interested respectively in pure and applied science. The deputation wished to urge the necessity for further grants in aid of research, both in pure science and in its applications to industry. It was often difficult to foresee, at the time a research in pure science was carried on, what its ultimate applications might be. The Röntgen rays, discovered incidentally in a purely physical investigation, but now of inestimable value in connection with surgery, furnished an instance. Therefore men who devoted themselves to such researches, with little prospect of immediate personal benefit, should receive from the State sufficient assistance to enable them to do their work in comfort. The neglect of pure science might be compared with the ploughing and manuring of a piece of land, followed by an omission to sow any seed.

Sir M. FitzMaurice, president of the Institution of Civil Engineers, supported Sir J. J. Thomson, and expressed the hope that research would be conducted in a more systematic manner in the future than it had been in the past.

Prof. H. B. Baker referred to the importance of chemical research in industry. It would be found that chemical processes formed the basis of many of the most important national industries.

Lord Crewe, replying as Chairman of the Committee of the Privy Council for Scientific and Industrial Research, said that increasing attention had been lately devoted to the industrial aspects of research. It had now become evident that the work of the Advisory Council could no longer be regarded as an annexe to the Board of Education. The Government had therefore decided to form a new department, presided over by the Committee of Council. The Government also recognised the need for further financial assistance for this work, and desired to encourage the application of research to the leading industries of the country on a large scale. It was clear that wealthy industries, which might naturally expect to derive direct profit from researches in their province, should be willing to defray part of the expenditure involved, and the Council was endeavouring to bring about a scheme of co-operation with the chief industries for developing researches of this nature. What they desired to see was the formation of trade associations which would survey the conditions in their respective industries and decide upon and initiate desirable researches. Such associations should work under carefully selected committees of direction, including some leaders in the industry concerned, men of science, and also representatives of the skilled workers in the different trades.

In addition to industrial research of this kind, of direct and immediate value to industry, there would also be other broader researches of great national value, but not offering immediate prospects of profits to individuals, which would form fit subjects for Government support. In view of the varied conditions under which co-operation in these different classes of researches would be carried on, it was difficult to assess the amount of money required in any particular year, and in the circumstances it was impracticable to proceed by annual estimate. The Chancellor of the Exchequer was therefore prepared to advise the Government to devote a large sum to cover operations during the next five years, on a scale which would enable them to spend four, and perhaps five, times as much on such co-operative industrial research as had been spent for the whole purposes of research by Vote hitherto.

The Chancellor of the Exchequer had also decided that, in order to encourage firms to make generous contributions, money devoted to research, on specified terms, will be regarded as "working expenses," and will thus be free from

[2] "The Emerald Deposits of Muzo, Colombia." Bull. Amer. Inst. Min. Eng., May, 1916.

income tax and excess profits tax. Money so allotted by traders must be devoted to a research or to an association for research under partial State control.

Speaking next on the subject of technical education, Lord Crewe said there had been conferences with local authorities with the view of bringing the conditions under which public money was granted to educational institutions more up to date. The new regulations would simplify administration and stiffen instruction. Special increases would be made in the Estimates of the Board of Education to assist local authorities, and improved arrangements would be made for the training of teachers and for scholarships for selected industrial students.

There would also be (in addition to the block sum to cover five years' expenditure mentioned above) an annual Vote in the Estimates for various purposes, and a sum would be set aside to meet cases in which assistance was required by the individual worker, or by professional societies which stood in need of funds to carry on research work.

Sir J. J. Thomson, on behalf of the deputation, thanked Lord Crewe for his address.

The following official statement has been issued as to the constitution of the new department:—

The Government have decided to establish a separate Department of Scientific and Industrial Research for Great Britain and Ireland under the Lord President of the Council, with the President of the Board of Education as vice-president. They have also decided, subject to the consent of Parliament, to place a large sum of money at the disposal of the new department to be used as a fund for the conduct of research for the benefit of the national industries on a co-operative basis.

The Board of Inland Revenue have decided, with the approval of the Chancellor of the Exchequer, that no objection shall be offered by their surveyors of taxes to the allowance, as a working expense for income-tax purposes, of contributions by traders to industrial associations which may be formed for the sole purpose of scientific research for the benefit of the various trades; and the allowance would be equally applicable as regards traders' contributions specifically earmarked to the sole purpose of the research section of an adapted existing association.

In both cases the allowance would be subject to certain conditions, *e.g.* the association or the research section to be under Government supervision and the trader's contribution to be an out-and-out payment, made from his trade profits and giving him no proprietary interest in the property of the association, etc.

In order to enable the department to hold the new fund and any other money or property for research purposes, a Royal Charter has been granted to the official members of the Committee of the Privy Council for Scientific and Industrial Research under the title of the "Imperial Trust for the Encouragement of Scientific and Industrial Research." The trust is empowered "to accept, hold, and dispose of money or other personal property in furtherance of the objects for which it has been established, including sums voted by Parliament to that end." The trust can take and hold land, and can "accept any trusts, whether subject to special conditions or not, in furtherance of the said objects."

A substantial gift has already been made to the trust by two members of the Institution of Mechanical Engineers for the conduct of a research in mechanical engineering to be approved by the department in the hope that this example will be followed by other members of the institution.

Mr. H. Frank Heath, C.B., has been appointed permanent secretary of the new department, to whom all correspondence should be addressed until December 31 next at the offices of the Board of Education, Whitehall. On and after January 1, 1917, all correspondence should be addressed to the Secretary, Department of Scientific and Industrial Research, Great George Street, Westminster, S.W.

NOTES.

PROFS. PAUL PAINLEVÉ, of Paris, and Vito Volterra, of Rome, have been elected honorary members of the Royal Institution.

THE sum of 1000*l.* has been left to the Paris Academy of Medicine by Dr. Magnan, a former president of the academy, for the foundation of a triennial prize for the best work on a subject relating to psychiatry.

A COMPETITIVE exhibition of artificial limbs is to be held in Bologna in February next, and the Rizzoli Orthopædic Institute of Bologna, under the auspices of which the exhibition is to take place, offers a prize of 200*l.* in connection with it.

A NEW medical periodical entitled *Archives médicales belges* is to be published at the beginning of next year. It will contain reports of the medical work done by exiled Belgians, and be issued by the medical department of the Belgian War Ministry.

MR. F. W. LANCHESTER, the new president of the Junior Institution of Engineers, will deliver his inaugural address to the institution on Monday, December 11, on "Industrial Engineering: Present Position and Post-War Outlook."

A COMMITTEE has been appointed to promote a memorial at the Middlesex Hospital to Mr. F. Clare Melhardo, late secretary-superintendent of the hospital. The memorial is to take the form of the raising of a fund for the permanent endowment of the Bland-Sutton Institute of Pathology.

ADMIRAL SIR HENRY JACKSON, K.C.B., F.R.S., First Sea Lord of the Admiralty, has been appointed to the vacant post of President of the Royal Naval College, Greenwich, and has been succeeded as First Sea Lord by Admiral Sir John Jellicoe, K.C.B.

WE regret to announce the death, on November 30, at a nursing home in London, of Prof. J. Wrightson, president of the College of Agriculture, Downton (1880–1906), honorary professor of agriculture at the Royal Agricultural College, Cirencester, and professor of agriculture and agricultural chemistry in the Royal College of Science, South Kensington, from 1882 to 1898.

DR. ERIC MJÖBERG, assistant in the Entomological Department of the Swedish State Museum, has received leave of absence for three years in order to prepare and conduct an expedition to the interior of New Guinea. His intention is to penetrate into the country by aeroplane, taking as his starting point one of the small islands in Geelwink Bay, at the north-west end of the country. Dr. Mjöberg recently left for America to carry out a lecture tour by which he hopes to raise large sums to cover some of the heavy expenses of his expedition.

THE annual meeting of the Hakluyt Society was held last year on November 23 at the house of the Royal Geographical Society. This year marks the tercentenary of Hakluyt's death, and the president of the society, Mr. Albert Gray, in the course of a commemorative address, remarked that investigations are being made for the purpose of discovering Hakluyt's birthplace. Nothing seems to be known of his father or mother, but there is a monument to his wife in Ludlow Church. The society hopes to find the original manuscript of a treatise by Hakluyt that was printed in America from a copy.

THE Walter and Eliza Hall Institute of Research in Pathology and Medicine has been established in Melbourne in connection with the Melbourne Hospital, through the generosity of the trustees of the Walter and Eliza Hall Fund. The institute is controlled by a board representing the trustees, the University of Melbourne, and the Melbourne Hospital. A spacious building, including a basement and three stories, has been erected at a cost of more than 10,000*l.* in immediate connection with the pathological department of the hospital. The hospital itself has recently been entirely rebuilt, and now contains 325 beds. Applications for the office of director of the institute are being invited through the Agent-General for Victoria, from whom full information may be obtained.

DR. EUGÈNE L. DOYEN, the well-known Parisian surgeon, died on November 21, aged fifty-seven. He was the author of a number of surgical treatises, the better known being "Traitement Chirurgical des Affections de l'Estomac et du Duodenum" (1895), "Technique Chirurgicale" (1897), and "Atlas de Microbiologie" (with M. G. Roussel, 1897). His best-known work, however, is "Etiologie et Traitement du Cancer" (1904). In 1901 he discovered a micro-organism in cancerous growths which he regarded as the cause of such formations, and named it *Micrococcus neoformans*. He introduced serum treatment for cancer, and claimed he had discovered both the cause and cure of this terrible disease—a claim which other medical men, with the best will in the world, have never been able to confirm. At an early date (1898) he utilised the kinematograph as a means of demonstrating his technique and his personality to medical students. He was an enthusiastic worker, but never succeeded in gaining scientific support for his many claims and theories.

CAPT. H. FAIRLEY MARRIS describes a new test for typhoid and paratyphoid fevers, based upon the effect of atropine on the rate of the heart-beat. In a well person, or in one suffering from a number of diseases other than those named, atropine causes an increase of the pulse-rate by about twenty beats or more per minute. Should the pulse-rate increase only ten beats or less, infection by one of these diseases is suggested; if the increase is more than ten and less than twenty beats per minute the interpretation is uncertain. The method of applying the test is as follows. At least one hour after a meal should elapse. The patient should be horizontal and remain perfectly quiet. The pulse-rate is then taken and recorded minute by minute for about ten minutes. Then 1/32 grain of atropine sulphate is injected hypodermically, and after an interval of twenty-five minutes the pulse-rate is again taken minute by minute until it is obvious that any rise which may have followed the injection of atropine has occurred and that the pulse-rate is falling again to the lower level—fifteen to twenty minutes may be necessary (*British Medical Journal*, November 25, p. 717).

THE ninety-first illustrated Christmas course of juvenile lectures, founded at the Royal Institution in 1826 by Michael Faraday, will be delivered this year by Prof. Arthur Keith, his title being "The Human Machine which All Must Work." The following are among the lecture arrangements before Easter:—Prof. C. S. Sherrington, six lectures on the old brain and the new brain and their meaning, and pain and its nervous basis; Prof. W. E. Dalby, two lectures on the structure of metals; Prof. J. W. Gregory, three lectures on geological war problems; Prof. F. G. Donnan, three lectures on the mechanism of chemical change; two lectures by Prof. E. S. Prior; Prof. A. Dendy, two lectures on sponges: a study in evolutionary biology; Prof. J. A. Fleming, two lectures on modern improvements in telegraphy and telephony; Mr. A. R. Hinks, two lectures on the lakes and mountains of Central Africa; Mr. Daniel Jones, two lectures on the science of speech; Dr. C. W. Saleeby, two lectures on Imperial eugenics; Mr. Stephen Graham, two lectures on Russian idealism. The Friday evening meetings will commence on January 19, when Sir James Dewar will deliver a discourse on soap-bubbles of long duration.

SIR RALPH PAYNE-GALLWEY, who died on November 24, at sixty-eight years of age, was a very famous wildfowler, and it was on his knowledge of the habits and haunts of wildfowl, gained during many winters spent in their pursuit, that his claim to the title of an ornithologist chiefly rests. In his knowledge of the habits of these birds as observed by a fowler (who has the best possible chances of observation) he was perhaps unrivalled. The various kinds of fowl have many little peculiarities, all of which have to be humoured, so to say, if the fowler is to get within striking distance of them. Hence the necessity of a knowledge of the general appearance in the distance, distinguishing calls, and different flight of fowl, and the endless other characteristics of which no one but those who in winter have hied them to the coast with its myriads of wild, wary birds can have any idea. Sir Ralph's most important book, "The Wildfowler in Ireland," is full of out-of-the-way information of the kind to delight the naturalist, and as it was begun at sea with a heavy gale blowing there is a certain freshness about it. "The Book of Duck Decoys," an exhaustive work, and the only one on the subject, also contains a good deal about the natural history of ducks and the ways of the birds. For in this kind of fowling the birds are led rather than pursued. His other best-known work is the "Letters to Young Shooters," the third series of which contains a useful description of all the wildfowl met with in the British Islands. Sir Ralph earned the gratitude of those interested in the former state of our avifauna by having the ancient sign of the "Dotterel Inn" (which stands on the Yorkshire wolds) restored, after it had been sadly ill-used by a local artist who had repaired it.

WE regret to announce the death of M. Emile F. Maupas, librarian of the National Library in Algiers, in his seventy-fourth year. M. Maupas devoted his spare time to zoological researches, the results of which appeared in eighteen papers issued between the years 1876 and 1901. His memoirs on the multiplication and conjugation of ciliate protozoa (1883, 1888, 1889) made his name well known to all students of zoology. By careful and laborious experiments he determined the rates of fission of about twenty species of ciliates under varying conditions of food and temperature. He found that in his cultures—each of which was begun with a single ciliate—there occurred, after a certain number of fissions had taken place, a gradual reduction of the ciliary apparatus and a de-

generation of the nuclei, which he regarded as indications of senescence, leading to cessation of fission and death. If, however, before such degeneration took place in any given culture, individuals of the same species, but of different origin, were introduced, conjugation took place. M. Maupas traced the nuclear interchange and the complete reorganisation of the nuclear apparatus, and concluded that this syngamic process determined rejuvenescence. Largely on account of his work, conjugation has been regarded as the sole panacea for protoplasmic old age and death. M. Maupas published, in 1890–91, brief accounts of his investigations on reproduction and sex-determination in rotifers, and in 1900–01 detailed researches on the moulting, encystment, and reproduction of nematode worms, in which, in addition to the descriptive matter, there are discussions on points of great general interest, *e.g.* that the dicœcious, and not the hermaphrodite, is the primitive condition, and that sex is determined in the egg very soon after fertilisation, if not earlier. For these papers on nematodes M. Maupas was awarded a prize by the Paris Academy of Sciences in 1901.

DR. E. W. SCRIPTURE recently read to the Pathological Section of the Royal Society of Medicine a communication on registration of speech sounds in the diagnosis of nervous diseases, in which he described a method of recording speech sounds in the early stages of certain diseases of the central nervous system, such as sclerosis, and he claims that the tracings so obtained are almost an infallible mode of diagnosis. The method has been carried out in various institutions in London. It is evident that very slight modifications of the articulating mechanism may thus be detected, and it is remarkable that such modifications are characteristic of different diseases; thus an additional method has been placed at the disposal of clinical physicians, and this has come from the region of experimental phonetics.

PROFS. SALA and Verga deal with the diagnosis of the peripheral nerve-lesions in 150 cases of gun-shot wounds in a paper just received ("Le lesioni dei nervi periferici per ferite d'arma da fuoco," *Memorie del R. Istituto Lombardo di Scienze e Lettere*, vol. xxi.—xii. della serie iii., fasc. x.; Milano: U. Hoepli). The authors lay stress upon the practicability of ascertaining, by study of the disturbances of skin and bone sensation, and by the electrical reactions of the muscle and nerves, the precise seat of the nerve-lesion, and to some extent whether it involves rupture of structural continuity of the nerve or strangulation of it by cicatricial fibrous tissue. The large part played in the causation of paresis, whether of motion or sensation, by cicatricial bands constricting otherwise uninjured nerve-trunks in such cases is dealt with at length and fully illustrated. The utility of testing at the time of the operation the exposed nerve-trunk with faradism applied by platinum-pointed electrodes, as in the physiological laboratory, is dwelt upon, and shown to be productive of no harm to the nerve-trunks. The operative procedures for freeing nerve-trunks from fibrous bands compressing them, and for repairing disrupted nerve-trunks, are discussed. A full report of the success of the treatment adopted is promised for a later paper.

IN the November issue of *Man* Mr. H. D. Skinner traces an interesting link of connection between the Melanesian and New Zealand cultures in a description of three characteristic Maori weapons, known as the Hani, Tewha-tewha, and the Pou-whenua—all forms of a wooden club. In one form the carving at the lower end has been boldly designed and finely executed with stone tools. The point represents a human tongue ornamented with scrolls; above it are the teeth and upper lip, above which again may be discerned a diminutive nose, eyes obliquely set and inlaid with circlets of shell, and a beetling brow with conventional forelock. With these forms the writer compares a paddle club from the Solomon Islands, from which, compared with the ordinary paddle of the same group, the difference is slight, and every intermediate gradation of shape might be figured. From these facts he arrives at the conclusion that we are justified in claiming a Melanesian ancestry for the two-edged clubs of Rarotonga and New Zealand. The question arises: Did the three Maori forms differentiate themselves in New Zealand, or must their point of origin be placed oversea? From a consideration of the facts the writer reaches the conclusion that the differentiation of the Tewha-tewha form had already begun in Melanesia.

THE activities of the United States Board of Agriculture cover a wide field, and, happily, their behests are promptly attended to. Originally the preservation of wild birds was undertaken purely from the point of view of economic zoology. During recent years, however, the Board has taken over the charge of numerous and extensive reservations for the protection of birds to save them from the ravages of the plume-hunter and the egg-collector, and they have done magnificent work in this direction. How great are the difficulties of the Board, and how wide its powers, may be gathered from the statement in the *American Museum Journal* for October to the effect that news reached the officials that a Japanese poaching vessel had been seen in the neighbourhood of the Hawaiian Islands, where a reservation has been established. At once the Revenue-cutter *Thetis* was ordered to cruise to the bird islands. In due time the vessel returned, bringing twenty-three Japanese feather-hunters, captured in their work of destruction. In the hold of the vessel were stored 259,000 pairs of wings, 2½ tons of baled feathers, and several large cases of skins, for which the Japanese, had they escaped with their booty, would have realised more than a hundred thousand dollars. In Florida, we are glad to learn, the white egrets are slowly recovering from the ruthless slaughter to which they have been subjected, though the warden charged with their protection goes in daily peril of his life from desperate and lawless agents of the plume-trade.

THE course of lectures on "The Origin and Evolution of Life upon the Earth," delivered by Prof. H. F. Osborn before the Washington Academy of Sciences earlier in the year, is now being made available to a far wider public through the medium of the *Scientific Monthly*. The October number contains the first lecture of part iv. Herein the contrasts between plant and animal evolution and the origin of animals are discussed. The process of the differentiation of the invertebrate types of to-day, it is urged, "began in pre-Cambrian times, and among aquatic types, of which we have as yet very imperfect knowledge. The evolution of the terrestrial forms began with the Devonian, when the increasing verdure of the land invited the invasion of life from the waters, the first conquest of the terrestrial environment being attained by the scorpions, shellfish, worms, and insects. This is an instance of the constant dispersion of new animal forms into new environments for their food supply, the chief instinctive cause of all migration. This impulse is constantly acting and reacting throughout geologic time with the migration of the environment." This is an interpretation to which some at any rate will demur. Rather migration seems, in the first place, to come about as a result of over-

population, when, to avoid competition, the individuals at the periphery of the range of the particular species in distress are compelled to extend farther afield. But be this as it may, these lectures provide most stimulating food for thought, and in their present form they have the further advantage of being most profusely illustrated.

THE failure of the North American wheat crop this year is causing some anxiety in the West Indies, as the islands rely entirely on this source of supply. It seems doubtful if the usual quantities of flour will be available, and the question of possible substitutes is receiving official attention. The *Agricultural News* (Barbados) of October 21 suggests that the cultivation of maize, Guinea corn, cassava, and sweet potatoes should be extended. All these foodstuffs are already grown in the islands, but, in contrast with the imported cereals, none of them will keep without special precautions; the sweet potato, the principal vegetable of the people, is particularly perishable. As regards corn, the difficulty can be overcome by drying, and the Governments of Antigua and St. Vincent have established kiln driers working on a co-operative basis. If the shortage of wheat flour should become serious, the rice crop of British Guiana will have to be drawn on to a greater extent than it is already, and the cultivation of this cereal, which is at present a large industry in Trinidad, may be further developed.

IN view of the shortage of potash by reason of the cutting off of the supply from German sources, two papers recently issued by the United States Geological Survey are now of especial interest. The first, "Evaporation of Brine from Searles Lake, California" (Professional Paper 98-A), records experiments by Mr. W. B. Hicks designed to discover an economical method of extracting the potash from the brine of Searles Lake. The latter is a bed of crystalline salts, containing in its interstices a brine which carries about 2·1 per cent. of potassium, probably in the form of chloride, sulphate, carbonate, and borate. The brine was fractionally evaporated and crystallised, the deposits formed during evaporation being kept separate from those resulting on cooling. As a result of a series of seven such evaporations and crystallisations, the author shows that only 8 per cent. of the potassium in the brine is separated, during either the evaporation or the subsequent cooling, when this is concentrated to one-half of its original volume. When the brine thus concentrated is further evaporated to about one-fifteenth of its original volume and cooled, more than 70 per cent. of the total potassium present is deposited, whilst 12–13 per cent. is left in solution. The second paper, entitled "Experiments on the Extraction of Potash from Wyomingite" (Professional Paper 98-D), is by Mr. Roger C. Wells. Wyomingite is a lava composed largely of the mineral leucite, which is a silicate of alumina and potash. The substance was subjected to levigation with water after crushing, was extracted with water in the presence of gypsum, was heated alone and with gypsum, sulphuric acid, potassium, hydrogen sulphate, alunite, calcium carbonate, calcium and magnesium chlorides, ammonium sulphate, and a bittern respectively. The results indicate that the most promising method would be to heat the wyomingite with 50 per cent. of its weight of alunite (a naturally occurring sulphate of alumina and potash found in the same neighbourhood as wyomingite), whereby 70 per cent. of the total potash (55 per cent. of that in the wyomingite) is rendered soluble.

A GENERAL survey of the coke industry of New South Wales is made by L. F. Harper and J. C. H. Minguye in Paper No. 23 of the New South Wales Department of Mines and Mineral Resources. Chemical analyses and physical properties are given for all types of coal found in New South Wales, and also unusually complete analyses of the coal ashes. Coke burning has been established in the colony for half a century, and is an important and growing industry, the production having risen from 304,800 tons in 1914 to 417,753 tons in 1915. A perusal of this report suggests, however, that the methods of the industry have not kept pace with modern coke-oven practice. Preliminary coal-washing is carried on to a very limited extent, although the ash content of the cokes is very high, and there is some laboratory evidence that washing would be serviceable. The sulphur in the coals and cokes is quite remarkably low, and might be even lower after washing. Unfortunately the survey has not included nitrogen content. The coking properties of the coals are good. A modified beehive oven is most commonly used for coking, rectangular in plan, but with arched roof. The coke is discharged by a ram and quenched outside the ovens. Heating is effected by burning part of the coke-oven gas in external flues, and in some plants the waste heat is collected for power production. The ordinary beehive oven is also in use, but only one modern by-product plant is in full operation (since 1915)—a battery of regenerative Semet-Solvay ovens at Newcastle, N.S.W., with semi-direct ammonia recovery and a benzol plant. Another battery of ovens of the Coppée type has been built in the neighbourhood, but trouble with refractory materials seems to have hindered its operation. Results obtained in the recovery ovens suggest that coking for by-products should have good prospects; the yields are stated as 30 lb. of ammonium sulphate, 3 gals. of benzol, 8 gals. of tar, 12,600 cub. ft. of gas (585 B.T.U.) per ton of coal. It is believed that these results may give a practical object-lesson on the possibilities of by-product coking in the colony, and do something to destroy the prejudices and conservatism evidenced by the general use of older, simpler, and cruder types of plant.

SCIENTIFIC PAPER No. 294, issued by the U.S. Bureau of Standards, gives an account of the accurate redetermination of the freezing point of mercury made at the bureau by Mr. R. M. Wilhelm. Temperatures were measured by means of three platinum thermometers standardised at 0° C., 100° C., and 444·6° C. About 40 c.c. of mercury were placed in a glass tube of 2 cm. inside diameter, and into it the bulb and a considerable length of the stem of the platinum thermometer were inserted. The mercury tube was surrounded by another glass tube of 3 cm. inside diameter, which was placed in a well-stirred freezing bath. In making a determination the temperature of the bath was maintained either a little above or a little below the freezing point of the mercury, and the slow change of temperature of the mercury owing to the transmission of heat across the layer of air between the two glass tubes was observed. At the melting- or freezing-point the temperature remained constant for ten to twenty minutes. Three different samples of mercury were used, and after purification gave identical results. The final result of the whole series of measurements is −38·873° C.

THE Journal of the Franklin Institute for November contains an account of some interesting work on riveted joints by Mr. Cyril Batho, of the McGill University. By means of the principle of least work it is shown how a series of equations may be obtained for any riveted joint, giving the loads carried by each of the rivets in terms of a quantity K, which depends upon the manner in which work is stored in, or by the action of, the rivets. A large number of experiments have been made with the object of determining

the distribution of the stresses; from the results of these the author deduces that the extensometer measurements on the outer surfaces of the cover-plates of a riveted joint are sufficient for the determination of the mean stresses in the plates, and that the partition of the load among the rivets may be determined from such measurements. All the experiments tend to show that friction does not play an important part, but further experiments are necessary on this point. Experiments on a number of specimens having a single line of rivets gave results in close agreement with the theoretical considerations. An empirical rule for the value of K is given for joints similar to the experimental specimens. We can commend a careful study of this important article to any who are interested in riveted joints.

THE *Journal of Anatomy and Physiology*, founded by the late Sir William Turner in 1866, will in future appear under the title *Journal of Anatomy*, and will be the official organ of the Anatomical Society of Great Britain and Ireland. In the preface to the first part of the fifty-first volume Prof. R. Howden, president of the society, remarks that until the year 1878 the journal was the organ of the two sciences, anatomy and physiology. In that year the *Journal of Physiology* was established, and thereafter physiological papers became few and far between in the joint journal, and finally ceased to appear. It has therefore been deemed advisable to drop the words "and Physiology" from the title. The editors of the *Journal of Anatomy* are Profs. A. Macalister, A. Thomson, A. Keith, and A. Robinson.

THE catalogue of publishers' remainders just issued by Mr. H. J. Glaisher, 55 Wigmore Street, W., is full of interest. The works offered for sale at greatly reduced prices are new unless otherwise stated, and cover a wide field. Very many of the books deal with scientific subjects. Among them we notice:—Newton's "A Dictionary of Birds"; Galton's "Memories of my Life"; Spence's "Notes of a Botanist on the Amazon and Andes"; Mill's "The Siege of the South Pole"; Clerke's "The System of the Stars" and "A Popular History of Astronomy"; Cooke's "Introduction to the Study of Fungi," "British Edible Fungi," and "Handbook to British Hepaticæ"; Smith's "The Life of Sir Joseph Banks"; Bonhote's "Birds of Britain"; Amundsen's "The North-West Passage"; "The Angler's Library," five vols.; Gadow's "Through Southern Mexico"; Scherren's "The Zoological Society of London." The catalogue should appeal to readers of NATURE in search of standard works at low prices.

ON a previous occasion the attention of readers was directed to the excellence of the pads of "Acribo" sectional paper supplied by Mr. W. H. Harling, 47 Finsbury Pavement, E.C. He is now able to provide the paper printed on linen bank in three scales, and in this strong form the popularity of such a convenient, accurate, and British-made product should be increased.

OUR ASTRONOMICAL COLUMN.

THE ZODIACAL LIGHT.—Mr. Denning writes us that displays of this light were surprisingly intense on the mornings of December 4 and 5. He has observed it on many hundreds of occasions, both at the morning and evening apparitions, but never remembers to have seen it more conspicuous. It stretched upwards from about E. by S., and its fainter limits were just traceable to the stars Regulus and γ Leonis in the Sickle of Leo. It was best seen at about 5.40 a.m., and as Regulus passed the meridian at Bristol at 5.23 and 5.19 on the mornings mentioned, the light must have extended over a considerable arc.

A NEW COMET.—A telegram from Prof. Pickering, received through the Centralstelle at Copenhagen on November 26, announces the discovery of a new comet by the Rev. Joel Metcalf on November 21. At Greenwich time 13h. 36·9m. on that day the R.A. of the comet was 3h. 38m., and the N.P.D. 71° 27′. No indication of the brightness or motion of the comet is given. The above position is located about 5° south of the Pleiades, which are now visible throughout the night.

THE SEARCH FOR A TRANSNEPTUNIAN PLANET.—Notwithstanding the failure of nearly half a century's systematic search for a planet beyond Neptune, M. A. Borelly, of the Marseilles Observatory, is still hopeful that such a planet may be discovered. The comet-seeker which he has mainly employed in his work on small planets has permitted the observation of stars down to the 12th magnitude, and M. Borelly is now inclined to think that the planet sought for must be of less brightness than this. He believes it possible, however, that the planet might be detected with the aid of the photographic chart of the heavens, which includes stars as faint as the 14th magnitude. If the period of the planet be a little more than double that of Neptune its motion would only be 1° per annum, or about 10″ per day, so that the short exposures which suffice to show the motion of planets between Mars and Jupiter would not be effective. The occurrence of what may be called Transneptunian comets, including the comets of 1532, 1661, 1862 (III.), 1843 (I.), 1880 (I.), 1882 (II.), is regarded as an argument in favour of the existence of planets outside the orbit of Neptune (*Jour. des Observateurs*, vol. i., No. 12).

SOLAR PROMINENCES IN 1916.—Admirable records of solar prominences are now being obtained under the direction of Mr. Evershed at Kodaikanal, and prompt publication of the results is a commendable feature of the work carried on. In view of the more satisfactory data relating to position angles, heights, and areas which are obtainable from the spectroheliograph photographs, the visual observations are now practically confined to displacements of the hydrogen lines and to metallic prominences. A summary of the observations for the first half of the present year is given in Kodaikanal Bulletin No. 52. Compared with the previous six months, there was a decrease of 22·6 per cent. in areas and an increase of 26·1 per cent. in the number of prominences, the average area per prominence having diminished by about one-third. The areas show a slight preponderance on the eastern, and the numbers a slight preponderance on the western, limb. Metallic prominences were observed in greater number than during the preceding half-year, and there was also a large increase in the number of displacements of the hydrogen lines observed at the limb. In observations on the disc 305 reversals of the C line, 34 darkenings of the D_3 line, and 103 displacements were recorded; there was a large preponderance of displacements towards the red. Absorption markings in H_α, attributed to prominences projected on the disc, were photographed on 147 days; the daily number was the same as for the previous period, but there was a diminution in area.

ANNIVERSARY MEETING OF THE ROYAL SOCIETY.

THE anniversary meeting of the Royal Society was held on Thursday last, November 30, when the report of the council was presented, and Sir J. J. Thomson delivered his presidential address, which included the following statement of the scientific work of this year's medallists:—

Sir James Dewar, F.R.S. (Copley Medal).

The scientific work of Sir James Dewar covers a wide field. By applying his ingenuity to problems of practical and theoretical importance, he has obtained results which have contributed largely to modern progress in physics. His early work dealt with organic chemistry, the nature and properties of the picoline and quinoline bases, and he investigated the properties of Graham's hydrogenium. He made a study of the explosion of gaseous compounds, and he was associated with Sir Frederick Abel in the introduction of cordite. Experiments on electro-photometry at one time engaged his attention, and he carried through some researches on the physiological and chemical efficiency of light. In conjunction with Prof. Liveing he published many results of spectroscopic investigations, and afterwards devoted considerable time to the spectroscopic examination of the various gaseous constituents separated from the atmosphere.

Sir James Dewar's best-known recent work is connected with low temperatures and the liquefaction of gases. His introduction of the vacuum flask and his discovery of the power of gaseous absorption of charcoal at low temperatures rendered possible his investigation of the properties of many liquefied gases. He was the first to succeed in solidifying hydrogen. Helium was then the only gas which had resisted liquefaction. Sir James Dewar foretold how this refractory gas might be obtained in liquid form, and the efficacy of the method was verified by Dr. H. Kamerlingh Onnes, who, in 1908, obtained liquid helium, and reached the lowest known temperature (about 3° abs.). Sir James Dewar's experiments in calorimetry and the electrical resistance of metal at low temperatures have opened a wide field of research.

Prof. William Henry Bragg, F.R.S. (Rumford Medal).

Prof. Bragg has been continuously engaged since 1904 in researches into the nature and properties of the rays from radio-active bodies of other ionising radiations. Using new methods in the study of the ionisation of gases by α rays which greatly simplified the experimental conditions, he investigated the distribution of the ions produced along the path of an α particle through a gas. These experiments threw an entirely new light on the nature of the absorption of α rays by matter, and proved that the α rays resulting from each radio-active transformation have a definite characteristic range, depending on the initial velocity. These investigations (in which he was assisted by Kleeman) formed one of the most important advances in our knowledge of the properties of these rays since their discovery.

Prof. Bragg also made important contributions to our knowledge of the nature and properties of β rays and kathode rays, and especially of their relation to γ rays and Röntgen rays. He attacked the problem of the nature of the process of ionisation by X-rays and γ rays and put forward the view, now generally accepted, that the ionisation is entirely secondary and due to the corpuscular rays produced by the primary radiations. His Bakerian lecture (1915) contains an investigation on the reflection of X-rays from crystals, which has led to most important and novel results.

Dr. John Scott Haldane, F.R.S. (Royal Medal).

Dr. Haldane is awarded a Royal medal on account of the important contributions he has made to physiology, especially on the subject of respiration. His study of the conditions of combination of carbon monoxide with hæmoglobin have been fruitful in many directions. They led him to the investigation of gas explosions in coal mines, which has had important results in the saving of life in mines. They also led to the discovery of methods for the determination of the oxygen tension in the blood and of the total volume of the circulating blood in man, which have had wide clinical applications.

Dr. Haldane has also studied the effect of high temperatures under varying conditions of moisture on the human body, and was the first to lay down the definite conditions under which it is possible to withstand or to work in high temperatures. The greater number of his papers, and those of his pupils, refer to the conditions of activity of the respiratory centre. He was the first to demonstrate beyond dispute the all-important part played by the tension of carbonic acid in the blood in the regulation of the respiratory movements, and to elucidate the chemical self-steering mechanism by means of which the pulmonary ventilation is adjusted to the respiratory needs of the body and to the activities of the animal. The knowledge obtained in these researches has enabled him to lay down the conditions which must be observed for the preservation of life among divers, and to elucidate the phenomena of mountain sickness and of acclimatisation to high altitudes.

Prof. Hector Munro Macdonald, F.R.S. (Royal Medal).

A Royal medal is awarded to Prof. H. M. Macdonald on the ground of his contributions to mathematical physics. Prof. Macdonald has been engaged continuously in original research for the last twenty-five years, and in that time has produced many notable memoirs and one remarkable book ("Electric Waves," Cambridge, 1902). His work extends over a wide range: hydrodynamics, elasticity, electricity, and optics, and branches of pure mathematical analysis which have applications to these subjects, especially the theory of Bessel's functions. Among the papers of more distinctly physical character, perhaps the most important are the series of papers treating of the theory of diffraction, and especially the diffraction of electric waves by a large spherical obstacle, a problem which is of especial importance in connection with the theory of the transmission over the earth's surface of the waves utilised in wireless telegraphy. He was the first mathematician to attack this problem, and also the first to obtain the correct solution. The interval between the first attack and the final conclusion was about eleven years (1903–14), and the discussion which took place in the meantime attracted contributions from some of the most eminent mathematicians of the day, including such authorities as Lord Rayleigh and the late Henri Poincaré.

Henri Louis le Chatelier, For. Mem. R.S. (Davy Medal).

M. le Chatelier, successor to Moissan at the Sorbonne, is the most distinguished living French chemist. His name will always remain associated with important discoveries in several divisions of chemistry. In co-operation with M. Mallard, he was the author of an elaborate investigation on the ignition and explosion of gaseous mixtures, in which several principles of fundamental importance were established. As the result of much investigation he introduced the le Chatelier thermo-couple, and inaugurated a new period in the measurement of high temperatures. M. le Chatelier was one of the pioneers of micrometallography, and one of the first to introduce exact methods and clear ideas into the science of industrial silicates. His views on the relation of science to industry and on the teaching of chemistry, which command great attention in France, are exemplified in his highly original book "Le Carbone."

Prof. Yves Delage (Darwin Medal).

Prof. Delage is a member of the Institute, professor in the faculty of science in the University of Paris, and director of the Zoological Station at Roscoff. He is well known for his biological and zoological writings, especially for his great work, "L'Hérédité et les Grands Problèmes de la Biologie Générale," and his important "Traité de Zoologie Concrète" (the latter published in conjunction with Prof. Hérouard).

Prof. Delage's original memoirs include a very important work on the development of sponges ("Embryogénie des Eponges; développement postlarvaire des Eponges silicieuses et fibreuses marines et d'eau douce," *Arch. Zool. Expér.* (2), x., No. 3, pp. 345–98).

M. Jean Gaston Darboux (Sylvester Medal).

Professeur de géométrie supérieure à la faculté des sciences de Paris since April, 1881. Secrétaire perpétuel de l'Académie des Sciences pour les Sciences Mathématiques since May, 1900. Author of "Leçons sur la Théorie Générale des Surfaces" (four volumes), "Leçons sur les Systèmes Orthogoneux," and of many individual papers dealing with kinematics, theory of partial differential equations, planetary theory, the principles of infinitesimal geometry, functions of a real variable, and numerous other subjects. He is one of the most distinguished of contemporary French mathematicians, and has been honoured by nearly every academy in Europe.

Prof. Elihu Thomson (Hughes Medal).

Prof. Elihu Thomson, of Lynn, Massachusetts, has long been a leading man in the technical applications of electricity in the United States. In the early 'seventies, when teaching in Philadelphia, he was one of the pioneers of electric arc lighting, and invented numerous pieces of electric apparatus. In 1887 he discovered, experimentally, the repulsion experienced by masses and sheets of conducting metal when placed in an alternating magnetic field. Following up this matter, he devised an alternating-current motor, for some years the only one of its kind. He is the inventor also of the process of electric welding which bears his name, and has made valuable investigations into the production of high-frequency discharges and oscillations.

The following are among the subjects referred to in the report of the council of the society:—

The late Lieut. H. G. J. Moseley, killed in action, bequeathed to the society the whole of his estate, to be applied to the furtherance of experimental research in pathology, physics, physiology, chemistry, or other branches of science, but not in pure mathematics, astronomy, or any branch of science which aims merely at describing, cataloguing, or systematising. The value of this bequest has not yet been fully ascertained. Under the will of the late Prof. Meldola the society will eventually receive a legacy of 500*l.*

The council has decided that in present circumstances it is not desirable that the Central Bureau should undertake any work pledging the society to publication of the International Catalogue beyond the fourteenth issue. The Committee of the Privy Council for Scientific and Industrial Research has made a grant of 4250*l.* to the catalogue on condition of an equal sum being provided from private sources for the purpose of assisting the society to keep this important scientific undertaking in being. Sir Charles Parsons guaranteed the collection of this second sum of 4250*l.*, and thus secured the contribution from the Treasury. At the request of Dr. Walcott, secretary to the Smithsonian Institution, Washington, the Carnegie Corporation of New York made a grant to the institution of 6000 dollars (1253*l.* 18*s.* 4*d.*) for the International Catalogue. Sir Charles Parsons has collected 1088*l.* in private subscriptions, and, by himself subscribing 1909*l.*, made up the sum available from all these sources to 8500*l.* 18*s.* 4*d.* It is believed that this sum will enable the catalogue to be published to the end of the fourteenth issue without the necessity of asking for further assistance.

In June last, at the request of the President of the Board of Agriculture and Fisheries, the president and council appointed a committee to consider and report upon the bionomics and economic importance of grain-infesting insects, with especial reference to imported grain, the committee consisting of the treasurer (chairman), Prof. V. H. Blackman, Prof. A. Dendy, Prof. Stanley Gardiner, Mr. W. B. Hardy, Prof. R. Newstead, with Mr. J. H. Durrant (of the British Museum), Mr. J. C. F. Fryer (representing the Board of Agriculture), and Mr. Oswald E. Robinson (president of the Incorporated National Association of British and Irish Millers). This committee has been at work for some time on the important subject referred to it, and has appointed a small sub-committee which is engaged upon the necessary investigations and has recently presented a progress report.

Under regulations for the administration of the recruiting schemes adopted by the Government last year the Board of Trade included a provision that analytical, consulting, and research chemists were not allowed to be called up for service with the colours without the consent of the Royal Society. The Military Service Act which became law last March embodied a list of certified occupations, including that of analytical, consulting, and research chemists, "if recommended for exemption by the Royal Society." These provisions have led to a large number of applications being made to the Royal Society by persons claiming to come within the category of chemists above described, and the consideration of these claims has given, and continues to give, rise to a large amount of labour and difficulty.

The Sectional War Committees mentioned in the last report of the council have continued their labours, and several of them have been actively engaged throughout the past year in consultation with the departments of Government concerned.

The classified lists for the War Register referred to in the last report of council have been completed so far as possible, printed, and placed in the hands of the naval and military authorities. In addition, a register of scientifically trained men available for work in connection with the war, covering roughly the period between the issue of Lord Derby's scheme and the passing of the first Military Service Act, has been compiled, and arranged in the form of a card index, which has been placed at the disposition of Government departments and freely consulted.

Owing to the special test work undertaken, and the large number of special investigations carried out for the Admiralty, the War Office, and the Ministry of Munitions, the work of the National Physical Laboratory has greatly increased during the past year, and it has been necessary temporarily to make considerable additions to the staff. In the last report of the council reference was made to the steps which had been taken before the war to secure more adequate support from the Government for the work of the laboratory, and while it is clear that during the war every effort must be given to war work, it is necessary that a scheme, to come into effect as conditions become normal, should be devised to enable the laboratory to take its place in the general plan of industrial research.

Several of the senior members of the staff have been seconded for service in Government departments, and their responsibilities at the laboratory have had to be assumed, to a great extent, by the younger men. Since the formation of the Ministry of Munitions the direc-

tor of the laboratory has acted as adviser in physics to the Ministry. He has also acted as chairman of the Instruments Committee of the Munitions Inventions Department, and has served on a number of committees of the Ministry of Munitions, the Munitions Inventions Department, and the Board of Invention and Research.

Large additions have been made during the year to the laboratory buildings owing to the growth of the work. Early in the year an urgent request was made by the Admiralty and the War Office for an extension of the aeronautics research. This required the provision of two or three additional wind-channels, with increased accommodation for model-making and similar purposes. Authorisation to proceed was immediately given by the Treasury, and the necessary building and constructional work was undertaken by the Office of Works. The new building contains two wind-channels, a 7-ft. and a 4-ft., with pattern-makers' shop, generator-room, offices, etc. An addition to the metrology building, to provide additional accommodation for the work of gauge-testing, has also recently been erected by the Office of Works, while other buildings have been provided for temporary purposes.

CHEMISTRY AT THE BRITISH ASSOCIATION.

THE work of Section B (Chemistry) at the recent meeting of the British Association at Newcastle-upon-Tyne differed somewhat from that of previous years in that it was concerned mainly with two subjects—coal and fuel economy, and the future of the British chemical industries. As the first of these important topics will be dealt with separately, the following brief account of the sectional proceedings will refer chiefly to the second of the subjects of discussion.

"The Future of the Synthetic Chemical Industry in Great Britain" was the subject of a paper by Mr. F. H. Carr, in which the question of training chemists for this branch of the industry was considered at some length. Mr. Carr does not profess to be an educationist, and that is perhaps the reason why he gave his interesting views on the education of chemists to Section B rather than adding them to the fascinations of the programme of Section L.

The essence of the educational scheme proposed by Mr. Carr is the establishment of technological colleges with a course of two years, the college itself being practically a business concern for the manufacture of fine chemicals. Students who did not qualify in successive stages would be liable to dismissal, and a daily attendance of eight hours with but short holidays would be demanded.

As the colleges would have practically the equipment of a works, the student would learn to look at chemical processes from the point of view of cost of materials, yield of finished product, and value of the time and labour, heat and power expended on any particular operation, while at the same time he would become familiar with the ordinary plant found in actual factories.

To impart this training a staff with thorough works experience would be needed, and it is unfortunately not very clear how such a staff could be got together, for such men would most likely be better off financially in works, and might perhaps have little taste for teaching. The college buildings and equipment would be provided by Government, while chemical manufacturers should supply the endowment.

This scheme might be expected to produce technically and scientifically trained men suitable as departmental managers, but the equally important trained operative must also be considered. Here Mr. Carr regrets the absence of an apprenticeship system, and feels the loss of the old mechanics' institutes. For the present, training will have to be carried out in the factory, but he suggests that there should be compulsory continuation of education until eighteen years of age, more latitude being given to schools to suit particular industries of the district, and more differentiation at the age of thirteen in the training of boys of different aptitudes and tastes.

Mr. Rintoul, in a paper on the "Preparation of Chemicals for Laboratory Use," described the work being carried on by Nobel's at Ardeer for producing pure reagents and materials hitherto chiefly obtained from Germany.

Dealing with the subject in a more general way, Mr. Rintoul was of the opinion that much of the research work for the preparation of such chemicals need not necessarily be carried out in technical laboratories, as much of it was well suited to university conditions. It would indeed afford an opportunity for bringing chemical industries and universities in contact, for instead of producing many papers of perhaps somewhat doubtful value, the university laboratories might produce authoritative statements on new or comparative methods for the preparation of compounds, information on which is at present either lacking or inaccurate. Most of the raw materials required could be obtained in the British Empire, and he deplored the fact of our dependence on Germany for supplies of pure materials the manufacture of which would be of educational value, and at the same time of importance in the industry.

A paper by Mr. C. M. Whittaker on the "British Coal-Tar Colour Industry in Peace and in War" gave a summary of the work already carried out, mainly by British Dyes, Ltd., to supply colours for all kinds of dye purposes, ranging from typewriter ribbons to khaki cloth. An immense amount of work has been done, and many colours are now made in this country in huge quantities for war purposes, and all credit is due to the firms concerned. The paper conveyed, no doubt rightly, the impression that every soldier and sailor, whether hale or wounded, was a living memorial to the industry of chemists concerned with the British coal-tar colour industry. Many people have perhaps not appreciated this aspect of the war.

Apart from the discussions on coal and fuel economy, the three papers above briefly reviewed constituted the *pièce de résistance* of the meetings of the Chemical Section, but there were also a few short papers of considerable interest which must just be mentioned.

Dr. J. E. Stead contributed three short papers on (*a*) the oxidation of nickel steel; (*b*) the reduction of solid nickel and copper oxides by solid iron; (*c*) the disruptive effect of carbon monoxide at 400° to 500° C. on wrought-iron. These papers, all of interest to metallurgists, have been the subject of a discussion at the Iron and Steel Institute.

Prof. W. M. Thornton gave an account of his stepped ignition in gases, and after reading the paper illustrated it experimentally. A short discussion on the paper showed that there was considerable divergence of opinion as to the real explanation of the phenomena observed and shown by Prof. Thornton.

Dr. J. A. Smythe contributed a note, illustrated by experiment, on a "Modified Chlorination Process." He showed how calcium chloride acted as a catalyst for the chlorination of ethylene and other hydrocarbons.

In conclusion it should be mentioned that throughout the meeting there was open an exhibition of British-made chemicals and apparatus, which showed what steps have already been made to replace goods in this line of enemy origin.

REFRACTORY MATERIALS.

A GENERAL discussion on refractory materials was held on November 8 at the Faraday Society, the chair being occupied by the president, Sir Robert Hadfield. Numerous exhibits were on view, including British, Colonial, and Indian raw materials, manufactured products, appliances, etc.

In his introductory address the president surveyed the whole range of refractory materials, and mentioned that when Belgian sand was no longer available for open-hearth furnace bottoms, those concerned were not long in discovering British sands which give practically the same results. This point was emphasised later by Mr. Cosmo Johns and Dr. Boswell.

Dr. J. W. Mellor (Stoke-on-Trent) opened the discussion with a paper on

"The Texture of Firebricks."

Dr. Mellor classed texture and refractoriness as the two most important properties of a firebrick. Numerous samples illustrating texture were exhibited, prepared by cutting across with a saw, polishing the cut face, and cementing a glass plate on with hot Canada balsam. This method of showing a brick's texture (now used, it is believed, for the first time) was suggested by Mr. Lomax.

Size of Grain.

The softening of clay material takes place gradually. From the fact that increased fineness of grain has been found to increase the contraction of fired clay bodies, presumably owing to increased surface reaction in promoting vitrification, it might be expected that pressure would also lower the softening temperature of a clay by increasing the area of contact, and this has recently been shown to be the case.[1]

This effect of fineness of grain comes out prominently in the case of high-temperature fluxes, like mixtures of clay and fine-grained quartz, where the vitrification temperature may be brought so low as to spoil the firebrick. Conversely, the presence of coarse-grained quartz appreciably increases the refractoriness of fireclays; the quartz grains, however, should be angular, not rounded, the rounded quartz grains being only loosely held by the clay bind, besides which angular particles pack together more closely and form a more compact skeleton for the brick, as in samples exhibited.

After-Contraction and After-Expansion.

The firebrick manufacturer arrests the chemical reaction at a certain stage. When the brick in use is strongly heated, the uncompleted reaction is continued, giving rise to *after-contraction*. This after-contraction a few years ago amounted to 2 or 3 per cent., but was reduced by improved methods to 1 per cent., and then to ½ per cent. It is usually impracticable to eliminate all the after-contraction in the original burning of the firebrick. Silica firebricks show an *after-expansion*, which may reach up to 16 per cent. The quartzose silica of clays behaves similarly, unless it be dissolved by the fluxes. The fluxes in a clay also expand about 6 per cent. in firing, so that the apparent contraction of a firebrick is a joint effect. In silica bricks the resultant effect is an expansion.

Refractoriness and other Qualities.

It is clear that conditions which increase the extent of surface of the clay particles in contact or which produce closer contact make the clay soften at a lower temperature, and this indicates how to obtain maximum refractoriness for normal conditions with a given clay. The refractoriness can be further augmented by addition of some of the higher refractories, like shrunk bauxite, shrunk zirconia, or carborundum. It should, however, be borne in mind that a coarse-grained refractory material has low crushing strength and tenacity, and is also very friable and liable to disintegration by shocks or abrasion, besides being easily penetrated by flue dusts and slags. When maximum refractoriness is not really wanted, some refractoriness may be sacrificed advantageously to improve other desirable qualities.

Hand-made v. Machine-made Firebricks.

With reference to the making of firebricks by hand or by machinery, the machines often get blamed for faults which have no direct connection with the use of the machines, but arise from differences in the method of preparing the clay, which affect the uniformity in texture of the product.

Corrosion of Firebricks.

The joints between firebricks are the weakest places in a structure. Where slags are concerned the firebricks should be fine-grained, and the jointing clay should quickly vitrify without cracking and weld the bricks together when the furnace is fired for the first time. Where bricks are exposed to corrosive vapours the chemical composition is of special importance, as well as the texture of the bricks.

Prof. T. Turner (Birmingham), referring to Dr. Mellor's statement that angular particles give closer packing than round particles, contended that the closest packing of all is obtained by adjusting two sizes of round particles so that the smaller grains shall approximately fill up the interspaces between the larger grains.

Other Refractory Materials.

Dr. Hutton directed attention to the great value as refractories of completely shrunk silica, alumina, and magnesia, all of which can stand sudden heating and cooling.

Dr. W. Rosenhain stated that zirconia has a promising future as a refractory material, especially the purified substance. It withstands very high temperatures, but should be previously heated to a higher temperature than that to which it is to be exposed, in order to avoid cracking. It is also very apt to form a carbide in a reducing atmosphere, and the properties of the carbide are very different from those of the oxide. J. A. A.

[1] J. W. Mellor and B. J. Moore, Trans. Eng. Cer. Soc., xv., 117, 1916.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

LIVERPOOL.—The University has just received two valuable gifts—8000*l.* from Mr. C. Sydney Jones, to endow the chair of classical archæology, hitherto maintained by temporary guarantees, and 10,000*l.* from Prof. and Mrs. Herdman, to establish a chair of geology. Both chairs are memorials: the first of a father, Mr. Charles W. Jones; the second of a son, Lieut. George A. Herdman, a young student, not merely of promise, but of distinction, who was killed in action in France a few months ago. Each satisfies a real need, for at Liverpool the course of study in Latin and in Greek recognises that without some knowledge of life and custom it is impossible to understand ancient history or to appreciate classical literature. The professor of classical archæology, therefore, takes an active part throughout the classical course, though his work is so arranged as to leave one term in the session free for research at home or abroad.

On the importance of geology it is needless here to dwell. Geology has its own place, and that a high one, among the sciences; without due provision for its study no university is complete. Geologists will be profoundly grateful, therefore, to Prof. and Mrs. Herdman for having completed the geological chairs in the English universities. Liverpool has long been such an active centre of geological work that the lack of a chair in the science at the University was a regrettable deficiency. New conditions of life have brought with them a growing demand for men whose scientific training shall include not only a knowledge of geological aspects of geography, but also of the earth's mineral resources. The war has cost science and the universities so much in life and brain, and also in wasted effort, that the example set by Prof. and Mrs. Herdman in establishing such a useful and appropriate memorial to their son will, we hope, be followed by others.

A PUBLIC lecture on "Chemistry and its Relation to National Affairs" will be delivered by Sir William A. Tilden, at Birkbeck College, Chancery Lane, on Tuesday, December 12 (Founder's Day), at 5.45 p.m. The chair will be taken by Sir Alfred Pearce Gould, Vice-Chancellor of the University of London. The lecture is open to the public without fee or ticket.

ACCORDING to the *Münchener medizinische Wochenschrift* the number of students during the summer semester of 1916 in the Austrian universities was as follows:—Vienna, 3472; Prague (Czech university), 1891; Cracow, 1281; Lemberg, 1174; Graz, 647; Prague (German university), 638; Innsbruck, 584. The proportion of medical students was highest at Vienna and at Graz (both about 30 per cent. of the total). At Vienna nearly two-fifths of the medical students were women.

THE evening classes held at University of London, King's College, Strand, W.C., will be open during the session 1916–17 to members of his Majesty's Forces of all ranks wearing uniform who have at any time passed the matriculation examination of the University of London, or any examination exempting therefrom, and are desirous of spending what time is available after their military duties in furthering their education in arts or science. In view of the fact that the attendance of such students will be liable to interruption, no tuition fee will be charged during the war for any classes or course of study entered upon. Those who attend these classes may be registered as internal students of the University of London.

THE General Medical Council on December 2 adopted by a majority a proposal to make Latin optional in the medical higher preliminary examination. The Education Committee of the council, in a report, expressed the opinion that the possession by a student of a senior leaving examination certificate or its equivalent, the matriculation certificate of the universities, affords ample evidence that all the objects of the council in prescribing a preliminary examination in general knowledge are fully realised. The report recommended the council to accept such certificates without further proviso than that they should embrace at least four subjects, including English and mathematics, the two or more additional to be chosen from among the principal subjects of the school curriculum. On the following day the question of making Latin optional in the preliminary examination of candidates for admission to the medical curriculum belonging to the junior class was discussed by the council, and eventually, at the suggestion of the president, Sir Donald Macalister, the question was referred back to committee.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 23.—Sir J. J. Thomson, president, in the chair.—Sir Robert **Hadfield** and Dr. E. **Newbery**: The corrosion and electrical properties of steels. The condition that a metal shall dissolve in an acid with evolution of hydrogen is:—Single potential of metal + over-voltage < single potential of hydrogen electrode, all measurements being, of course, made in the given acid. If therefore we assume that the atmospheric corrosion of a metal is a process similar to that of dissolution in an acid, it should be possible to predict the corrosion-resisting power of a given metal by determining its single potential referred to a hydrogen electrode, together with its over-voltage in a suitable electrolyte. Experiments on a number of special steels have been carried out to test the validity of the above assumption. The over-voltage, single potential, and loss of weight in acid of each specimen were determined and compared with the atmospheric corrosion observed after exposing clean surfaces to the air for ten weeks. The results showed that the electrical method gives decidedly better estimates of the corrosion-resisting powers of steels than the acid method, and although neither method gives trustworthy estimates in all cases, yet the electrical method appears to rest upon a sound theoretical foundation, and is probably capable of further developments which may result in the formation of trustworthy corrosion data.—Dr. A. E. H. **Tutton**: Monoclinic double selenates of the nickel group. In this paper the results are given of the investigation of the double salts, potassium nickel selenate, rubidium nickel selenate, cæsium nickel selenate, and ammonium nickel selenate, each containing six molecules of water of crystallisation. The results are in line with all those already published for the complete monoclinic double sulphate series with $6H_2O$, and for the isomorphous magnesium and zinc double selenate groups. The morphological and physical properties exhibit the progression in accordance with the atomic weight of the alkali metal brought out by the previous work, and the ammonium salt is shown to belong to the isomorphous series, and to exhibit the peculiar traits described in connection with the other ammonium salts of this monoclinic series already dealt with.—Dr. A. E. H. **Tutton**: X-ray analysis and topic axes of the alkali sulphates and their bearing on the law of valency volumes. An X-ray spectrometric analysis, carried out with the author's crystals in the laboratory of Prof. W. H. Bragg by Prof. A. Ogg and Mr. F. Lloyd Hopwood, of the rhombic crystals of the alkali sulphates R_2SO_4, where R is K, Rb, Cs, and NH_4, has indicated that four molecules of R_2SO_4 are contained in the unit rectangular cell of the space-lattice, as suggested by the author in 1894. The atoms of sulphur occupy the corners of the rectangular cell and the middle point of each side. The planes of sulphur atoms parallel to the (001) face are of pseudo-hexagonal structure, the atomic centres being arranged in nearly regular hexagons, as suggested by Federov and adopted by the author. The metallic atoms are also probably arranged in nearly regular hexagons. It is fully substantiated that the constants, molecular volume, and topic axial ratios afford true indications of relative volume and dimensions of elementary space-lattice cells in the cases of crystal structures of isomorphous series.—Dr. T. J. I'a. **Bromwich**: The scattering of plane electric waves by spheres. The first section contains a very general solution of the electromagnetic equations in curvilinear co-ordinates, and it is proved that this solution contains as particular cases those previously obtained by Hertz, Fitzgerald, Rayleigh, Love, and Lamb. This general solution is then applied to the problem indicated in the title of the

paper, and the results are analysed further in two particular cases, corresponding to long waves and to short waves. The formulæ deduced here for the case of short waves have been tested numerically for the values given by $\kappa a = 9$ and 10—that is, for wave-lengths one-ninth and one-tenth of the perimeter of the sphere. —J. **Proudman**, A. T. **Doodson**, and G. **Kennedy**: Numerical results of the theory of the diffraction of a plane electromagnetic wave by a perfectly conducting sphere. This paper is entirely concerned with the computation, from quoted formulæ, of the electric disturbance at a great distance from the sphere. The length of the incident wave being $2\pi/\kappa$, and the radius of the sphere being a, results are obtained for $\kappa a = 1, 2, 9, 10$. Tables and curves are given of the results and also of the principal stages of the work. The methods of carrying out the computations, the means of securing accuracy and detecting errors, and an analysis of the results are also given.

Linnean Society, November 16.—Sir David Prain, president, in the chair.—A. W. **Waters**: Some collections of the littoral marine fauna of the Cape Verde Islands made by Cyril Crossland in the summer of 1904—Bryozoa. The collection made by Mr. Cyril Crossland consists of forty-five species or varieties, of which twenty-five were already known from the Atlantic, fifteen are British, twenty-four Mediterranean, probably seventeen Australasian. Of the forms in this collection seven are considered either new species or new varieties.

Zoological Society, November 21.—Dr. S. F. Harmer, vice-president, in the chair.—Dr. B. **Petronievics** and Dr. A. Smith **Woodward**: New parts of the pectoral and pelvic arches lately discovered in the London specimen of Archæopteryx. The coracoid bone most closely resembles that of the ratite birds and the Cretaceous Hesperornis. The pubic bones are twice as long as the ischia and meet distally in an extended symphysis, gradually tapering to a point, which seems to have been tipped by a mass of imperfectly ossified cartilage. —B. F. **Cummings**: Studies on the Anoplura and Mallophaga, being a report upon a collection from the mammals and birds in the society's gardens—Part II. This paper continues the account of the Mallophaga, and contains descriptions of five new genera and two new species. Some observations are made upon the spermatophores in a genus parasitising the ibises, and emphasis is laid on the frequently remarkable differences found in the structure of the internal organs, especially those of the male reproductive system.—Lieut.-Col. J. M. **Fawcett**: A collection of Heterocera made by Mr. W. Feather in British East Africa. Of the 124 forms dealt with, forty-five are described as new, together with seven new genera.

Geological Society, November 22.—Dr. Alfred Harker, president, in the chair.—C. **Reid** and J. **Groves**: Characeæ from the Lower Headon Beds. The investigations here recorded have been made at Hordle Cliffs (Hampshire), where the strata below the superficial gravel belong entirely to the Lower Headon Beds, and consist of fresh-water and brackish-water (more or less calcareous) deposits, laid down apparently in wide shallow lakes and lagoons. Such habitats are the most favourable to the growth of Characeæ, and several of the beds have yielded numerous remains of these plants. There is a great diversity in the fruits of Chara found, representing evidently a number of species belonging to several different sections or genera. Characeæ are found in still fresh or brackish water all over the world under widely different conditions as regards heat, etc., and may therefore be expected to occur in almost all fresh-water formations. For these reasons it is suggested that the fruits of this group of plants, when more widely collected, may prove of considerable value as zonal fossils for the correlation of lacustrine deposits lying in isolated basins. Doubtless, on account of their small size, the Characeæ have in the past often been overlooked.

MANCHESTER.

Literary and Philosophical Society, November 14.—Mr. T. A. Coward (vice-president) in the chair.—Dr. J. S. **Thomson**: The Gorgonacea of the Cape of Good Hope. The paper contains descriptions of twenty-nine species of Gorgonacea, of which twelve are new. The new species are as follows:—Family Briareidæ, *Anthotheta parviflora*, sp.n.; family Melitodidæ, *Melitodes fauri*, sp.n., *Melitodes grandis*, sp.n., *Mopsella singularis*, sp.n., *Wrightella trilineata*, sp.n., *Wrightella fragilis*, sp.n., *Wrightella furcata*, sp.n.; family Primnoidæ, *Stachyodes capensis*, sp.n.; family Gorgoniidæ, *Leptogorgia africana*, sp.n., *Leptogorgia aurata*, sp.n., *Eugorgia lineata*, sp.n., *Stenogorgia capensis*, sp.n.—Prof. F. E. **Weiss**: The manufacture of manure from peat. In 1815 a Scottish landowner described a method which consisted of spreading alternate layers, about 6 in. deep, of peat and fairly fresh dung, until a heap of about 4 or 5 ft. was constructed, which was then left for some months. The peat was transformed into a perfect compost as effective, weight for weight, as farmyard manure. Peat and seaweed have been similarly combined, and it was found unnecessary to add lime in the preparation of this manure, the acidity of the peat becoming neutralised by the ammonia contained in the dung, while decay-producing bacteria may percolate into the peat, in addition to those normally contained in it, but the activity of which is inhibited by the presence of humic acid. Dachowski's experiments with bog-water were dealt with. The method of preparation of "bacterised peat" (humogen) was also explained, and various experiments made to test the value of this manure were discussed.—J. **Barnes**: Sugar and starch in the banana (*Musa paradisiaea*).

NEW SOUTH WALES.

Linnean Society, September 27.—Mr. A. G. Hamilton, president, in the chair.—E. F. **Hallmann**: Revision of the genera with Microscleres included, or provisionally included, in the family Axinellidæ (Porifera); with descriptions of some Australian species. Part II.—The Australian species hitherto comprised in the genus Axinella have been re-examined, and have been found to belong to four distinct genera, Allantophora, Sigmaxinella (s.str.), and two others proposed as new. Reasons for the inclusion of the genera Tylodesma and Biemna in the family Axinellidæ are adduced.—T. **Whitelegge**: Preliminary note on the gametophyte of *Psilotum triquetrum*, Swartz. Spores were successfully grown on the rhizomes of *Davallia pyxidata*, but better results were obtained from spores germinated in the synangia.—F. H. **Taylor**: Contributions to a knowledge of Australian Culicidæ (Diptera). No. III. —Five species are described as new, and notes on synonymy and additional records for known species are given.—Dr. V. H. **Brotherus**: Some new species of Australian mosses. Thirty-seven species are described as new.—T. G. **Sloane**: New species of Australian Carabidæ belonging to the tribe Scaritini (Coleoptera). Twenty-three species and one genus are proposed as new; these include some interesting forms from the Murchison district of West Australia.

CALCUTTA.

Asiatic Society of Bengal, November 1.—Sir G. **Grierson**: Ōrmuṛī or Bargistā language: an account of a little-known Iranian dialect. The Ormurs or Baraki are a tribe living in Afghanistan in the midst of Afghans, but do not speak the Pastu language.

Their position and their language were long a problem with ethnographists and linguists. Sir G. Grierson has in this paper satisfactorily solved the problem by a careful examination of their language, which he declares to be western Iranian. A full grammar and vocabulary of the language will appear in the appropriate volume of the Linguistic Survey.—B. A. **Gupta**: Folklore in caste proverbs.—Sarat Chandra **Mitra**: Some Indian ceremonies for disease transference. In this paper the author has described and compared the different ceremonies, current in western and southern India, for conveying the disease-spirit, in a chariot, from one place to another.

BOOKS RECEIVED.

In Far North-East Siberia. By I. W. Shklovsky ("Dioneo"). Translated by L. Edwards and Z. Shklovsky. Pp. vii+264. (London: Macmillan and Co., Ltd.) 8*s*. 6*d*. net.

Geological Map of Mysore. (Bangalore: Department of Mines and Geology.)

Economic Geology. By Prof. H. Reis. Fourth edition. Pp. xviii+856+plates lxxv. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 17*s*. net.

The Canning of Fruits and Vegetables. By Z. P. Zavolla. Pp. xii+214. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 10*s*. 6*d*. net.

Stresses in Structures. By A. H. Heller. Revised by C. T. Morris. Third edition. Pp. xviii+374. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 11*s*. 6*d*. net.

A Treatise on Mine-Surveying. By B. H. Brough. Fourteenth edition, revised and enlarged by H. Dean. Pp. xviii+477. (London: C. Griffin and Co., Ltd.) 7*s*. 6*d*. net.

Studies in Animal Behavior. By Prof. S. J. Holmes. Pp. 266. (Boston, Mass.: R. G. Badger.) 2.50 dollars net.

Cambridge University Calendar for the Year 1916–1917. Pp. xxvi+1077. (Cambridge: At the University Press.) 7*s*. 6*d*. net.

The Anthocyanin Pigments of Plants. By M. Wheldale. Pp. x+318. (Cambridge: At the University Press.) 15*s*. net

At Suvla Bay. By J. Hargrave. Pp. x+182. (London: Constable and Co., Ltd.) 5*s*. net.

DIARY OF SOCIETIES.

THURSDAY, DECEMBER 7.

ROYAL SOCIETY, at 4.30.—The Cytomorphosis of the Marsupial Enamel-organ and its Significance in Relation to the Structure of the Completed Enamel: J. T. Carter.—The Development of the Pancreas, the Pancreatic and Hepatic Ducts in *Trichosurus vulpecula*: Margaret Tribe.—The Fossil Human Skull found at Talgai, Queensland: S. A. Smith.—The Typical Form of the Cochlea and its Variations: H. J. Watt.—The Structure and Biology of Archotermopsis, together with Descriptions of New Species of Intestinal Protozoa, and General Observations on the Isoptera: Dr. A. D. Imms.—Torsional Hysteresis of Mild Steel: J. J. Guest and F. C. Lea.

CHILD STUDY SOCIETY, at 6.—Psycho-analysis in Relation to Children: Dr. Constance E. Long.

CHEMICAL SOCIETY, at 8.—Spinacidene: A New Hydrocarbon from certain Fish-Liver Oils: A. Chaston Chapman.—The Nitration of 2-acetylamino-3:4-dimethoxybenzoic acid and 3-acetylamino-1:2-dimethoxybenzene: C. S. Gibson, J. L. Simonsen, and M. G. Rau.

FRIDAY, DECEMBER 8.

ROYAL ASTRONOMICAL SOCIETY, at 5.—Photographic Determination of the Parallax of Three Southern Binary Systems: J. Voûte.—Errata in the Double Star Measures of the *Monthly Notices*, vols. lxvi. to lxxv.: E. Doolittle.—The Choice of an Origin for Galactic Longitudes: C. D. Perrine.—The Radiative Equilibrium of the Sun and Stars: A. S. Eddington.—An Observation by Lamont of Prof. Barnard's Proper Motion Star: A. C. D. Crommelin.

MALACOLOGICAL SOCIETY, at 7.—A Revision of the Species of the Family Pleurotomidæ occurring in the Persian Gulf, Gulf of Oman, and Arabian Sea: Dr. J. Cosmo Melvill.—The Occurrence in England of *Helicella neglecta*: A. S. Kennard and B. B. Woodward, with Notes on the Anatomy by Dr. A. E. Boycott, and on the Radula by the Rev. E. W. Bowell.—The Occurrence of *Eulota fruticum* in a Living State in Kent: A. S. Kennard and B. B. Woodward.

MONDAY, DECEMBER 11.

SOCIETY OF ENGINEERS, at 3.—The Sources of the Minerals Required by the Iron and Steel Industries of the United Kingdom: Prof. W. G. Fearnsides.—The Mineral Resources of the British Empire as regards the Production of Non-Ferrous Industrial Metals: Prof. C. G. Cullis.

ROYAL SOCIETY OF ARTS, at 5.—Coal and its Economic Utilisation: Prof. J. S. S. Brame.

VICTORIA INSTITUTE, at 4.30.—The Influence of Christianity upon other Religious Systems: Rev. W. St. Clair Tisdall.

WEDNESDAY, DECEMBER 13.

ROYAL SOCIETY OF ARTS, at 4.30.—The Development of Imperial Resources: H. W. Fox.

THURSDAY, DECEMBER 14.

ROYAL SOCIETY, at 4.30.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Colonial Telegraphs and Telephones: R. W. Weightman.

MATHEMATICAL SOCIETY at 5.30.—Orbits Asymptotic to an Isosceles Triangle Solution of the Problem of Three Bodies: Prof. D. Buchanan.—Diffraction of Waves by a Wedge of any Angle: Prof. H. S. Carslaw.—(1) Proof that almost all numbers n are composed of about $\log n \log\log n$ prime factors; (2) An Asymptotic Formula for the Number of Partitions of a Number: G. H. Hardy and S. Ramanujàr.—Two Theorems of Combinatory Analysis and Two Allied Identities: Prof. L. J. Rogers.—The Harmonic Functions associated with the Parabolic Cylinder (second paper): C. N. Watson.—(1) The Internal Structure of a Set of Points in Space of any Number of Dimensions; (2) The Inherently Crystalline Structure of a Function of any Number of Variables: Prof. W. H. Young and Mrs. Young.

ROYAL GEOGRAPHICAL SOCIETY, at 5.—(*Discussion*): British and Metric Measures in Geographical Work, opened by the Secretary.

OPTICAL SOCIETY, at 8.—The Refractometry and Identification of Glass Specimens—especially Lenses: L. C. Martin.—A Workshop Method of Determining the Refractive Index of a Piece of Glass having one Flat Surface: Dr. R. S. Clay.

ROYAL SOCIETY OF ARTS, at 4.30.—The World's Cotton Supply and India's Share in it: Prof. J. A. Todd.

LINNEAN SOCIETY, at 5.—Observation on the Root System of *Impatiens Roylei*, Walp.: Miss Isabel McClatchie.—The Teeth of some Palæozoic Sharks: Dr. A. Smith Woodward.—Sex Distribution in *Myrica gale*, Linn.; Miss A. J. Davey and Miss M. Gibson.

FRIDAY, DECEMBER 15.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.

ILLUMINATING ENGINEERING SOCIETY, at 5.—Suggestions regarding War Economies in Lighting: L. Gaster.

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