THURSDAY, AUGUST 3, 1916.

ORE-DEPOSITS.

The Deposits of the Useful Minerals and Rocks: their Origin, Form, and Content. By Dr. F. Beyschlag, Prof. J. H. L. Vogt, and Dr. P. Krusch. Translated by S. J. Truscott. Vol. ii., pp. xxi+515–1262. (London: Macmillan and Co., Ltd., 1916.) Price 20*s.* net.

THE first volume of this treatise was reviewed in NATURE for January 28, 1915 (vol. xciv., p. 583). The second volume completes the work so far as ore-deposits are concerned. The third volume does not appear as yet to have been published in Germany. Ore-deposits are classified according to their mode of origin as follows: magmatic segregations, contact-deposits, lodes, and ore-beds. The first volume dealt with the first two of these groups and with tin-lodes and quicksilver deposits belonging to the third. The second volume deals with lodes of gold and silver; lead, silver, and zinc; uranium; antimony; iron; manganese; copper; pyrites and arsenopyrites; nickel and cobalt. It concludes with an account of those ores which occur as beds in sedimentary deposits. Each section is preceded by a bibliography.

Gold-silver lodes are first described. The largest and richest of these occur in geologically young and chiefly Tertiary districts. The most striking examples are found in the Andes of Chile, Bolivia, and Peru, in the mountain ranges of Mexico, in the Great Basin of the United States, in the Sierra Nevada, and in the Rocky Mountains. Similar lodes are met with in Japan, in Sumatra, in Borneo, and in the Philippines. Examples occur in Europe in the Carpathians and in south-eastern Spain, where, as in the localities already mentioned, Tertiary igneous rocks abound; but not in the Alps and Pyrenees, where such rocks are absent. The evidence from distribution alone that they are in some way connected with vast outpourings of igneous rock—especially andesite and dacite—is therefore very strong, but it does not stand alone; other reasons are given, and finally the conclusion is reached that the young gold-silver lodes were formed by heated waters circulating towards the close of the eruptive activity in the district in which they occur, and that "these waters, together with their metal content, were derived directly from the eruptive magma." The view expressed in the sentence just quoted will certainly not be generally accepted if it must be taken to imply that the water is not of meteoric origin. Having dealt with the common characteristics and discussed the mode of origin of this important and widely distributed group of lodes the authors proceed to describe special cases. These local descriptions are illustrated by maps and diagrams, and in the more important cases contain particulars as to the development of the industry and of the amount and value of the ore raised. Take, for example, the case of Western Australia. The Kalgoorlie field was discovered at the beginning of the 'nineties. The economic conditions at the start were most unfavourable, supplies had to be obtained from Perth, more than 300 miles away, and water cost 2½*d.* a gallon. But in a few years all was changed. A railway was constructed between the two places, and also a pipe line capable of delivering 5,000,000 gallons of water per day. In 1909 Western Australia produced 1,595,263 oz. of fine gold, about one-fourteenth of the world's production, and not quite one-half of the total production of Australasia. Between 1903 and 1909, the last date for which figures were available when the book was written, there had been a continuous decline, which the authors attribute to decrease of value with depth. The corresponding figures for 1913, as quoted in Whitaker's Almanack, are 1,314,043 oz., so that the decline is still going on.

This goldfield has been examined by Dr. Krusch. The lodes are intimately associated with amphibolites, some of which are schistose and others massive. Although no evidence is given that any of the surrounding rocks are of Tertiary age, the authors refer the lodes to the younger series on account of their nature. They are described as veined zones consisting of a large number of small fissure-filings from which intense impregnation and replacement of the country rock have proceeded. The lode material consists chiefly of quartz containing auriferous pyrites with gold—and other tellurides in variable quantities. All the lodes are more or less decomposed near the surface, and where the gold is chiefly associated with sulphides two well-marked depth-zones occur: an oxidation zone from which most of the gold has been leached, and an abnormally rich cementation zone. On the other hand, where the gold is chiefly in the form of telluride no cementation zone exists, and the oxidation zone carries free gold exclusively.

The book then deals with the old gold lodes. These are not, as a rule, associated with eruptive rocks, quartz is by far the most abundant gangue mineral, and the country rock is rarely impregnated with metal, as is so frequently the case with the young gold-silver lodes. That quartz-veins carrying gold are more abundant and lodes of the Comstock type less abundant in the pre-Tertiary than in the Tertiary rocks is unquestionable, but it may be doubted whether, on this account, it is desirable to introduce age as a factor into the classification of ore-deposits. The gold-quartz lodes of California, Ballarat, the Barberton district of the Transvaal, and other areas are then described. The wonderful deposit of Mount Morgan is considered in this connection, and the various theories that have been advanced to account for it are discussed. The authors favour Rickard's view that it represents a highly altered part of a shattered country which has been saturated with mineral solutions and in part replaced by auriferous quartz; or, in other words, that it is one of the rare cases of a metasomatic gold-deposit.

Space prevents us from following the authors in their descriptions of the other metalliferous

lodes, but, in view of the fact that two of them are Germans, it may be interesting to note briefly what they say about the mineral resources of "German" colonies. Gold-bearing lodes occur in the contact-belts around different eruptives, mostly of a dioritic nature, near the village of Sekenke, in East Africa. They are lenticular in form, and five of them are payable, three of these constituting the Dernberg lode. The average assay of sixty samples, after rejecting those which yielded abnormally high results, gave 47 gm. per ton. These samples were taken from the cementation zone, which is of no great depth. The gold content of the primary zone does not appear to be sufficient to pay for working. In West Africa gold-copper ore is won on Swakop River, where a garnetiferous layer in gneiss is sparsely impregnated with copper. Auriferous copper deposits of a more important character occur on the Groot and Klein Spitzkop, some 20 km. to the north-west of Rehoboth. The copper-ore occurs sometimes as malachite, sometimes as chalcocite, bornite, or chrysocolla. The primary ore probably consists of pyrites and chalcopyrite. The gold occurs either as free gold or associated with pyrites. Wedges of country rock between converging veins have assayed 3 gm. to 4 gm. of gold and 20 gm. of silver per ton. Auriferous conglomerates have been observed in the Ussungo district, but they have not as yet proved to be of any economic importance.

In dealing with the world's production of gold and silver the authors estimate that the total yield from 1493 to 1911 was 20,737 tons, representing 2838 millions sterling, a small sum compared with the cost of the present war.

The volume concludes with an account of ore-bearing rocks interstratified with sedimentary deposits. This part commences with a description of the conditions under which stratified rocks are formed, and especially of those chemical and physical processes which throw light on the origin of ore-deposits. Then follow descriptions of iron-ore beds, of manganese beds, of copper-shale beds, of auriferous conglomerates, and finally of placer deposits yielding tin, gold, and platinum.

The treatise is a valuable addition to the literature of ore-deposits, and the translator deserves high praise for the way in which he has done his work.

NAPIER AND HIS LOGARITHMS.

Napier Tercentenary Memorial Volume. Edited by Dr. C. G. Knott. Pp. xi+441. (Published for the Royal Society of Edinburgh by Longmans, Green and Co., London, 1915.) Price 21*s.* net.

THE first place in this miscellany is naturally assigned to Lord Moulton's inaugural address. For once in a way, this is not an empty compliment; for the address is a model of what such an oration should be. There is only one mathematical formula in it, and this so simple and familiar to the audience that it did not need to be written down, while several important points are brought out with convincing lucidity. Of these are (i) that Napier, before publishing his "Canon," had arrived at the notion of a logarithm as a continuous function—we may even say, as one defined by a differential equation; (ii) that the essential property of the logarithm, in Napier's eyes, is that, if $a : b = c : d$, then $\log a \sim \log b = \log c \sim \log d$, so that a table with *numbers* as entries, and logarithms as extracts, will economise labour in doing rule of three sums.[1]

The papers contributed are, on the whole, more interesting and appropriate than is usual in productions of this kind. Of course, some of the contributors, however eminent, have little knowledge, and less interest, about the history of logarithms; so they either write an original note on an irrelevant subject (such as spherical harmonics) or a perfunctory page or so on relevant but well-known topics. As there are twenty-six technical papers, we cannot notice them all, but have to select those which seem to us most worthy of attention.

Among these are the two brief contributions by Prof. G. Vacca. One of these recalls the work of Pietro Mengoli; the other is, we think, vital to the whole question of what was the induction that led Napier to his goal. In Fra Luca Paciolo's "Summa de Arithmetica" (Venice, 1494) there is the following statement:—

"If you wish to know in how many years a sum of money will double itself at compound interest (paid per annum), divide 72 by the rate per cent. For example, if the rate of interest is 6 per cent., the number of years is 12."

No doubt this rule was obtained empirically; but the interesting thing is that we have a formula implying that the number of years required is inversely as the rate per cent. Now, Napier was a business man, and his *constructio* is essentially the formation of a table of compound *discount* at a very small rate per cent. We are convinced that this mercantile method contains the germ of Napier's invention, and not any trigonometrical formula. If we assume that, for a small fixed rate r,

$$A = (1+r)^{\alpha} = 1 + \alpha r,$$

then with

$$B = (1+r)^{\beta},\ C = (1+r)^{\gamma},\ D = (1+r)^{\delta},$$

we have approximately

$$\frac{AD}{BC} = \frac{(1+\alpha r)(1+\delta r)}{(1+\beta r)(1+\gamma r)} = 1 + (\alpha + \delta - \beta - \gamma)r,$$

and now, if $A : B = C : D$, we have, to the same degree of approximation, $\alpha - \beta = \gamma - \delta$, which is Napier's fundamental theorem. We *now* know that if

$$\phi(x/y) = \phi(x) - \phi(y) + \phi(1),$$

then $\phi(x) = p \log_e x + q$, where p, q are constants. In Napier's original system, as Prof. Gibson points out (p. 128),

$$p = -10^7,\ q = 7.10^7 \log_e 10.$$

[1] For reasons given later, we entirely disagree with Lord Moulton's suggestion that the first germ of Napier's discovery is to be found in the expression for the difference of two cosines as the product of two sines.

These "logarithms" serve for rule of three sums, but they are *not* suitable for simple multiplications or divisions. Briggs appears to have seen how to amend the system by choosing 10 for the base, and 1 as the antilogarithm of zero. Whether the same idea had occurred to Napier is uncertain; at any rate, after consultation, the two men agreed upon the usefulness of the transformation, and Briggs performed the necessary computations. On all points in this connection Prof. Gibson's paper is very convincing and instructive. We do not suppose that either Briggs or Napier consciously thought of a base or a unit as we do, but they probably realised the meaning of a formula,

$$\lambda(x) = p \log(x) + q,$$

where $\lambda(x)$, $\log(x)$ are logarithms of the same number in two related systems. Here, again, Prof. Gibson's paper should be consulted.

We now come to the question of priority, which ought never to have been raised; it is astounding that even M. Cantor should prolong this idle controversy. Bürgi's table of *antilogarithms* appeared in 1620; his calculations appear to have been finished by 1610 (p. 209); Napier's table of *logarithms* appeared in 1619. Each table was the result of years of work; to convert either into the other, fraudulently, would involve a vast amount of labour; and there is not a shred of evidence that either man had access to the MS. of the other. It is the case of Newton and Leibniz over again in another form. So far as actual priority in publishing a table of logarithms is concerned, Edward Wright has a claim superior to that of either Napier or Bürgi; but he was sensible enough to know the difference between a special table constructed for use with Mercator's chart (essentially a $\log \tan \frac{1}{2}\theta$ table) and one adapted for general computation; even supposing that he knew, before the "Canon" was published, that his own table was a table of logarithms—which is extremely unlikely. Finally, Wright paid ample tribute to the genius of Napier, and never made any claim on his own account. This was reserved for the eccentric Benjamin Martin.

Among the other papers may be noted Dr. Glaisher's excellent paper on logarithms and computation; Prof. Sampson's careful bibliography of books exhibited; Dr. Knott's account of Edward Sang and his logarithmic calculations; Prof. d'Ocagne's notes on nomograms and multiplying machines; Mrs. E. Gifford's account of her new table of natural sines; papers on probability by Messrs. Erlang and Quiquet; and one on the arrangement of mathematical tables by Dr. J. R. Milne. In its way, the last is of outstanding importance, because everything possible should be done for those who have to use tables daily and for hours together; such things as paper, colour, typography, etc., are not the trifles they may seem to the amateur.

The general appearance of the volume is excellent; it is well printed, and the illustrations (two in colour) are most interesting; the indexes are ample, and the price is not extravagant. The biography of Napier has been well done by Dr. P. Hume Brown, and Mr. G. Smith has contributed a careful account of Merchiston Castle. The editor (Dr. Knott) may be congratulated on the result of his labours. G. B. M.

AN AGRICULTURAL POLICY.

Agriculture after the War. By A. D. Hall. Pp. vii + 137. (London: John Murray, 1916.) Price 3*s.* 6*d.* net.

IN this little book Mr. Hall sets out his views as to the methods to be adopted after the war in order to develop agriculture to the full extent demanded by the national necessities. Mr. Hall insists that more food must be grown at home as an insurance in time of war, to develop our resources and reduce our foreign indebtedness, and to increase the agricultural population as a specially valuable element in the community. This can be attained only by bringing more land under the plough. Farmers will not on their own responsibility plough up grass land: to do so is to destroy a certain, though small, source of profit for the sake of a more risky, but possibly larger, one. Mr. Hall considers that the old *laissez-faire* policy will no longer meet the case: the State may be driven to adopt some system of bounties or protective duties to make the profits more certain and the inducements more tangible. Five methods are outlined for obtaining a more intensive cultivation of the soil: the establishment of large industrial farms working on a considerable area with all the economic advantages of organisation and scientific management; the establishment under certain conditions of colonies of small holders working under co-operative organisation; the intensification of existing methods; the reclamation and settlement of waste and undeveloped areas; and the establishment of certain subsidiary industries.

Mr. Hall's writings are always marked by breadth of view and saneness of outlook, and it is gratifying to know that these have not deserted him since he left the country for Dean's Yard. He has never hesitated about a proposal because it happened to be rather revolutionary, nor does he do so here. The scheme suggested is comprehensive and logical, but it has its revolutionary aspect, and the final solution, in his own words, is "for the State to become the ultimate landowner."

It is undeniable that the land is not producing as much as it might do. It is equally undeniable that no comprehensive attempt has been made to get it to do so. Almost every estate has an amenity value and a sporting value in addition to its agricultural value—thus the land has to serve three masters. Trees, hedgerows, grass, parks, plantations, warrens, are all kept up, even when they are in direct conflict with the agricultural productivity of the land. To make matters worse, the farmer lacks the manufacturer's certainty of return. The manufacturer works on a contract; he knows precisely how much he will be paid, and what output he may

expect; he usually has a quick return for his outlay, and he can insure against many of his risks. The farmer, on the other hand, rarely, if ever, works on a contract; he starts expending money in August on a crop that will not be sold for fifteen months; he does not know definitely what price he will receive, or what yield he will get. The whole thing is a hazard, and he cannot insure against his risks. Consequently he has to allow a large margin for safety, and he balances his risk on the arable land by having a considerable area of grass on which the risk is at a minimum.

The application of scientific methods has decreased the risk and increased the effectiveness of the capital involved, but, of course, it cannot deal with the great factor of price. This problem is for the statesman, and when he comes to deal with it he will find Mr. Hall's book a useful guide. E. J. R.

OUR BOOKSHELF.

The New Public Health. By Prof. H. W. Hill. Pp. x+206. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1916.) Price 5*s.* 6*d.* net.

THE object of this book is to bring before the general public the newer conceptions of the aims and methods of public health. The older public health mainly dealt with the environment; the newer is chiefly concerned with the individual. The old teaching stated that infectious diseases were generated in the foul, ill-smelling, unventilated, sunless hovels of the slums; that a pinhole leak in some plumbing fixture accounted for diphtheria or typhoid fever; that dampness caused malaria, and impure water yellow fever. The new teaching begins and usually ends with the search for (*a*) the infected individual, (*b*) the routes of spread of infection from that individual, (*c*) the routes of disposal of the excreta of the community, by which, if infection occur, the infecting agent might reach the members of the community. To locate all the infective individuals of the community and to guard all their discharges is the ultimate goal of modern preventive measures.

The author surveys the sources, routes, and control of infectious diseases, the old and the new practice in the control of epidemics, and individual and community defence and administration. The book is written in a vigorous and trenchant style which arrests the attention and carries conviction. The only criticism of it that might be passed is that the casual reader might gather that such factors as garbage heaps and ill ventilation are of little moment to the public health, whereas actually the author indicates that they are not to be neglected, though their importance and significance are very different from what used to be considered to be the case. R. T. H.

The Pathology of Tumours. By Dr. E. H. Kettle. Pp. viii+224. (London: H. K. Lewis and Co., Ltd., 1916.) Price 10*s.* 6*d.* net.

IN this book the author gives an excellent account of the characters, occurrence, and general pathology of tumours, innocent and malignant. No doubt students and practitioners will find it of considerable service, though it may be remarked that we fail to find in it any novelty in matter or arrangement, or anything that has not been just as adequately stated in some other books that could be named. The illustrations, however, are both numerous and excellent, and this feature will probably be the one which will recommend the book.

In the opening chapters the general biology of tumours is dealt with, including statistics of occurrence, the experimental study of tumour growth, and the general principles of treatment. Here, however, we fail to find any reference to changes in the body fluids which occur in malignant disease, such, for instance, as alterations in the anti-tryptic power and lipoclastic action of the blood-serum.

In the second part the naked-eye and microscopical characters of the different forms of tumours are described, and finally the occurrence of tumours in the various organs and tissues of the body is detailed. Altogether the book gives a very practical summary of tumour formation and development in general.

Harper's Hydraulic Tables for the Flow of Water, in Circular Pipes under Pressure, Timber Flumes, Open Channels, and Egg-shaped Conduits, with much Accessory Information. By J. H. Harper. Pp. 192. (London: Constable and Co., Ltd., 1916.) Price 8*s.* 6*d.* net.

WITH painstaking assiduity, the author has worked out, with the aid of certain well-established formulæ, what he terms a "grill" or network of solutions, covering such problems as are likely to arise in actual practice "regarding the flow of water in either closed or open conduits, with any reasonable assumption of rugosity and with any rational arrangement of grade, in quantities from a small fraction of a foot to several thousand feet per second." The formulæ selected are those of D'Arcy, Bazin, and Kutter—all authoritative in their degree, but labouring under the disadvantage of possessing extremely variable coefficients, which render their application a matter of some difficulty, quite apart from the complexity of the expressions themselves. It has recently been shown by Mr. A. A. Barnes that the inherent cause of this diversity lies in the strict adherence to the fundamental equation of Chezy, viz. $v = c\sqrt{rs}$, and that if the equation were written in the form $v = cr^{\alpha}s^{\beta}$, coefficients could be determined which are simple in character and constant for the same class of channel. For those who prefer older methods the volume will undoubtedly prove of use in obviating the necessity for working out experimental cases in detail. Within the range of the tabulated results, it is easy to interpolate values sufficiently correct for preliminary approximations. The tables are also diagrammatically expressed in charts, and there are some supplementary notes on hydraulic formulæ generally, which make the book a succinct little manual on the subject. B. C.

LETTERS TO THE EDITOR.

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

Productive Work and Classical Education.

AT this time people are awakening to the mischief that has been done to this country by the neglect of science as a part of education, and there seems a danger of the pendulum of opinion swinging too far, and of classics being looked upon as something to be completely eliminated from the educational curriculum. In relation to this, I think a short personal anecdote may be instructive. In 1868 I had the privilege of working with the late Prof. Willy Kühne as his only student in his laboratory in Amsterdam, and the friendship which began there continued up to the time of his death.

Prof. Kühne was a most remarkable man. He was, I think, one of the greatest physiological chemists of last century, and was quite half a century in advance of nearly all his contemporaries. Belonging to a rich banking family, he could go where he pleased, do what he pleased, and obtain any optical or other apparatus he needed, regardless of cost. He accordingly elected to work with Claude Bernard, and used the chemical and microscopical skill which he acquired to such advantage that at an age when most men are only thinking of beginning university life he had produced a monograph on protoplasm and contractility ("Ueber Protoplasma und Contractilität"), which was not only far in advance of anything then in existence when it was written, but still remains unrivalled half a century later.

His great ability led to an invitation to become professor of physiology at Amsterdam. After some years he was invited to occupy the chair at Heidelberg rendered vacant by the transference of Prof. H. von Helmholtz to Berlin. This invitation he accepted, and remained at Heidelberg until his death.

Such a career seems ample vindication of the claim that classics is unnecessary to education, more especially if it be borne in mind that Kühne was an exceptionally good linguist, speaking three or more languages with perfect ease, that he had travelled much in Europe, and was a perfect encyclopædia of knowledge and criticism in painting and sculpture. Yet there was one bitter drop in his cup of knowledge and honour. The nature of this was confided to me as a strict secret by our mutual friend, Prof. Hugo Kronecker, when we were discussing together some data for a short life of Kühne which Kronecker thought of writing. As both Kühne and Kronecker are dead, there is no further reason for preserving the secret, which I for one never could have suspected. It was that Kühne had felt deeply the scorn with which some people had regarded him because he had never taken a classical degree. Fools they were no doubt, but their attitude probably indicated the mental attitude of the mass of German graduates to whose devotion to a scientific education we are now inclined to attribute much of Germany's success.

LAUDER BRUNTON.

1 De Walden Court, New Cavendish Street,
London, W., July 15.

Gravitation and Temperature.

DR. P. E. SHAW'S striking experimental result (*Phil. Trans.*, 1916) as to *a variation* of gravitational attraction with temperature of the *large* mass, and that of Poynting and Phillips as to *no variation* in attraction with temperature of the *small* mass, may seem reconciled satisfactorily by the formula put forward by the latter collaborators, and quoted by Dr. Shaw in NATURE (July 13), viz. :—

$$F=G\left(1+\kappa\frac{MT+mt}{M+m}\right)\frac{Mm}{r^2} \quad . \quad . \quad . \quad (1)$$

where T and t are the absolute temperatures of the masses M and m respectively, placed at a distance r apart. But it seems desirable to notice that this formula does not in general allow of the derivation of the attraction of a finite mass from the attractions of its component particles in the usual way by vector addition.

Thus, for a pair of particles, each of mass m, at temperatures T and t, and placed r apart, we have as the attraction :—

$$F_1=G\left(1+\kappa\frac{T+t}{2}\right)\frac{m^2}{r^2} \quad . \quad . \quad . \quad . \quad (2)$$

Again, the attraction of *two* particles, each of mass m, close together, and at temperature T, on a single particle of mass m and temperature t at a distance r, would be :—

$$F_2=G\left(1+\kappa\frac{2T+t}{3}\right)\frac{2m^2}{r^2}. \quad . \quad . \quad . \quad (3)$$

Hence, F_2 is not, in general, equal to

$$2F_1 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (4)$$

For the effective temperature of the system varies between those of the particles, according to their relative masses, just as the position of the centre of mass of a system varies among those of its particles according to their masses.

Accordingly, the component attractions do not sum to their resultant in the usual way.

Of course, this is no disproof of the formula, but must be regarded simply as a somewhat grave consequence involved by the formula. It is indeed a consequence that may well give us pause before accepting the formula, pending either (*a*) a rigorous derivation of the formula theoretically, or (*b*) some crucial experimental evidence that it is preferable to other formulæ.

Suppose, instead of formula (1), we try the following :—

$$F=G(1+\alpha\theta)\frac{M(1+\beta T)m(1+\beta t)}{r^2} \quad . \quad . \quad (1a)$$

where, as before, T and t are the absolute temperatures of the masses M and m, and θ is the mean, or effective, temperature of the space, whether vacuous or not, between the masses.

It is to be noted that, with Max Planck's theory of entropy, a temperature is now theoretically assignable to a vacuous space which is a field of radiation. Using this different formula for the cases already considered, if one particle at temperature t is attracted by one or two particles at temperature T, we have the relations :—

$$F_1=G(1+\alpha\theta)(1+\beta T)(1+\beta t)\frac{m^2}{r^2} \quad . \quad (2a)$$

$$F_2=G(1+\alpha\theta)(1+\beta T)(1+\beta t)\frac{2m^2}{r^2} \quad . \quad (3a)$$

So here,

$$F_2=2F_1 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (4a)$$

And, however we vary the mass at temperature T, *provided the temperature θ remains unchanged*, the attraction on the single particle would vary in direct proportion to the attracting mass.

This new formula, then, restores the validity of the vector addition of the component attractions. It seems, however, at first sight to have lost the power

to explain the contrasted experimental results of the temperature effect of the large mass, and the lack of it in the small mass. For, obviously, the temperatures of the masses may now be interchanged without altering the value of the attraction if only the value of θ is constant.

But, in the actual experiments by Dr. Shaw, might not the heating of the large mass near the small one possibly involve an increase of θ? And again, in the heating of the small mass carried out by Poynting and Phillips, the earth itself being the large mass, might not the value of θ be practically constant? If so, possibly the formula (1a) here suggested might prove consistent with all the experimental results just reviewed.

E. H. BARTON.

Nottingham, July 18.

The Gun-firing on the Western Front.

IN NATURE for July 13 Dr. C. Davison directs attention to Dr. van Everdingen's investigations with regard to the propagation of sound, and he also refers to the inaudibility of the reports in the face of a gentle wind when the observer was comparatively near. In this neighbourhood the sounds are heard distinctly when a quiet situation is found, but a very marked peculiarity is the fact that the direction of the wind seems to make no appreciable difference in the intensity of the sound. For example, on July 19 the booming was very intense and quite easily heard with the wind blowing from the north-west. On the 20th, with the wind from the east, the audibility was no greater, possibly not so great. Westerly winds have been frequent of late, but have not diminished the sounds at all, whereas it is a fact that on some occasions with an easterly wind no sounds were heard. It is, of course, impossible to say whether there was firing or not on these latter occasions, but it is certainly worth recording that on the majority of the occasions upon which I have heard the sounds since the end of 1914 I have at the same time observed that the wind was westerly.

Presumably in this neighbourhood we are beyond the silent zone, and in the second-sound area, and the suggestion seems to be that in this area the effect of wind is negligible. Two further points worth noting are the facts that the sounds here are practically as intense as at Brighton, though we are about fifty miles farther from the source, and also that the direction of the source is always fairly obvious.

The sounds being so distinct here, and having lost so little intensity in the fifty miles which lie between this neighbourhood and Brighton, it seems likely that they should still be audible at much greater distances. Possibly they could be traced to very extreme distances with the aid of some very sensitive sound detector, if any suitable instrument is available.

It would also be interesting to get evidence from aeronauts. Plenty of balloons are in use now, and doubtless the sounds have been noted, if audible.

C. WELBORNE PIPER.

Blackheath, S.E.

Portraits of Wm. Smith.

IN Phillips's "Memoirs of Wm. Smith," the father of English geology, p. 125, reference is made to his portrait, taken in 1805, by Solomon Williams, and another by Jackson, and still another by Fourau, the last presumably being now in the Geological Society's rooms. So far I have been unable to trace the portraits by the two first-named artists. Can any of your readers assist me?

T. SHEPPARD.

Museum, Hull.

NATIONAL AFFORESTATION.

SIR W. SCHLICH, in an important article in the *Quarterly Journal of Forestry* for July, urges the importance of afforestation and discusses the measures which should be taken to secure for the nation a sufficient supply of timber in the future. The quantity of timber used in the United Kingdom is enormous, and increases year by year. In addition to the home production, estimated at about 2,000,000 loads annually, there was an import of 11,590,318 loads, valued at 33,788,884*l.*, in 1913, as compared with 10,104,504 loads, worth 25,676,988*l.*, in 1899. Only 10 per cent. of the total timber imported in 1913 came from British possessions, as against 22 per cent. in 1899. All these figures relate solely to the raw material, timber; but there must be added wood manufactures to the value of 3,583,187*l.*, and wood-pulp estimated at 4,617,739*l.*, entering our ports in 1913. We draw our main supplies from Russia, Sweden, Norway, France, the United States, and Canada. In all these countries, except Russia and Canada, the tendency in the future will be towards restricted production, diminished export, and increasing prices of timber, owing to the annual growth in the forests not being sufficient to replace what is taken away by cuttings and by forest fires. Our main imports are coniferous timber, pitwood, and wood-pulp, three classes of forest produce which can be profitably produced in our climate. A review of the whole situation shows that a considerable increase in the area under timber in the United Kingdom would be economically sound, and would also serve as an insurance against an unexpected timber famine brought about by international complications in the future.

Sir W. Schlich discusses at length the amount and nature of the land available for afforestation. As most forest work is done in winter, when agricultural work is slack, a scheme of afforestation will provide extra labour for agriculture in spring and summer, and consequently will be a considerable help to increased productivity of the land generally. This point is of especial importance in connection with small holdings, and should be taken into account when considering schemes for the settlement of discharged soldiers after the war. Very large continuous forest tracts are not necessary. Small blocks of woodland, with a minimum area of 500 acres, scattered over the country in the vicinity of small holdings, make an ideal combination. Sir W. Schlich summarises his proposals for afforestation as follows:—

(1) The afforestation of not less than 3,000,000 acres of surplus land, by planting about 30,000 acres a year.

(2) Private proprietors, Corporations, and the State should take part in the work of afforestation, the State doing that part which the other two agencies are not willing or able to undertake.

(3) Financial assistance should be given to private proprietors in the work of afforestation, if necessary, by making advances to them at the rate of interest at which the State can take up money.

To secure success from the very outset it is essential

Science and state

to create a separate branch for forestry in the Board of Agriculture to deal with all forestry questions. There should be a Director of Operations, occupying the post of Joint Secretary or Assistant Secretary, to begin with. He should be a duly qualified forest expert, and be assisted by an adequate number of trained inspectors to supervise the field work. Well-considered plans of operations must at once be drawn up for each block, laying down the order of planting, deciding the selection of species to be planted according to the quality of the soil in each subdivision, drawing up a network of roads for future transport, to be constructed when required, and other matters.

A NATIONAL STATUTORY BOARD OF SCIENCE AND INDUSTRY.

WE have received for publication from the British Science Guild the following memorandum on the relations which should exist in future between the State and science, and suggesting that a national statutory Board of Science and Industry should be formed. The memorandum, which has been forwarded to the Government, is signed by some 220 of the most important representatives of industry, science, and education :—

The British Science Guild, which was founded in 1905 with the object of bringing home to all classes "the necessity of applying the methods of science to all branches of human endeavour, and thus to further the progress and increase the welfare of the Empire," is of opinion that the present European crisis affords a unique opportunity for impressing upon all who are engaged in the executive functions of government, as well as upon those who are concerned with industry and commerce, the paramount importance of scientific method and research in national affairs.

There has been much discussion upon these matters, and the following conclusions are submitted by the Guild as representing authoritative opinion :—

A. The material prosperity of the civilised world during the past century is mainly due to the application of science to practical ends.

B. While we stand high among all nations in capacity for original research, as represented by the output of our scientific workers, this capacity has been comparatively little utilised in British industry.

C. The State has neglected to encourage and facilitate scientific investigation, or to promote that co-operation between science and industry which is essential to national development.

D. Modern conditions of existence demand that instruction in science, and training in scientific method, should be a fundamental part of education.

E. The present control of all stages of educational work, from the primary school to the university, mostly by men who have an inadequate appreciation of the meaning and power of science, is largely responsible for the unsatisfactory preparation commonly provided for the work of life.

Since its foundation the British Science Guild has urged that, in the interests of national welfare, serious attention should be given to these defects, and steps taken to remedy them. The establishment of the scheme for the development of scientific and industrial research, under a Committee of the Privy Council, is a welcome recognition of the intimate relations between scientific investigation and industrial advance; and the Advisory Council which advises the Committee as to the expenditure of the sums provided by Parliament, amounting for the year 1916–17 to 40,000*l.*, has already been responsible for the institution of researches which should lead to most valuable industrial results. The outlook of the Council may, however, be extended profitably in several directions; for it should be even more comprehensive than that of the Development Commission, which provides for the development of rural industries, among other matters. This Commission, with the Board of Agriculture and Fisheries, and the Imperial Institute, which has recently been transferred from the Board of Trade to the Colonial Office, is not concerned directly with manufacturing industries, upon which so large a part of the nation's prosperity depends.

The field of the Privy Council Committee and its Advisory Council is thus distinct from that of any existing State department; and it should embrace all progressive industry and science. It is suggested that a Board or Ministry is necessary to discharge the functions indicated in Clause I. of the recommendations subjoined, in such a way as to fulfil modern requirements.

I. A national statutory Board of Science and Industry, the permanent staff of which should consist mainly of persons of wide scientific knowledge and business experience, should be established to :—

(1) Promote the co-ordination of industrial effort.

(2) Secure co-operation between manufacturers and all available laboratories of research.

(3) Co-ordinate, and be the executive centre of, such joint scientific committees as have been formed by the Royal Society, the Chemical Society, and various trade and educational associations.

(4) Undertake inquiries as to products and materials, and generally to serve as a national bureau of scientific and industrial intelligence.

(5) Collect and publish information of a scientific and technical character; and provide so far as possible for the solution of important problems bearing upon industry.

(6) Institute a number of paid advisory committees consisting of men of wide scientific knowledge assisted by expert investigators and technologists who should receive reasonable fees for their services.

(7) Organise scientific effort on the manufacturing side and in commercial relations with other countries.

(8) Arrange measures for the mobilisation of the scientific, industrial, and educational activities of the nation so as to ensure ready response to national needs and emergencies.

(9) Encourage investigation, and, where necessary, give financial aid towards the synthesis and artificial production of natural products and for other researches.

Such a Board would naturally administer the scheme of the Privy Council Committee, as well as take over certain functions of existing departments and boards.

The functions of the Board would be much the same as regards the promotion of scientific and industrial research and training, the co-operation of universities with industries through trade associations, and the maintenance of a record of scientific and technical experts, as outlined in the report on "British Trade after the War" by a Sub-Committee of the Board of Trade.

II. In all departments of State in which scientific work is carried on, adequate provision should be made for the periodical publication and wide distribution of bulletins, leaflets, and reports, so that increased public interest and attention may be encouraged in the results.

III. Every industrial undertaking, subsidised or otherwise assisted by the State, should have upon its board of directors men who possess expert scientific knowledge of the business in which they are engaged.

IV. In order to develop industries which especially require the services of scientific workers, adequate remuneration and improved prospects should be offered by the Government, by municipal corporations, and by manufacturers to men who have received an effective scientific training. Means should be found of compensating and rewarding persons whose researches have proved of decided national or public advantage without being profitable to themselves.

V. A knowledge of science should be regarded as an essential qualification for future appointments in the departments of the public service concerned with industrial, scientific, and technical developments. The Royal Commission on the Civil Service recommended in 1914 that a Committee should be appointed to consider the present syllabus of subjects of examination for clerkships (Class I.). This Committee should be constituted without delay, and science as well as other branches of modern learning should be adequately represented upon it, and upon the Civil Service Commission itself.

VI. Measures should be taken to revise the educational courses now followed in the public schools and the Universities of Oxford and Cambridge.

VII. In elementary and secondary schools supervised by the Board of Education, more attention should be given to scientific method, observation, and experiment, and to educational handwork.

THE NATIONAL RESEARCH COUNCIL OF THE UNITED STATES.

PRELIMINARY STATEMENT.

IN response to a request from the President of the United States, the National Academy of Sciences has undertaken to organise the scientific resources of educational and research institutions in the interest of national preparedness.

Public welfare and national security depend upon industrial progress and military efficiency, and these in turn result from practical applications of scientific knowledge. A superstructure, no matter how perfect, must have firm foundations, and thus the development of our industries must go hand in hand with the advancement of science through research.

Euclid, working out problems in pure mathematics in Alexandria, prepared the way for the calculations of the engineer. Galileo, discovering the satellites of Jupiter, convinced the world of the truth of the Copernican theory, broke down absurd medieval conceptions which prevented scientific progress, and stimulated exploration and advance in every field. Pasteur, studying the optical properties of certain crystals with no thought of practical result, was led to his investigations of bacteria and his epoch-making discoveries for the benefit of mankind.

Thus scientific research in the laboratory, whether for the advancement of knowledge or for direct industrial application, is a most fundamental form of national service, which should be encouraged by every possible means. Since the beginning of the war this fact has been recognised in England by the creation of a Scientific Council, and in Australia by the establishment of a National Institute of Science and Industry. Both bodies will devote their efforts to the promotion of scientific and industrial research.

ORGANISATION OF THE NATIONAL RESEARCH COUNCIL.

During the Civil War the need of scientific advice was clearly recognised by our Government. Accordingly the National Academy of Sciences was chartered in 1863 by Act of Congress, which stipulated that "the Academy shall, whenever called upon by any department of the Government, investigate, examine, experiment, and report upon any subject of science or art. . . ." During the war, and frequently in later years, the Academy has been consulted by Congress, by the President, and by various members of his Cabinet.

The Naval Consulting Board, recently appointed by the Secretary of the Navy, has recommended the establishment of a naval experimental and testing laboratory and taken steps of far-reaching importance in the mobilisation of the industrial resources of the nation. The National Academy is now requested by the President to organise the extensive scientific resources of existing research laboratories in the interest of preparedness. To this end it has established a National Research Council.

The *purpose* of the Council is to bring into co-operation existing Governmental, educational, industrial, and other research organisations, with the object of encouraging the investigation of natural phenomena, the increased use of scientific research in the development of American industries, the employment of scientific methods in strengthening the national defence, and such other applications of science as will promote the national security and welfare.

Membership.—The Council will be composed of leading American investigators and engineers, representing the Army, Navy, Smithsonian Institution, and various scientific bureaux of the Government; educational institutions and research endowments; and the research divisions of industrial and manufacturing establishments.

In order to secure a thoroughly representative body, the members of the Council are being chosen in consultation with the presidents of the American Association for the Advancement of Science, the American Philosophical Society, the American Academy of Arts and Sciences, the American Association of University Professors, and the Association of American Universities, and with the advice of a special committee representing the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Electrical Engineers, and the American Chemical Society. Members of the Cabinet will be asked to name the representatives of the various departments of the Government.

Research committees of two classes will be appointed: central committees, representing various departments of science, comprised of leading authorities in each field, selected in consultation with the president of the corresponding national society; local committees in co-operating institutions engaged in research.

The Council of the Academy will recommend to the National Research Council the following plan of procedure, subject to such modification as may seem desirable:—

(1) The preparation of a national inventory of equipment for research, of the men engaged in it, and of the lines of investigation pursued in co-operating Government bureaux, educational institutions, research foundations, and industrial research laboratories; this inventory to be prepared in harmony with any general plan adopted by the proposed Government Council of National Defence.

(2) The preparation of reports by special committees, suggesting important research problems and favourable opportunities for research in various departments of science.

(3) The promotion of co-operation in research, with the object of securing increased efficiency; but with careful avoidance of any attempt at coercion or interference with individual freedom and initiative.

(4) Co-operation with educational institutions, by supporting their efforts to secure larger funds and more favourable conditions for the pursuit of research and the training of students in the methods and spirit of investigation.

(5) Co-operation with research foundations and other agencies desiring to secure a more effective use of funds available for investigation.

(6) The encouragement in co-operating laboratories of researches designed to strengthen the national defence and to render the United States independent of foreign sources of supply liable to be affected by war.

Co-operating Bodies.—Arrangements have been made which assure the Council of the hearty co-operation and support of members of the Cabinet and other officers of the Government; the officers of many national societies; the heads of the larger universities and research foundations; and a long list of the leading investigators in Government bureaux, research foundations, industrial research laboratories, and educational institutions.

From the cordial interest shown by all those who have learned of the work in its preliminary stages, it is evident that as soon as a widespread request for co-operation can be extended it will meet with general acceptance.

EDWIN G. CONKLIN,
SIMON FLEXNER,
ROBERT A. MILLIKAN,
ARTHUR A. NOYES,
GEORGE ELLERY HALE, *Chairman.*
(*Organising Committee.*)

PSYCHOLOGICAL EFFECTS OF ALCOHOL.[1]

THE literature on the alcohol question is already vast, but it promises to be bigger still if the ambitious programme of Prof. F. G. Benedict and his colleagues is accomplished to the full. It must be more than thirty years ago that, feeling the tyranny of the ultra-teetotal party in America, the late Prof. Atwater founded a famous committee with the object of freeing, at any rate, the scientific section of the community from the limitations of opinion and research on the question which the so-called temperance party sought to impose upon them. Excellent work they did, but in the intervening years the methods of research have been so improved that the work of that committee urgently needed revision. So in January, 1913, Prof. Benedict invited the co-operation of physiologists throughout the world to share in a gigantic investigation of the numerous problems presented by the dietetic use of alcoholic beverages, and obtained sympathetic answers from a large number of eminent people in all countries. In the present volume a long list is given of these, and grateful acknowledgment is made of friendly, helpful letters from the majority of them.

This appears to have completed the measure of their co-operation, and Prof. Benedict, so far as actual work is concerned, has been left to tread an almost lonely furrow. The brochure from the pen of himself and Dr. R. Dodge deals only with quite a limited branch of the subject, but the results obtained are of considerable importance. The experiments were performed with moderate doses of alcohol (30 to 45 c.c.), and were carried out with great perfection of technique and with proper controls. The majority of the subjects were normal young men, a few were psychopathic owing to previous misuse of alcohol, fewer still were the number of actual teetotalers who consented to lend themselves to the experiment, and one only was a confirmed heavy drinker; the results obtained with him can be left out of account, as he soon rebelled against a limitation of his usual supply of whisky. Otherwise, with differences in detail, the main results were the same in all cases.

The principal question investigated was whether or not these small doses of alcohol produced any delay of, or interference with, various neuro-muscular processes, and the selected processes were some of them simple, such as the knee jerk, others more complex, such as reflexes, in which the eyes were concerned, and others, still more complicated, involved mental operations, such as association of ideas and memory. Electrocardiograms and pulse records were also taken, and the cardiac acceleration noted was found to be due to a depression of the inhibiting mechanism. The answer to the main inquiry is certainly a rather unexpected one, so insistent are the claims of the teetotalers that even a moderate drinker is putting an enemy into his mouth to steal away his brains. For it was found that, whereas these small doses of the drug depressed the simplest reflex actions, such as the knee jerk, the more complex the neural arc involved in a reflex, the less was this effect manifested, whilst in operations involving mental work and memory the effect was either nil or an improvement was noted. In other words, the lower centres (*e.g.*, the vagus centre and the knee-jerk centre in the lumbar cord) are depressed most, and the highest least. "If alcohol had selectively narcotised the higher centres it would have been used as an anæsthetic centuries ago." W. D. H.

[1] "Psychological Effects of Alcohol: an Experimental Investigation of the Effect of Moderate Doses of Ethyl-alcohol on a Related Group of Neuro-muscular Processes in Man." By Raymond Dodge and Francis G. Benedict. Pp. 281+32 figures. (Carnegie Institution of Washington. Publication No. 232. 1915.) Price 2.50 dollars.

THE FUNERAL OF SIR WILLIAM RAMSAY.

THE funeral of Sir William Ramsay took place at Hazlemere, High Wycombe, on Wednesday, July 26, in the presence of a large and representative gathering comprising very many who had been students of his. The congregation included:—Sir J. J. Thomson and Prof. Emerson Reynolds (representing the Royal Society); Prof. F. G. Donnan, Prof. E. G. Coker, Prof. A. R. Cushny, Prof. G. D. Thane, Prof. J. A. Platt, Dr. S. Smiles, Mr. H. Keene (acting treasurer), and Dr. W. W. Seton (secretary) (representing University College, London); Dr. Alexander Scott, Sir W. Tilden, Sir J. Dobbie, Lieut.-Col. A. Smithells (also representing the University of Leeds), Prof. Liversidge, Prof. J. M. Thomson (also representing King's College, London), Prof. Frankland (also representing the University of Birmingham), Prof. H. E. Armstrong, Prof. J. F. Thorpe, Prof. W. H. Perkin (also representing Magdalen College, Oxford), and Prof. Phillips (representing the Chemical Society); Sir Boverton Redwood, Sir A. Pedler, Lady Napier Shaw, and Mr. R. Mond (representing the British Science Guild); Sir Philip Magnus and Prof. H. Jackson (representing the University of London); Sir Henry Craik, M.P. (representing the University of Glasgow); Prof. Philip and Dr. Schryver (representing the Imperial College of Science and Technology); Prof. C. Lloyd Morgan (representing the University of Bristol); Mr. T. F. Burton (representing the Society of Chemical Industry); Mr. A. Chaston Chapman (representing the Society of Public Analysts); Dr. L. Thorne (representing the Institute of Brewing); Prof. A. M. Worthington, Sir Napier Shaw, Sir Edward and Lady Brabrook, Dr. Veley, Dr. J. A. Harker, Mr. O. Hehner, Dr. W. Gray, Sir J. Mackenzie Davidson, Dr. G. Carey Foster, Dr. G. Senter, Dr. Morris W. Travers, Dr. Lewis Reynolds, Mr. W. Macnab, Mr. G. McGowan, Dr. J. Scott Keltie, and Mr. and Mrs. R. Priestley. The last-named, it is of interest to note, in addition to paying their personal tribute of respect, represented the family of the great chemist Priestley. We understand that telegrams of condolence were received from the Franklin Society, the New York section of the Society of Chemical Industry, the Principal of Houston University, Texas, and the President of the Instruction Publique de France, also many letters and telegrams from the presidents and secretaries of various learned societies among the Allies, and that a wreath has been, or is being, sent by the Chemical Society of France. The foregoing list, which does not aim at completeness, testifies to the esteem and affection felt for the great man of science whose remains were laid to rest a week ago.

DR. J. A. HARVIE-BROWN.

THE ranks of naturalists have suffered a great loss through the death of Dr. J. A. Harvie-Brown, who took for many years an active and effective interest in ornithology and faunistic studies. He was born at Dunipace in Stirlingshire in August, 1844, and died there on July 26 last. He studied at the universities of Edinburgh and Cambridge, travelled widely in Norway, Russia, Transylvania, and elsewhere, and had a very intimate acquaintance with Scotland. A very active man in early life, and keen with his rod and gun, he was for many years unable to move about much, and was but little known, except by his writings, to the younger naturalists. To the end, however, he kept up his interests, and was a very good correspondent. His generous recognition of the work of other naturalists was very characteristic, and he was always ready to give assistance from his extraordinary store of information. He had a very high standard of precision and cautiousness of statement, and was not slow to winnow wheat from chaff, but there was always good-humour behind his tonic criticisms. Dr. Harvie-Brown had a very extensive and accurate knowledge of birds and their habits, and was particularly interested in problems of distribution and migration. His studies of the capercaillie, the squirrel, the fulmar, and so on are models of their kind. He was for many years one of the editors of the *Annals of Scottish Natural History*, and continued his assistance when that became, in 1912, the *Scottish Naturalist*. The number of articles and notes that he published in those journals and elsewhere was enormous. Dr. Harvie-Brown will be most remembered as the editor of, and chief contributor to, the well-known series of volumes on the "Vertebrate Fauna of Scotland." Along with Mr. T. E. Buckley, he wrote the volumes on Sutherland, Caithness, and Cromarty (1887), the Orkney Islands (1891), Argyll and the Inner Hebrides (1892), the Moray Basin (1895), and he was alone responsible for that dealing with the Tay Basin and Strathmore (1906). The fine workmanship of these volumes is widely recognised. Dr. Harvie-Brown was a landed proprietor, and a good instance of the gentleman of leisure who worked hard at ornithology and came to have an expert knowledge of some of its aspects. In 1912 he received the honorary degree of LL.D. from the University of Aberdeen in recognition of his contributions to a knowledge of the Scottish fauna.

NOTES.

THE second National Exposition of Chemical Industries will be held in New York on September 25–30. During the same week the annual meeting of the American Chemical Society will take place. The meetings of the American Electrochemical Society will be held on September 28–30.

ON Wednesday, July 26, the memorial to Sir William White, promoted by the Institution of Naval Architects, was formally handed over to the council of the Institution of Civil Engineers. The presentation was made by Admiral Sir Reginald Custance and Earl Brassey, who stated that 3000*l.* had been collected. The money is to be allotted to the foundation of a Research Scholarship Fund, the provision of a memorial medallion to be placed in the hall of the Institution of Civil Engineers, and a grant to Westminster Hospital. The memorial was accepted by

Mr. Alexander Ross, the president of the Institution of Civil Engineers, and now occupies a position on the right hand of the entrance hall. The medallion consists of a portrait of Sir William, carved in relief in white stone, with a warship visible in the distance. The carving is mounted on grey marble, and carries underneath it a tablet, on which are inscribed the words:—"Sir William Henry White, K.C.B., LL.D., D.Sc., F.R.S., President, 1903–1904, Director of Naval Construction, 1885–1902. A Tribute from the Shipbuilders of Many Nations." Above is a scroll bearing the motto, "Build Staunch, Build True."

NEWS of Sir Ernest Shackleton's latest attempt to rescue his comrades on Elephant Island is expected daily. Last week the small Chilean steamer *Yelcho* returned to Ushuaia, in Tierra del Fuego, after towing to a point 240 miles south of Cape Horn the schooner *Emma*, with the rescue party on board. The *Yelcho* was in a damaged condition, but that may be the result of heavy seas. The telegram makes no mention of ice, and the report that the weather was favourable when the *Yelcho* turned back has really no bearing on the prospects of approaching Elephant Island. As already announced, the *Discovery* will be dispatched by the British Admiralty in the event of the *Emma* failing. It will, of course, take the *Discovery* some sixty days to reach Elephant Island, but, whatever the condition of the pack may be, she is powerful enough to force her way through and reach the stranded men.

A MALARIA mosquito survey is being conducted, under the supervision of Prof. W. B. Herms and Mr. S. B. Freeborn, on behalf of the California State Board of Health and the University of California. So far endemic malaria has been found at a maximum height of 5500 ft., and the anopheline carriers have been located. It is estimated that three summers will be required to complete the survey of the State.

THE Ellen Richards Research prize of 200*l.* for the best thesis written by a woman embodying new observations and new conclusions based on independent laboratory research in biology (including psychology), chemistry, or physics is offered by the Naples Table Association for Promoting Laboratory Research by Women. Application forms are obtainable from Mrs. A. W. Mead, 283 Wayland Avenue, Providence, Rhode Island, U.S.A. The competing papers must reach the chairman of the committee before February 25, 1917.

WE regret to announce the death, on July 25, at the age of seventy-six, of Mr. Roland Trimen, F.R.S.

WE note with regret the death, on July 28, at the age of seventy-three, of Sir W. H. Power, K.C.B., F.R.S., from 1900 to 1908 principal medical officer of the Local Government Board.

THE death is announced, at the age of eighty years, of the anthropologist, Prof. Johannes Ranke, of the University of Munich.

IT is with great regret that we learn that Lieut. Harper has been killed in action. Edgar H. Harper, who was thirty-three years of age, was born at Dungannon, not far from Belfast. His university career was one of exceptional brilliancy. At Trinity College, Dublin, he won the McCullagh and Bishop Law's prizes, and was awarded a special prize in the junior fellowship examination. He also graduated with first-class honours in the Royal University of Ireland. About the year 1908 he was appointed assistant-lecturer in pure and applied mathematics in the University College of North Wales, and six years later he obtained the chair of mathematical physics at University College, Cork. Last year he took a commission in the South Staffordshire Regiment. During his tenure of office at Bangor Prof. Harper's talents were turned to good account in the important part that he played in developing the mathematical theory of aeroplane stability. Although this work was undertaken in collaboration, the numerous references to his name in Prof. Bryan's "Stability in Aviation" bear testimony to his powers as an original investigator, quite a number of the results stated in that work having been first discovered by him. It was Prof. Harper, for example, who first discovered the necessity of extending the theory of inherent stability to cases other than that of horizontal flight. One result was the discovery of serious theoretical limitations in the angle at which an aeroplane could be expected to rise in the air. In connection with the effect of a dihedral angle on lateral stability we are also indebted to Prof. Harper for a number of elegant geometrical and other artifices by which the use of cumbersome algebraic expressions is greatly reduced. He was also joint author with Mr. Ferguson of "Aerial Locomotion" in the series of "Cambridge Manuals of Science and Literature."

SECOND-LIEUT. F. W. CATON, who was killed in France on June 28, was a chemist of rare ability, though he had contributed little to the literature of the subject. His influence was chiefly through his lectures on chemical and botanical subjects, but he showed great promise in biochemical research, on which he was engaged when war broke out. In August, 1915, he was gazetted to a commission in the South Staffordshire Regiment, but it was felt that his chemical knowledge could be of greater service to his country, and he was transferred to the Royal Engineers in March last, and soon afterwards accompanied them to France. He had a brilliant academic career; he went to Oxford from Brighton Grammar School with a postmastership to Merton College, and took his degree with honours in 1906, afterwards taking the London B.Sc. with first class honours in chemistry. For two years he was at the Wellcome Chemical Research Laboratory, where his work was productive of good results. In 1910 he was appointed chemistry master at Taunton School, leaving there in 1912 to take up the appointment of lecturer and inspector under the Staffordshire Education Committee. His death at the early age of thirty-two is sincerely deplored by those who knew him, either as a man or as a scientific worker.

MALACOLOGISTS will learn with regret of the death, at the age of fifty, of Henri Fischer, the son of Paul Henri Fischer, the celebrated author of the "Manuel de Conchyliologie" (a translation and extension of S. P. Woodward's "Manual"). Henri was educated at the Ecole Normale Supérieure and became "Maître de Conférences" attached to the Sorbonne. Following in his father's footsteps, he took up the study of mollusca, but more especially from the morphological point of view. In his thesis, "Recherches sur la morphologie du foie des Gastéropodes," and in many other memoirs of his he paid special attention to the embryological development. Individually and in collaboration with other zoologists, he wrote numerous important papers on his chosen subject, besides contributing articles on the mollusca collected on the "Mission Pavie" (1904), on those obtained by Prince Albert of Monaco in his dredging expeditions (1906 and 1910), and on the Arctic mollusca procured by the Duke of Orleans in 1907 (1910), whilst with Prof. Jobin he described the Cephalopoda obtained on the scientific expeditions of the *Travailleur* and *Talisman* in 1880–1883 (1906). He was besides one of the editors of, and

a frequent contributor to, the *Journal de Conchyliologie,* from vol. xlii., 1894, to the date of his death.

WE have just learned that Dr. Francesco Bassani, professor of geology in the University of Naples, died at Capri on April 26 last. He was born near Vicenza on October 29, 1853, and graduated in the University of Padua. After studying vertebrate palæontology at Paris, Munich, and Vienna, he eventually became professor at Naples in 1887. He devoted himself especially to the study of fossil fishes, and published numerous important memoirs on the fossil fishes of Italy. With the aid of many devoted pupils he enriched the geological museum of the University of Naples until it became one of the greatest collections of fossils in Italy; and during the failing health of his latter years he never lacked willing helpers in the continuation of his researches. One of his most distinguished pupils, Prof. G. de Lorenzo, has contributed an appreciative notice of the professor, with a portrait and list of his writings, to the *Rendiconti* of the Royal Academy of Naples (May–June, 1916).

WE have received from Prof. A. Cushieri a copy of his oration delivered at the funeral of the late Mr. Napoleone Tagliaferro, who was for many years director of public instruction in Malta. Mr. Tagliaferro, who died in October, 1915, was a most active supporter of the scientific exploration of the Maltese Islands, and his loss is mourned by many friends in Britain as well as in his native land. He laboured much in making known the dolmens and other prehistoric monuments of Malta, and took part in many excavations of the caves which were inhabited by early man. He also helped to make the Valetta Museum worthy of the Maltese University.

IN a paper read before the Indian Section of the Royal Society of Arts on June 1 Prof. Wyndham Dunstan summarised the work which the Imperial Institute has done for India, more especially during the thirteen years in which the institute has been a Government establishment. The work may be classified under three heads. First, there has been organised for public exhibition a collection of articles representing important raw materials produced in the dependency, with illustrations of the chief industries, tabular information, and diagrams respecting Indian trade and commerce, and maps, pictures, and photographs of the cities and industries concerned. All important exhibits are provided with descriptive labels, which enable the visitor at once to gain general knowledge of the sources and uses of the materials shown; these include, for example, fibres, teas, silks, opium, lac, metals, and minerals. Secondly, valuable work has been done by the Scientific and Technical Research Department, including special investigations upon the constituents of Indian drugs, oils, foodstuffs, and minerals. These researches were carried out with the view of promoting the utilisation of Indian raw materials in British manufactures, and were often supplemented by technical trials on a commercial scale undertaken in conjunction with trade experts or manufacturers. Among examples mentioned in some detail are researches upon opium, podophyllum, aconite, henbane, and datura; tanning materials and leather; turpentine and rosin; Burma beans; various textile and other fibres; coals, and thorium minerals. Finally, there has been established a Technical Information Bureau, the functions of which are to collect, collate, and distribute published information respecting the production and industrial uses of raw materials. This branch has been increasingly patronised by merchants, manufacturers, and producers, and has gradually come to be recognised as a sort of general "clearing-house" for information of the character indicated. That there is room for India to contribute more largely in the future to the Empire's resources of raw materials is instanced by particulars given respecting cotton, copra, hides, beeswax, thymol, and potash supplies.

AN article of general interest has lately been published, in the *Lancet,* on some of the wounded in the battle of Jutland Bank. It gives great and well-deserved praise to Sir Almroth Wright's plan for the treatment of septic wounds, not by antiseptic dressings, but by continuous saline irrigation. The action of the saline fluid not only washes out the interstices of the wound, but promotes the outward flow of lymph, which carries out of the wound the causes of its infection. This method, founded on an immense amount of scientific research, has given admirable results in the war, and the national debt of gratitude to Sir Almroth Wright is larger than ever. But while we praise his work we must not be led into the folly of belitting that of Lister. To be able to prevent an accidental wound, already infected, from going septic—that was Lister's achievement in 1865, and the world's gratitude to him is everlasting. To be able to make, in the operations of surgery, a deep extensive wound, exposing freely any cavity of the body, and to know that the whole wound would heal rapidly and painlessly, from end to end, under a single dressing, left untouched until the wound was healed—that was Lister's achievement in the years after 1865. In the multitude of wounds there are thousands of opportunities for Wright's method, and there are thousands of opportunities for Lister's method, with those modifications which have since 1865 been found valuable. Nothing could be less logical, or less practical, than to represent these two methods as hopelessly at strife; each has its worth for the saving of limbs and lives.

MR. R. E. NICHOLAS, hon. curator of the Tudor House Museum, Southampton, has published a "Record of a Prehistoric Industry in Tabular Flint at Brambridge and Highfield, near Southampton" (Toogood and Sons, Southampton). He carefully describes the sites with explanatory diagrams, and devotes no fewer than forty-one plates to illustrations of the flints, which are photographed or drawn in a most effective manner. The modes of chipping of the specimens are remarkably varied, and in an appended note Dr. Robert Munro expresses the opinion that the industry represents the transition period between the Palæolithic and Neolithic civilisations. He compares the undoubtedly worked flints with those found at Cissbury, in the Oban caves, and in the shell mounds of Oronsay. Such discoveries appear to be rare along the south coast of England on account of its submergence in post-Glacial times.

THE great sea-serpent was observed on June 14 by a Swedish officer, Major O. Smith, in Lilla Värtan, a small tract of water not far from Stockholm, connected with the Baltic. "At 2.25 p.m.," he says, "we suddenly observed a movement on the water like a choppy swell, not more than 100 metres from us. Elsewhere the water surface was smooth, without boat or anything that could cause such a movement in the water. Observing more closely, we each of us saw a very distinct head, like a huge serpent head, somewhat elongate, larger than a man's head, and behind it a long, serpent-like body with a length of about 25 metres. One wave or hump followed the other, ten or more in number. Towards the hinder end a larger part of the body was raised above the water. For more than a minute we could observe this peculiar creature. It swam at a speed of about two knots. I have seen both porpoises and whales, and

can judge of the differences between the various movements in the water. This movement was like that of a serpent." A. F. Robbert writes to *Svenska Dagbladet* (June 21) that last year he observed a similar phenomenon due to sudden gusts of wind raising small regular billows which interfered with the reflection of the sun from the water and thus intensified the effect. Had he not been possessed of a scientific training and a critical spirit accustomed to observation, he would certainly have regarded the phenomenon as produced by a sea-serpent.

THE Brooklyn Museum Science Bulletin, vol. iii., No. 4, is devoted to the description of the sharks of Long Island. The authors, Messrs. J. T. Nichols and R. C. Murphy, have brought together some valuable information on this theme, in regard to the life-histories of these fishes. In referring to the food of the blue shark, the "junior writer" remarks that captured blue sharks, as well as certain other species, have the power of everting the stomach, so that the whole organ, turned inside out, trails a foot or more from the mouth. Possibly, it is suggested, this denotes a habit of ejecting indigestible material such as most sharks frequently swallow. In regard to the strange hammer-head shark, he remarks that its food includes squids, barnacles, and crabs, as well as menhaden and other fishes. But on one occasion, from an eleven-foot specimen, many detached parts of a man, together with his clothing, were taken. Outlines of the several species described add materially to the value of this report.

DR. JAMES RITCHIE'S paper on a remarkable brackish-water hydroid (Rec. Ind. Mus., xi., part vi., No. 30) is well worth the attention of students of the Hydrozoa. The organism described, *Annulella gemmata* by name, comes from a brackish pond in Lower Bengal. It consists of solitary, naked polyps temporarily attached by an adherent basal bulb which is surrounded by perisarc embedded in a gelatinous secretion. The usual mode of reproduction is by asexually produced buds, which break away from the parent as minute planulæ. Dr. Nelson Annandale, who collected the hydroid and studied it alive, believes that he saw gonosomes borne in a circle round the hydranth and breaking away as free medusæ, but Dr. Ritchie finds no trace of such an arrangement in the preserved material.

IN the Journ. Agric. Research (vi., No. 3) J. H. Merrill and A. L. Ford describe two nematode worms parasitic on insects. Both worms belong to the genus Diplogaster, the host of one being the longhorn beetle, *Saperda tridentata*, of the other *Leucotermes lucifugus*. The life-histories of the nematodes are described, and the termite-infecting species may be deadly to its host.

UNDER the title of "Staircase Farms of the Ancients," Mr. O. F. Cook, in the *National Geographic Magazine* for May, gives a striking account of the system of terrace cultivation and irrigation carried out in Peru during the Inca period. The writer, an accomplished botanist, remarks that, Peru being the home of the potato, it may be regarded as the source from which will be derived new stocks to maintain the varieties of this great food staple. Peru has many kinds of potatoes, superior in quality to the varieties now under cultivation in the United States, but most of them would not meet with approval, because the tubers would be difficult to peel on account of their irregular form and deep eyes. But with such an infinity of new forms to draw upon in South America, it should be possible by careful selection to combine all the desirable features. Peru offers a specially important field for economic botany, as many of the agricultural plants of this region are still entirely unknown in other countries.

"*Pinus longifolia*, a Sylvicultural Study," by R. S. Troup, is the latest issue in the series of Indian Forest Memoirs (Calcutta, 1916). This pine is one of the most useful trees in the Himalayas, where it forms at low altitudes extensive gregarious forests, which are accessible and easily worked, yielding a timber of fair quality. The tapping of the tree for resin and turpentine promises to develop into a considerable industry, and the revenue from this source in the Naini Tal division is now much greater than that derived from timber and fuel. The memoir is profusely illustrated, but lacks an index and also a map of the distribution of the forests of this valuable tree. The botanical account is elaborate, and errors in current text-books concerning the period of shedding of the leaves and the time required by the cones to ripen are corrected. This species is very liable to "twisted fibre," which renders useless a considerable percentage of the timber, as it cannot be sawn into planks. The cause of this phenomenon, which may be often observed in sweet chestnut growing near London, is obscure, but some evidence is adduced to show that it may be attributed to damage done during youth by fire or other injurious agency. Full information is given concerning the natural and artificial modes of regeneration and the best methods of management of forests of this pine, as well as of the ways by which danger from fire and grazing can be averted or lessened. Numerous tables relating to rate of growth and yield per acre are appended.

DR. ERWIN F. SMITH, to whose researches we owe so much of our knowledge of plant diseases, has expounded his views on the parasitic nature of cancer in an address before the Washington Academy of Sciences (*Science*, June 23). With refreshing vigour he claims a close analogy between the malignant tumours of animals and the crown-gall of plants due to *Bact. tumefaciens*. Great weight is laid on the peculiar group of sarcomatous tumours of birds, discovered by Peyton Rous, and shown by the latter to be due to an ultra-microscopic virus, while the fact that the majority of bird tumours have not been reproduced in the same way is ignored. The paper on "Crown-Gall" in the *Journal of Cancer Research* (vol. i., No. 2, 1916) is a monument to Dr. Smith's industry, and gives a very complete picture of the varied effects of *B. tumefaciens* in a variety of plants. The results of animal inoculation with this organism are in no way comparable with tumour growth, a failure which does not greatly detract from the interest of the author's ingenious speculation.

MR. R. BULLEN NEWTON has contributed to the "Reports on the Collections made by the British Ornithologists' Union Expedition to Dutch New Guinea, 1910–13," an important description of some fossiliferous limestones from Mount Carstensz, with photographic illustrations of their microscopical structure. The limestones obtained from the snow-line at 14,200 ft. appear to be of Miocene age, and correspond with limestones already known from the Philippines, Formosa, Christmas Island, Sumatra, Borneo, Celebes, and Australia. They are filled with Foraminifera of the genera Lepidocyclina, Cycloclypeus, and Amphistegina, besides abundant Nullipores of the genus Lithothamnium. Pebbles from the bed of the Utakwa River seem to represent another much older limestone, perhaps of Lower Jurassic age. Fragments of lignite of uncertain origin also occur. Mr. Newton

has added to the value of his work by including an exhaustive bibliography of the geology of New Guinea.

THE water-power resources of the United States continue to be studied in detail by the Geological Survey, and several further reports have been published. Water-supply Paper 372 deals with a water-power reconnaissance in South-central Alaska, and shows that there is less water-power available in that region than had been supposed, and most of it is unavailable during the winter months. This latter objection could, of course, be overcome by adequate storage reservoirs, which are no doubt possible; but more accurate surveys are needed before this could be decided. The possible competition of water-power with coal power—for coal occurs in this region—raises important geographical questions, but is outside the scope of the inquiry. A second volume (No. 373) deals with the water resources of Hawaii, but, unfortunately, contains no discussion of results.

THE Geological Survey Report, No. 6 of the Department of Mines, Tasmania, "Reconnaissance of the North Heemskirk Tinfield," by L. L. Waterhouse (1915, pp. iv+74, 7 plates), describes the economic geology of the mining field, which is situated on a somewhat inaccessible part of the western coast of Tasmania. The oldest rocks are a series of slates, quartzites, and tuffs, which are regarded by Twelvetrees as Cambro-Ordovician, though there is no direct fossil evidence of their age. These rocks have been invaded by Devonian granites and gabbros, and by diabase which is assigned to the same age as the upper Mesozoic sill that is such a conspicuous feature in the central plateau of Tasmania. The only Cainozoic rocks consist of flows of basalt and beds of sandstone and conglomerate, some of which have been cemented into a hard quartzite, such as is often found associated with the Australian basalts. Associated with these rocks are ancient river deposits with tin-bearing gravels. Mr. Waterhouse shows that these are younger than the diabase and gabbro and older than the basalt; hence his geological study of the field helps the prospector by showing that it is no use boring through the older basic rocks in the hope of discovering under them a continuation of the tin-bearing gravels. The tin is primarily due to the Devonian granites, and quartz-tourmaline-cassiterite veins occur around it near Mount Heemskirk. Some primary ores of copper have been found, but also in too small quantities to be of economic value. Some extensive masses of magnetic iron ores occur beside the granite massif, but, owing to their inaccessible position, their tonnage is too small for present use. The value of the field depends upon its alluvial tin ores, which are worked by hydraulic sluicing. The report is illustrated by a useful geological sketch-map.

THE Memoir of the Geological Survey on the country around Milford (1916, price 2*s*. 6*d*.) is a further addition to the description of the South Wales coalfield, and includes a petrological account of the Ordovician volcanic rocks of Skomer Id. Dr. Thomas proposes two new names, Skomerite and Marloesite, for types of lava in which albite-oligoclase is associated with augite in a fine-grained ground. The marloesites contain glomeroporphyritic groups of olivine and albite. The map given indicates a remarkable variety of igneous types running in parallel bands across the island, and summarises the work already published by Dr. Thomas in 1911.

MR. S. TABER publishes in the *American Journal of Science*, vol. xli. (June, 1916), p. 532, a paper, based on experiments, on "The Growth of Crystals under External Pressure," which has a wide geological bearing. Previous workers have held contradictory views as to the reality of a crystallising force, which the author reconciles by showing that "a crystal surface will not grow under pressure and therefore will not do work in overcoming external forces resisting growth unless the surface is in contact with a supersaturated solution." He suggests that the outward pressure exerted by a growing concretion may cause the solution of material, which it gradually replaces. On the other hand, when a material has its solubility increased by pressure, there is a contraction of the total volume, and the separation of such a substance again from solution in a closed and limited space, as in the capillary passages of a shale, may develop enormous pressure. Is the author right, however, in stating that concretions in which the bedding planes are retained, and not thrust aside, are rare in shales?

THE report of the Chief Inspector of Mines in Mysore for the year 1914 has just been issued, and shows quite a flourishing state of affairs. The staple mining industry is, of course, gold mining, and the production for the year amounts to 562,617·56 ounces, being an increase of about 0·2 per cent. on the previous year. It is a very satisfactory feature of the report that this production was obtained with a considerably greater measure of safety so far as the workers are concerned; the death-rate in the gold mines was 2·28 per thousand, as against 4·38 in 1913, whilst the number of serious injuries also shows a marked decrease. A considerable proportion (27·9 per cent.) of the fatalities were due to the air-blasts that form such a marked characteristic of the Kolar gold mines. Much attention is being given to these air-blasts, which are due to the splitting off of masses of the country rock, which appears to be in a condition of excessive internal strain, and the methods recently adopted of closely stowing the stoped-out areas with waste rock appears to have been attended with decidedly beneficial results. Of the other mineral products, manganese ore is the most important, the output being given as 18,055 tons, as against 10,501 tons in 1913. Small quantities of chromite, magnesite, mica, asbestos, and corundum have also been produced, but none of these minerals are as yet being got in any important quantity.

THE Meteorological Service of Canada has introduced a change in its monthly record of observations, and the issue for January, 1916, which has recently been received, gives data in more extended detail than formerly. Under the directorship of Mr. R. F. Stupart the results published are of a high scientific value, and deal practically with every branch of meteorology. A detailed list is given of the stations used, which shows a very extensive and complete series of observations. Hourly observations of pressure, temperature, and humidity are given at selected stations, and there are detailed observations of rainfall, sunshine, and wind. The weather conditions during January, 1916, were far from normal, and it is mentioned that the result of the persistent far southerly course of the depressions tracked from the Pacific Ocean was a continuance of northerly winds and almost unprecedented cold in British Columbia and the Western Provinces. A map for the area under discussion, exhibiting the difference from average temperature, shows a deficiency of 20° F. over Yukon, and as much as 25° F. in British Columbia, whilst the eastern half of the Dominion experienced very mild weather with much rain. It will be remembered that over England, and generally on this side of the

Atlantic, the weather was abnormally warm in January.

THE rainfall maps of Australia for 1915, prepared by Mr. H. A. Hunt, Commonwealth meteorologist, have been published. A large map shows the distribution of rainfall for the year, and a number of smaller maps, printed on the back, give the rainfall for each month. The year was characterised by an unusual amount of rainfall in the western part of the continent, which in some parts was the heaviest on record. On the other hand, the drought conditions in Queensland were the most severe ever experienced in that State. There were great losses of stock, and the sugar crops in the east coastal districts, as well as many of the cereal crops on the downs, were everywhere a failure. In the southern wheat belt, however, the conditions of rainfall were all that could be desired. Accompanying these well-sustained rains another important factor was the exceptionally mild winter, with a June and July temperature for the continent about 2½° above the normal. Probably the wheatlands of Australia never before experienced such favourable conditions of temperature and rainfall, and the result was a record harvest. The comparison with the previous year was most marked, for 1914 was a year of drought in South Australia and the Riverina.

THE *Quarterly Review* for July contains an article by Dr. Charles Davison on the sound of big guns. The author has collected together those accounts of the propagation of the sounds of big guns to great distances which are sufficiently numerous and well-authenticated to provide a basis for generalisations on the subject. The firing at Waterloo appears to have been heard in Kent, 140 miles away, and that when the *Alabama* was sunk by the *Kearsarge* in 1864, 125 miles away. The guns fired at the Naval Review in 1897 were heard 135 miles away, and the minute-guns fired at the funeral of Queen Victoria in 1901, 139 miles away. In all cases the audibility was greatest down the wind, owing, as Sir George Stokes showed sixty years ago, to the bending of the sound-waves downward by the greater speed of the wind as the height above the ground increases. The remarkable zones of silence which sometimes intervene between stations near the guns and the more distant points at which the sounds are heard are equally well explained by the existence of local winds blowing towards the source of sound and tilting up the sound-wave above the heads of the listeners. The author makes no reference to the approximate equality of the maximum distances a century ago and now when the guns are much larger, although this requires explanation.

AT the present time, when the production of glass apparatus for scientific and technical purposes is receiving special notice in this country, attention may be directed to Circular No. 9 of the United States Bureau of Standards, which deals with the testing of glass volumetric apparatus. It is drawn up, no doubt, with a view to American requirements, but the principles involved are of general application. For the assistance of manufacturers specifications are given respecting the construction of glass instruments, such as measuring flasks, cylinders, pipettes, burettes, specific gravity bottles, and "Babcock" bottles for milk analysis. The information indicates the requirements of the Bureau as to the dimensions, designs, and types of vessels which are suitable for standardisation, and describes how the graduation of them should be carried out, with the limits of error which are tolerated in the calibration. Useful hints may be gathered from the circular by manufacturers who are taking up the industry in question.

OUR ASTRONOMICAL COLUMN.

MONOCHROMATIC PHOTOGRAPHS OF PLANETS.—Prof. R. W. Wood has given an account of further results obtained by the photography of celestial bodies through filters transmitting limited regions of the spectrum (*Astrophysical Journal*, vol xliii., p. 310). After much preliminary work, successful photographs were readily obtained when the 60-in. reflector at Mount Wilson was placed at his disposal for four nights during last October. For the ultra-violet filter a bromine cell was used, transmitting the region from 3500 to the end of the solar spectrum at 2900; the infra-red screen transmitted the region above 7000, the yellow screen all rays above 5000, and the violet from 4000 to 4500. In the case of Saturn the pictures taken through the infra-red screen only showed the merest traces of the belts ordinarily seen, while through the yellow screen the planet presented its usual appearance. On the plates taken with violet light a very broad, dark belt surrounded the planet's equator, and a dark cap of considerable size was shown about the pole. These features were also present in ultra-violet light, but were less pronounced; they may possibly be due to the existence in the planet's atmosphere of some substance capable of absorbing violet and ultra-violet light. Another point of interest was a decrease in contrast between the inner and outer ring as the wave-length of the effective light decreased, suggesting that the outer ring contains so much finely divided matter that it shines in part by diffusion. In the case of Jupiter, the dark belts were scarcely visible on the infra-red plates, while they were shown in greatest contrast with violet light. The dark polar cap shaded off gradually in the yellow and infra-red pictures, but was sharply terminated in the violet and ultra-violet photographs. It is hoped that it may be possible to investigate the surface of Mars by this method at the next near approach to the earth.

THE POLAR CAPS OF MARS AND SOLAR RADIATION.—An interesting investigation of the rate of melting of the polar caps of Mars in relation to the sun-spot period has been made by M. Antoniadi. An examination of the records of the planet from 1862 to 1914 has shown that, in general, the polar caps melt more rapidly at times of great solar activity than when solar activity is feeble. Out of twenty-one series of observations during the period in question, no fewer than seventeen were definitely in favour of this conclusion, and only four unfavourable. Two of the exceptions were the oppositions of 1862 and 1873, when the melting of the caps was normal, in spite of considerable solar activity; another was in 1877, when rapid melting occurred with feeble solar activity; and the fourth in 1886, when rapid melting was associated with only moderate solar activity. The slowest recorded shrinkage of the caps accompanied the prolonged sun-spot minimum of three years ago, while one of the most rapid rates of melting coincided with great spot activity in 1894. M. Antoniadi's conclusion is in satisfactory agreement with the now generally accepted view that solar radiation is greatest at times of sun-spot maximum, and with the supposition that the polar caps of Mars are very thin, and consequently very sensitive to variations of temperature (Royal Astronomical Society, June).

VARIABLE STARS NEAR THE SOUTH POLE.—In continuation of the search for variables on photographs covering the entire sky, Miss Leavitt has examined plates of the stars near the South Pole, and has discovered nineteen new variables in that region. One of them is apparently of the Algol type, having a normal magnitude 10 and a minimum of 10·6 (Harvard Circular 191).

THE IPSWICH CONFERENCE OF THE MUSEUMS ASSOCIATION.

THE twenty-seventh annual conference of the Museums Association was held in Ipswich on July 10–12, when the following institutions were represented by delegates:—(1) Five national museums—the British Museum, the British Museum (Natural History), the Victoria and Albert Museum, the National Museum of Wales, and the Museums of the Royal Botanic Gardens at Kew; (2) two London museums—the Horniman Museum and the Wellcome Historical Medical Museum; (3) the following twenty-five provincial museums and art galleries—Brighton, Bristol, Carlisle, Chelmsford, Derby, Dundee, Exeter, Halifax, Hastings, Hull, Ipswich, Leicester, Lincoln, Liverpool, Merthyr Tydfil, Newbury, Norwich, Perth, Peterborough, Plymouth, Reading, Salford, Warrington, Worcester, and Worthing; and (4) the Museum of the University of Manchester.

After a hearty welcome by the Mayor of Ipswich, the president, Mr. E. Rimbault Dibdin, curator of the Walker Art Gallery, Liverpool, addressed the delegates, taking as his subject the effect of the war upon the art museums of the country. He had sent a series of questions to eighty-two art museums in Great Britain, and from their answers was able to give some interesting details as to their experiences. Briefly summarised, his remarks indicated that whereas several London galleries have been closed by the action of the Government, and one or two others report a reduced attendance, the majority of the provincial institutions show an increased attendance, and only one has been closed. It thus appears that the protest lodged with the Prime Minister by the Museums Association against the Government Retrenchment Committee's suggestion that provincial museums and art galleries should be closed has been thoroughly justified.

Mr. F. Woolnough read a paper on "The Future of Provincial Museums," in which he said the question was chiefly one of finance, and pleaded for the removal of the restrictions which either make museums dependent upon a share of the library rate for their income or limit them to the Museums and Gymnasiums Act halfpenny.

Some remarkable specimens were shown by Mr. F. R. Rowley in illustration of his comments on the use of arsenious jelly as a preservative. This method was described by S. Delépine in the *Museums Journal* for April, 1914, p. 322. Mr. Rowley has made some slight modifications, which will form the subject of a note in the journal. Among the specimens shown were a viper, newts, crustacea, and marine algæ. The latter were beautifully preserved, both as to colour and form, and all had the advantage of being embedded in a clear, solid mass, which could be laid flat.

"The Educative Value in Public Museums of Introductory Cases to Animal Groups" was introduced by Dr. J. A. Clubb, who advocated the primary importance of comparative morphology, as against mere classification, for the inspiration and enlightenment of the ordinary visitor. How to get hold of those who come to the museum with no previous knowledge of, or particular interest in, its subjects is an urgent problem, to which Dr. Clubb and many other thinking curators are addressing themselves.

Mr. R. A. Smith, of the British Museum, announced that certain duplicates of prehistoric implements were available for distribution to provincial museums.

The claims of the British Science Guild were brought forward by Mr. E. E. Lowe, who spoke of the Guild as an association with magnificent and comprehensive aims which should claim the allegiance of every person interested in the national utilisation and recognition of scientific work and workers.

Many communities are now organising photographic surveys of their own districts in order that accurate historical and scientific records may be handed down to posterity, and Dr. A. H. Millar's paper on the "Photographic Survey of Dundee" was particularly opportune.

Mr. F. Woolnough, the curator of the Ipswich Museum, gave demonstrations (*a*) upon a case for exhibiting postage stamps, and (*b*) upon the "Fothergill" and hot-sand methods of drying flowering plants in their natural colours. Many of the plants dried by the "Fothergill" process showed remarkably successful results. A useful demonstration was given by Mr. W. K. Spencer on the use of gelatine moulds for plaster casts. He showed that where an object was much "undercut" the flexibility of gelatine gave it many advantages over plaster.

To the business meeting the hon. secretary (Mr. E. E. Lowe) reported as to his efforts to get rectangular glass exhibition jars made in England. Many manufacturers had been interviewed, but none were able to tackle the work in the midst of present labour and other difficulties. There is little doubt, however, that the manufacture will be embarked upon within the next year or so, thus rendering museums, hospitals, and medical schools independent of the German supply. The secretary can offer an immediate order for 250*l.* worth to anyone who will undertake to produce rectangular jars of a good quality at a reasonable price, and he has evidence of a large annual demand.

RECENT ZOOLOGICAL RESEARCH IN SOUTH AFRICA.[1]

THE "Annals of the Natal Museum," although only yet in its third volume of publication, has justly earned repute for the quality of the researches published therein. The journal is well printed and admirably illustrated with lithographic and other plates. In its current issue we have a bulky record of original investigations covering a wide field in the rich fauna of South Africa. Mr. Hugh Watson contributes an important and very fully illustrated memoir on the carnivorous slugs, with particular reference to the genus Apera. This genus appears to be confined to the maritime provinces of South Africa, one species occurring on the slopes of Table Mountain, and the remainder in Natal and the eastern part of the Cape Provinces. In addition to a systematic revision of its species, the author gives a valuable account of the anatomy of the genus and a full discussion of its phylogeny. He concludes that the species of Apera have not been directly evolved from any herbivorous form, and in their anatomy and geographical distribution are more closely related to the Rhytidæ than to any other group. The only other carnivorous slug found in South Africa is the English *Testacella maugei*, Fér, which has a very wide distribution, and has probably been introduced into South Africa through the agency of man.

Mr. Claude Fuller, of the Division of Entomology, Pretoria, writes on South African Termites, and in a paper of more than 170 pages records a good deal that is new and interesting concerning the biology of these insects. Termites appear to be irregularly distributed in the Union, being rare in the South-West Cape, while in Natal and the Transvaal the soil is riddled from end to end of the country with their

[1] "Annals of the Natal Museum." Edited by Dr. Ernest Warren, director. Vol. iii., part ii., October, 1915. Pp. 107–504 and plates vii–xxxv. Price 15*s.* net.

tunnellings. Mr. Fuller describes his observations upon the behaviour of the winged sexual forms belonging to six different species. He shows that the belief that the aerial migration has for its object the prevention of interbreeding is not necessarily true, since the flights frequently comprise individuals of both sexes which readily pair. This same feature has also been observed by the reviewer in the case of a Himalayan Termite. Intercrossing occurs at times among individuals of different nests, but Mr. Fuller concludes that the real object of the production of sexual forms in such vast numbers is in order to perpetuate the species, which suffers immense mortality during the annual exodus. Some sixty-four pages are devoted to observations on the nest-building habits and general economy of thirteen species of Termites, and details of the various types of nests are well illustrated on the accompanying plates. The remainder of the paper comprises a systematic account of species, chiefly belonging to the genera Hodotermes, Termes, and Eutermes. The characters of the soldiers and workers are well described, but unfortunately no accounts of the winged forms are included, and it is to be hoped that the author will make these the subject of a further memoir.

Mr. J. Hewitt contributes a paper on South African Arachnida, mostly based on specimens in the Albany Museum. Altogether three genera, eleven species, and one variety are recorded as new, and the most interesting feature brought to light is the discovery of two new genera of marine spiders taken near Cape Town. The remainder of the journal is occupied by two short papers by Dr. Warren, one dealing with the tendency of the Saturniid moth, *Melanocera menippe*, Westw., to exhibit parthenogenesis, and the other with an extension of his previous observations upon hybrid cockatoos. A. D. IMMS.

THE CROYDON NATURAL HISTORY SOCIETY.

THE Transactions of the Croydon Natural History and Scientific Society for 1915, a copy of which has just reached us, contain a particularly good paper by Mr. G. M. Davies on the rocks and minerals of the Croydon regional survey area. The paper runs to 44 pages, and includes a careful series of analyses of rock-specimens from the Weald Clay and all the more recent formations. Reference is made to the discovery of the Marsupites-zone of the chalk at Russell Hill, Purley, and to the decomposition of marcasite, which gives rise to the soft masses of hydrated iron oxide ("red ochre") so frequent in the chalk. A few sarsens are noted as occurring in the neighbourhood. Granules and grains of zinc-blende and galena are noted as occurring in fuller's-earth at Redhill and Nutfield. The number of minerals found in residues is somewhat surprising, and a complete list is given. The regional survey, under the direction of Mr. C. C. Fagg, shows satisfactory progress, and in connection with it Baldwin Latham has prepared a map showing the site of the five Bournes which flow in the area.

Mr. William Whitaker describes an extraordinary outlier of Blackheath pebble-beds at Tandridge Hill. With the pebbles are patches of fairly large unworn flints, resembling in shape flints as found in chalk-pits. Flints in any intermediate stage of weathering are not found, and the two cannot have been produced by the same agency. It is thought that, during or after the deposition of the rounded Blackheath beds, the unworn flints have been quietly removed from the chalk during the dissolution of the latter, and left near to their original position. The extension of the outlier so far south is of interest, but especially is it so in that though the uppermost outlier is nearly 800 ft. O.D., the lowest extension is 200 ft. lower, on the face of the escarpment of the chalk. Hence we here find Eocene beds resting on lower chalk, an occurrence unknown elsewhere. The conclusion come to is that long-continued solution of pebble-covered chalk took place on a large scale, and the pebble-beds were very gradually let down. There was no evidence of faulting. It is fairly certain they could not have been originally deposited on the middle and lower chalk as now found.

The usual valuable meteorological statistics for 1915, compiled by Mr. F. Campbell-Bayard, with rainfall day by day from 104 stations, is of value to water-economists. In a paper summarising the fossil records of *Ginkgo biloba* and its ancestors, Mr. E. A. Martin remarks that there has been of late a considerable increase of small specimens of this tree in this country. Hitherto this "living fossil," as Seward calls it, has been represented chiefly by male trees, and it is hoped a balance may be restored now that it is included in florists' catalogues.

THE LAKE VILLAGERS OF GLASTONBURY.[1]

THE Lake Village of Glastonbury consisted of between eighty and ninety round huts surrounded by a stockade, and planted for security at the edge of the sheet of water, that is now represented by the peat in the marshes, extending from Glastonbury westward to the sea. The inhabitants smelted iron and made various edged tools and weapons—axes, adzes, gouges, saws, sickles, bill-hooks, daggers, swords, spears, etc. They also smelted lead ore from the Mendip Hills, and made net-sinkers and spindle-whorls. They probably carried on the manufacture of glass beads and rings and other personal ornaments. They were also workers in tin and bronze. It is likely that the beautiful Glastonbury bowl was made in the settlement, since unused rivets of the same type as those of the bowl have been commonly met with. They were expert spinners and weavers, carpenters and potters, using the lathe in both industries. The discovery of a wooden wheel, with beautifully turned spokes, proves that they possessed wheeled vehicles, while the snaffle-bits of iron imply the use of the horse. Their commerce was carried on partly by land, and the possession of canoes gave them the use of the waterways. They were linked with other settlements by the road running due east from Glastonbury, that formed a part of the network of roads traversing the country in the prehistoric Iron age, more especially with the lead mines and the fortified oppida, or camps, of Mendip and of the rest of the county. They were also linked with the Bristol Channel by a waterway along the line of the river Brue, and along this was free communication with the oppidum of Worlebury, then inhabited by men of their race.

The lake villagers were undoubtedly in touch with their neighbours by sea and by land. Their jet probably came from Yorkshire; their Kimmeridge shale from Dorset; the amber from the eastern counties, or from the amber coast south of the Baltic. The cocks for fighting were probably obtained from Gaul, and the oblong dice are identical with those used in Italy in Roman times. Some of the designs on their pottery are from the south, and the bronze mirrors are probably of Italo-Greek origin. The technique of the

[1] Abridged from a paper read before the Literary and Philosophical Society of Manchester on April 18 by Hon. Prof. W. Boyd Dawkins, F.R.S.

Glastonbury bowl is that of the goldsmiths of Mykenæ. The whole evidence points to a wide intercourse with the other British tribes, as well as to a commerce with those of the Continent, extending so far south as the highly civilised peoples of the Mediterranean. It falls in line with that offered by other discoveries recorded in other parts of Britain, in settlements and tombs, by General Pitt-Rivers, Sir Arthur J. Evans, and others, proving that the inhabitants of Britain were highly civilised, and were not isolated from the high Mediterranean culture for some two hundred years before the Roman conquest.

We may infer from the absence of Roman remains that the lake village was abandoned before the influence of Rome was felt in Somerset. All doubt, however, as to this point is removed by the recent explorations of Wookey Hole Cavern, where the group of objects in the lake villages was found in five well-defined layers underneath two superficial strata of Roman age, the latter being dated by the coins, ranging from the time of Vespasian (A.D. 69–79) to Valentinian II. (A.D. 375–392). Here we have proof that the civilisation of the prehistoric Iron age was pre-Roman, and that it ended in Somerset with the Roman conquest. It has been traced in other parts of Britain so far back as 150 to 200 B.C.

The lake villagers were of pure Iberic stock, without admixture with other races. They belong to the small aborigines in Britain in the Neolithic age, characterised by long or oval heads, who were conquered in the Bronze age by the invading Goidels, and in the prehistoric Iron age by the invading Brythons, both of whom have left their mark in the topography of the district, by river names, such as the Axe (Goidelic) and the Avon (Brythonic for water), and hill names, such as Dundry dun (Goid)=fort, Mendips Maen (Bryth)=stone, Pen (Bryth)=hill. From these it may be concluded that the language spoken by the lake villagers was closely allied to the Welsh. They were closely related to the Silures, the ruling tribe in South Wales at the time of the Roman conquest.

The village was sacked, and, as the skulls exhibited show, the inhabitants had been massacred, probably during the conquest of that region by the Belgic tribes, whose further progress was arrested by the Romans. This remarkable discovery is being followed up by the examination of another lake village at Meare, on the same waterway, and belonging to the same pre-Roman age. The first volume was published in 1911, and the second is now nearly completed. When the whole story is told, by Bulleid and Gray and the other contributors to "The Lake Village of Glastonbury," it will fill a blank in the prehistory of Britain, and form a sound basis for history.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

MR. T. E. GORDON has been appointed professor of surgery in Trinity College, Dublin, in succession to Prof. E. H. Taylor.

THE Astley Cooper prize for the present year, for a treatise on "The Physiology and Pathology of the Pituitary Body," has been awarded to Dr. W. Blair Bell, of Liverpool.

DR. T. G. MOORHEAD (Captain, R.A.M.C.) has been elected professor of the practice of medicine in the school of the Royal College of Surgeons in Ireland, in the place of Sir John Moore, retired.

EFFORTS are being made by the Kansas State Board to get the State universities to co-operate in an endeavour to induce the Government to establish a health experiment and research laboratory in connection with each university school of medicine under the U.S. Public Health Service.

THE Board of Education has recently issued an interesting Memorandum on the teaching of coal-mining in part-time schools (Circular 953; price 4*d*.), upon lines which constitute a departure to some extent from the methods of teaching coal-mining students that have hitherto obtained, in that they definitely recognise the principle already tacitly admitted by some of the most experienced teachers of mining, namely, that the subject in which coal-mining students least need instruction is that of coal-mining. The coal-mining communities may to-day claim to rank amongst the most intelligent of our working classes, a condition of things due largely to the fact that a man is required to pass a written examination before he can enter the ranks of the higher colliery officials. All British coal-fields have accordingly arranged some system of mining tuition, and the object of the present Memorandum is to co-ordinate these, and to base the methods of instruction upon sound principles. The insistence upon a scientific training as the basis of all mining education is a welcome feature of this Memorandum, and there can be no doubt that its general adoption will prove useful. It is perhaps legitimate to regret that its wording is in places open to misconstruction; thus the expression "practical mathematics" is here used in the sense of elementary mathematics applied to practical purposes, instead of in its generally adopted sense; again, it is a pity that the term "mining science" is repeatedly used when the real meaning is science applied to mining. The main point, however, is that the Board of Education has now issued a definite scheme in which a systematic and progressive education in scientific principles is recognised as the correct method of training coal-mining students.

THE report of the Board of Education for the year 1914–15 (Cd. 8274) is now available. The period dealt with coincides almost exactly with the first year of the European war, and the report is consequently concerned largely with the dislocations and modifications in the educational services brought about by the conflict. For reasons of economy the Board has suspended the great bulk of its statistical work, and many of the illuminating tabular statements of previous years are wanting. The report not unnaturally emphasises the need for economy in the administration of the public services; but we notice with satisfaction the admission:—"We desire, however, to record our conviction that the claim to regard reductions of expenditure on the public service of education as true economies requires, in the case of every item, the most careful scrutiny." All grades of education are dealt with fully in the report, but it is possible here to refer to one or two points only. The demand for munitions of war has had two effects upon technical schools: first, many schools have been engaged in actual munition work, and, secondly, many schools have inaugurated experimental courses for the training of unskilled persons for the purpose. As to the number of students in attendance at continuation and technical schools in England, the report states that the number of evening and other part-time schools recognised by the Board for 1913–14 was 6269, and the number of individual students under instruction at any time during the year in these schools was 726,626. In the same year twenty-seven institutions providing instruction courses were recognised, the total number of such courses in them being seventy-eight. The number of institutions in which day technical classes were recognised in

1913–14 was eighty-nine; the corresponding number for 1912–13 was 110, but this included institutions providing courses which in 1913–14 became junior technical schools. Up to and including 1914–15 there were forty-nine recognised junior technical schools, thirty-seven for boys and twelve for girls. The report contains also a survey of the influence of the war upon the work of universities and university colleges assisted by Treasury grants.

SCIENCE as "Cinderella" is the subject of an informing and suggestive article in a recent issue of the *Glasgow Herald*, and of a subsequent trenchant letter in the same journal by Prof. Soddy, F.R.S., which deals with the manner in which a certain large endowment intended for the promotion of scientific study and research is, and has been, diverted largely to other purposes of an entirely general educational character, which, however desirable to promote, were not the objects Mr. Carnegie had directly in view when making his generous gift of 1,000,000*l.* sterling in aid of the extension of the means of scientific investigation in the Universities of Scotland. It was perhaps too much to expect that a body of trustees, upon which there was, and is, only a very limited representation of men of distinction who were, or had been, actively engaged in scientific research, should regard that object as its first duty, but it is startling to learn how inadequately the interests of science have been served in the disposal of the income derived from the trust. The truth is that there is a lamentable lack of vital and intelligent interest in the sphere of science as an essential factor in the education of the nation, and as an indispensable instrument of its civilised progress. It is only by a thorough understanding of the phenomena of Nature and of man in all his activities and aspects, and through a firm grasp of the knowledge so gained, that humanity can rise to higher levels of well-being. The unfortunate attitude of the governing classes of the nation towards science is, as has been well said, largely "the result of the monastic traditions of the great public schools and universities in which most of our leading politicians have been trained." We need a genuine endowment of research, which shall have for its sole purpose the personal encouragement and support of the most gifted men of the time, who will give their whole energies to the pursuit of knowledge, assisted by men of proved competence. The teaching and training of the capable youth of the nation may well be left to the many able expounders of scientific theory and practice now available, who would draw their inspiration from the work of such men as are here indicated. We seek at this supreme crisis of our national history a man of clear vision and firm purpose who, taking all branches of knowledge for his province, will assign to each its true place and function in the education and training of all classes of the people. Such a man and such a purpose have yet to be achieved.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, June 30.—Prof. C. V. Boys, president, in the chair.—Dr. P. E. **Shaw** and C. **Hayes**: A sensitive magnetometer. A torsion balance of extreme delicacy carries a pair of purest silver balls, each 3 gm. weight. A solenoid, with horizontal axis passing through one of the silver balls, is brought close to the balance. On exciting the solenoid, divergent fields of known strength are obtained in the region of the ball. The resulting attraction of the ball to the solenoid is shown by a mirror reflecting a distant scale to a telescope. The couple on the torsion beam required to produce 1 mm. scale deflection is $4{\cdot}5\times10^{-7}$ dyne cm., and this torsion balance is 10^6 times as sensitive as any known to have been used previously in this kind of work. The results of these experiments are:—(1) The magnetic properties of the silver are ascertained even for weak fields of 1–10 gauss. (2) The silver has a pronounced retentivity, this effect being presumably due to the small trace of iron impurity. (3) The relation of susceptibility of the silver to the field used is found. The susceptibility of each of the constituent materials, (*a*) pure silver, (*b*) residual pure iron, appears to be greatly modified by the presence of the other material.—Dr. H. S. **Allen**: The latent heat of fusion of a metal, and the quantum-theory. A criticism is given of a theory of the process of fusion recently put forward by Ratnowsky. The author of the theory obtains an expression on certain assumptions for the entropy of a substance in the solid state. He then proceeds to deduce a simple formula suitable for use at high temperatures. It is shown that this formula is incorrect in consequence of the omission of a term in the expansion.—Prof. H. **Chatley**: Cohesion (part ii.).

MANCHESTER.

Literary and Philosophical Society, May 9.—Prof. W. W. Haldane Gee, vice-president, in the chair.—Dr. E. **Newbery**: The theory of over-voltage. The author gave an account of the history and reasons for the study of over-voltage. The following points were discussed:—(1) Methods of measuring over-voltage, including the direct potential difference method, the "knickpunkt" method, the bubble-angle method, the oscillograph method, and the rotating commutator method. (2) The most important phenomena connected with, and controlling factors of, over-voltage. (3) The chief theories put forward to account for over-voltage. (4) The following theory was suggested—over-voltage of an electrode is determined by four factors:—(*a*) Supersaturation of the electrode surface with non-electrified gas under very high pressure, due to the permeability of the metal to the ionised gas, but non-permeability to the molecular and also to the spontaneous decomposition of the alloys containing the same gas. (*b*) Formation of a series of alloys or solid solutions of gas (or compound of gas and electrode substance) with the electrode surface. (*c*) Deficiency or excess of non-hydrated ions, charged and discharged, in the immediate neighbourhood of the electrodes. (*d*) Inductive action of the escaping ionised gas on the electrode.—R. F. **Gwyther**: The specification of stress. Part iv. (continued). The paper contains the stress relations for the most usual co-ordinate systems which were previously withheld. The method originally used to obtain the equations is retained, as the fact of the elimination of the displacement is of importance. The stress relations are consequently not limited in their application to specifically elastic stresses; they apply with equal effect to stress having only the general character of elastic stresses.

PARIS.

Academy of Sciences, July 10.—M. Camille Jordan in the chair.—E. **Perrier**: Remarks on the book, "Les Allemands et la Science."—M. Gonessiat was elected a correspondant for the section of astronomy in the place of the late G. H. Hill; M. Walden a correspondant in the section of chemistry in the place of Emil Fischer; M. Bataillon a correspondant for the section of anatomy and zoology in the place of the late J. H. Fabre; and M. Depage a correspondant for the section of medicine and surgery in the place of the late Guido Bacelli.—M. **Akimoff**: The transcendants of

Fourier-Bessel with several variables.—F. **Arago**: Contribution to the experimental study of waves.—M. **Dussaud**: New experiments on the separation of the luminous and calorific effects of a source of light. The two lenses forming the optical system are separated in such a manner that air can be circulated between them. The heat effects are thus reduced to a negligible quantity.—G. K. **Burgess** and H. **Scott**: The thermo-electric measurement of the critical points of iron. By the method described, which is a modification of that used by MM. Boudouard and Le Chatelier, both the A_2 and A_3 points are clearly shown by pure iron (99·968 per cent. iron).—J. M. **Lahy**: The psycho-physiology of the machine-gunner.—L. **Roule**: The migration of the tunny fish (*Orcynus thynuus*).—C. **Nicolle**: An attempt at preventive inoculation in exanthematic typhus.

July 17. — M. Ed. Perrier in the chair. — The president announced the death of Elias Metchnikoff, foreign associate, and gave an account of his life-work.—G. **Bigourdan**: The renaissance of astronomy at Paris, starting from the sixteenth century.—A. **Colson**: Demonstration of the rational character of the new solubility formulæ.—E. **Bourquelot** and A. **Aubry**: The biochemical synthesis of a galactobiose. The synthesis was effected by the action of emulsin upon an aqueous solution of galactose. Although the product could not be obtained in the crystallised state, it is shown that a galactobiose is formed.—E. **Teodoresco**: The presence of a phycoerythrin in *Nostoc commune*.—J. **Pavillard**: Some new flagellæ, epiphytes of the pelagic diatoms.—G. **Bourguignon**: A method of determining chronaxy in man with the aid of condenser discharges. Classification of the muscles of the superior member by the chronaxy according to their radicular origins.—J. **Delphy**: Abdominal scoliosis in *Mugil auratus* and the presence of a parasitic myxosporidia in this fish.

BOOKS RECEIVED.

The Chemistry of the Garden. By H. H. Cousins. Revised edition. Pp. xviii+143. (London: Macmillan and Co., Ltd.) 1*s*.

Economical Dishes for Wartime. By F. A. George. Pp. 48. (Birmingham: Cornish Bros., Ltd.) 6*d*.

Memoirs of the Connecticut Academy of Arts and Sciences. Vol. v. The Collection of Osteological Material from Machu Picchu. By G. F. Eaton. Pp. 96+plates xxxix. (New Haven, Conn.)

Cours de Manipulations de Chimie Physique et d'Electrochimie. By M. Centnerszwer. Pp. vii+180. (Paris: Gauthier-Villars et Cie.) 6 francs.

Exercices et Leçons de Mécanique Analytique. By R. de Montessus. Pp. ii+334. (Paris: Gauthier-Villars et Cie.) 12 francs.

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

A Shilling Arithmetic. By J. W. Robertson. Pp. viii+191. (London: G. Bell and Sons, Ltd.) 1*s*.

Revision Papers in Arithmetic. By C. Pendlebury. Pp. xv+68+xviii. (London: G. Bell and Sons, Ltd.) 1*s*.

Department of Mines. Memoirs of the Geological Survey of New South Wales. Ethnological Series. No. 2: i., The Cylindro-Conical and Cornute Stone Implements of Western New South Wales and their Significance. ii., The Warrigal, or "Dingo," Introduced or Indigenous? By R. Etheridge, jun. Pp. vii+53+plates xii. (Sydney: W. A. Gullick.) 7*s*. 6*d*.

Les Allemands et la Science. By Prof. G. Petit and M. Leudet. Pp. xx+375. (Paris: F. Alcan.) 3.50 francs.

Fungoid and Insect Pests of the Farm. By F. R. Petherbridge. Pp. vii+174. (Cambridge: At the University Press.) 4*s*. net.

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

Combinatory Analysis. By Major P. A. MacMahon. Vol. ii. Pp. xix+340. (Cambridge: At the University Press.) 18*s*. net.

A Bibliography of British Ornithology. By W. H. Mullens and H. K. Swann. Part ii. (London: Macmillan and Co., Ltd.) 6*s*. net.

Hyperacoustics. By J. L. Dunk. Division I. Simultaneous Tonality. Pp. vi+311. (London: J. M. Dent and Sons, Ltd.) 7*s*. 6*d*. net.

The Danish Ingolf-Expedition. Vol. iii., Nos. 3 and 5. Crustacea Malacostraca. By H. J Hansen. Pp. 145+12 plates+1 chart, and a list of the stations, and pp. 259+16 plates+1 chart, and a list of the stations. (Copenhagen: Bianco Luno.)

A Treatise on the Circle and the Sphere. By Dr. J. L. Coolidge. Pp. 602. (Oxford: At the Clarendon Press.) 21*s*. net.

Fermat's Last Theorem. By M. Cashmore. Pp. 63. (London: G. Bell and Sons, Ltd.) 2*s*. net.

City and Guilds of London Institute. Department of Technology. Programme for the Session 1916–17. Pp. viii+408. (London: John Murray.) 9*d*. net.

CONTENTS.

Editorial and Publishing Offices:
MACMILLAN & CO., LTD.,
ST. MARTIN'S STREET, LONDON, W.C

Advertisements and business letters to be addressed to the Publishers.

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