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State Control of Exploration.

THE spread of sovereignty to polar regions has resulted in various measures of authority in uninhabited or sparsely habited lands. These vary from the effective jurisdiction of Denmark in western Greenland and the police control of Arctic Canada to the merely nominal jurisdiction without resident authority in the British claims in the Ross and Falkland dependencies in the Antarctic. As the rule, the authority is exercised solely in the interests of the native fauna, and is aimed at restricting the destruction of game and at the same time levying some tribute on hunter and whaler.

The latest Arctic power is Norway, with her new-found possession of Spitsbergen, or to be more precise, the archipelago of Svalbord, an ancient name revived to embrace all the islands between lat. 74° and 81° N. from long. 10° to 35° E. Norwegian control of these islands was granted by the Supreme Council in 1920 and became operative in 1925. Norway's first act was the promulgation of game laws to restrict the ravages of the winter fur trappers; and now measures have been announced for the regulation of exploring expeditions that employ Norwegian vessels or engage Norwegian subjects in Norwegian ports. This will apply to most expeditions to Spitsbergen, since Norwegian subjects are nearly always included in their personnel, even if Norwegian vessels are not employed. Such expeditions in future must notify Norges Svalbard og Ishavs-undersökelser, the government department set up for the purpose. Their plans and equipment will be considered by a committee, which includes a government ship surveyor and a member with personal experience of Arctic wintering. This applies particularly to such expeditions as intend to winter or are proposing to go to regions where conditions may necessitate wintering.

The regulation is a wise one. It may rob the Arctic of many adventurous tales that the future might produce, since well-found and efficiently led expeditions do not produce the same measure of adventure or yield the same thrills as those in inexperienced hands; but we cannot regret that loss. Experience has shown that several expeditions in the recent past have been so poorly equipped or badly led, through lack of experience, that they have got into difficulties which necessitated relief measures either by the coal-mining companies in Spitsbergen or by the Norwegian State. The possibility of this burden and expense must be avoided in future so far as possible. On financial

grounds alone the new regulation of the Norwegian Government is justified. The sum expended on relief expeditions in Spitsbergen in recent years would have handsomely financed several useful polar expeditions. There is no reason to anticipate any interference with properly conducted expeditions or any desire to discourage legitimate enterprise.

Norwegian interest in her new possession does not stop there. The Spitsbergen department to which we have referred is organising, as indeed it has done for several years, the survey and scientific exploration of the country in so far as this work remains to be accomplished. It is now proposed, for the suggestion cannot be made obligatory, that all scientific expeditions to Spitsbergen should consult the Spitsbergen department before maturing their plans. By so doing, an expedition will save spending time on work that is already partly or wholly done or avoid overlapping the field of work of contemporary expeditions. Help of a more practical nature will also be available in reference to literature and maps and advice on routes and equipment. This information will be provided free of charge, and all that is asked in return is a report of the work of the expedition and copies of any publications concerned with its results. The institution of an inquiry office and bureau of advice has much to be said in its favour. There have been too many instances of overlap of work, and this applies not merely to Spitsbergen—especially when the results of expeditions have been long delayed in publication, and the difficulty of tracing the numerous papers, often in obscure journals of small circulation, is only too well known to all workers in polar regions. The Norwegian Spitsbergen department also promises the publication of research papers, at the cost of printing only, in its *Skrifter om Svalbard og Ishavet*. Anyone who has had occasion to work in Greenland and made use of the *Meddelelser om Grönland* must realise the value of the regional grouping of papers in this way.

Another aspect of Norwegian work in Spitsbergen deserves notice. The nomenclature of the islands is in a state of chaos. Many features have had several names, and many names have been corrupted and changed in usage. Some years ago Sir Martin Conway tried to unravel the muddle by going back to the earliest names for each feature. But historical precedence, though logical, is not always practical, especially in a land that is inhabited or much frequented. The Norwegian Government is now engaged in a survey of all Spitsbergen names with the view of reaching a state of finality. We understand that priority will be a general guide, but we trust that usage will not be overlooked. Familiarity may give a name justification; and it is to be hoped that the tendency which Norwegian maps of Spitsbergen have already shown of translating proper names of a descriptive nature will not be generally followed. Proper names, even if they are difficult of pronunciation by Norwegians, have at least historical value. It must be remembered that most place names in Arctic regions are labels that will be used only in scientific works and will not pass into popular use. There can, however, be no objection to the recommendation that new names proposed by any expedition should be submitted for approval to the Spitsbergen department. This measure is justified, and comparable steps are advisable in all polar lands. The Geographic Board of Canada is now engaged in a survey of all place names within the Dominion and has done much to dispel confusion. It is hoped that the Norwegian Spitsbergen department will be as successful.

Epistemology for Physicists.

An Account of the Principles of Measurement and Calculation. By Dr. Norman R. Campbell. Pp. x+293. (London: Longmans, Green and Co., Ltd., 1928.) 12*s*. 6*d*. net.

THIS is a somewhat difficult book to review, and we are not quite certain that its title adequately describes its contents. In the first place, we may note that 'Calculation' seems here to denote a process quite different from the arithmetical investigations with which many of us are accustomed to associate the term. In his Chapter xii. Dr. Campbell gives the equations:

$$x = vt, \qquad y = \tfrac{1}{2}ft^2,$$

which he says can be established if a particle be projected horizontally in a gravitational field—although we fancy he might find it difficult to establish them except as conceptual limits, even if he could catch a 'particle' and project it horizontally. From these equations he deduces *algebraically*:

$$y = fx^2/(2v^2),$$

and terms the process 'calculation.' His chapter shows that he understands by calculation the deduction of mathematical results (by some form of algebraical analysis) from the equations, which are more or less approximately satisfied by the numerical values provided by physical experiment. The computer will meet only with disappointment if he hopes to find included under the "Principles

of Calculation" anything approaching a treatise, or even an essay, on the science of computing. No work on this topic exists in English, and the German text-books are by no means wholly satisfactory.

When, however, we have accepted Dr. Campbell's definition of 'calculation,' we see that his work is an epistemology of measurement and of the application of mathematical processes to the functional tables based on measurement, which appeals essentially to the physicist, and not to the computer. Although the reviewer has spent his whole life in measurement and calculation, he is very doubtful whether a careful study of the first 134 pages of the present work has at all cleared up for him his notions on the classification of magnitudes, on units and on factors. He has the misfortune to be English, and Dr. Campbell is Scottish, and therefore is probably a stronger logician. The great English physicists, in the reviewer's opinion, have in the past worked, perhaps, more by instinct than after a logical analysis of their fundamental conceptions. The inter-racial difference is well marked when our author comes—as he does at considerable length and with some degree of novelty—to deal with the "Principle of Similitude" as applied to the argument from dimensions. Here he writes: "All the difficulties and controversies of the subject have arisen from Rayleigh's tragic inability to give any clear account of a method of reasoning which he himself used with such great success" (p. 270).

The physicist who has reached 'instinctively' a solution even in Rayleigh's tragic fashion may test it and retest it experimentally without troubling himself greatly about the epistemology involved in his process. Nay, he may appeal, and justifiably appeal, to that famous proposition: "Qui veram habet ideam, simul scit se veram habere ideam, nec de rei veritate potest dubitare." Many great scientific discoverers have probably felt the truth of this without venturing to appeal to it, but it may not be a way of safety for the lesser workers. The only test of the relative virtues of the epistemological and 'instinctive' training—supposing, of course, a teacher of high order—would be for the latter to persuade half his pupils to study closely Dr. Campbell's first 130 pages and to tell the other moiety to proceed without doing so, and then to determine statistically their relative success in later experimental investigations.

Numerical dimensional problems have ever been a great stumbling-block to the student of slow receptivity at the start of his physical career; often far too little time and practice are devoted to them. Will Dr. Campbell's introduction to the general principles of measurement help such students? Only an experiment on a big scale can answer the question. We hope it may be made.

We have already referred to the topics of Chapters xii. (Calculation) and xiii. (Argument from Dimensions). Between these and the earlier eight, mostly classificatory chapters, are inserted three chapters on what are really statistical problems. A great deal of this seems to suggest that Dr. Campbell is not so fully acquainted with modern mathematical statistics as we might have anticipated. He is, we think, particularly unfortunate when he comes to deal with correlation in his chapter on 'approximate laws.' In the great majority of cases that the physicist has to handle, the bi-variate relation is not linear, and the student can learn little from the coefficient of correlation. He should be introduced straight away to the correlation ratio, which will be far more helpful to him.

Again, Dr. Campbell uses the term 'mean error' in the Gaussian or German sense; a use not established in England,[1] where the term 'standard deviation' is now fairly current. Although he rejects the normal curve of errors,—and rightly rejects it as a universal law,—his reasons for doing so (p. 182) seem to the present reviewer invalid. The 'fetish' character of this law can only and has only been demonstrated by showing that the astronomical errors and other distributions of deviations which are supposed to obey it, certainly do not, when a test of 'goodness of fit' is applied to these frequency distributions. Yet, although Dr. Campbell rejects the 'fetish,' he tells us on p. 169 that "the probable error is two-thirds of the mean error"! Again, at times he takes 'range' as a measure of the accuracy of his observations apparently in preference to standard deviation; but while the latter varies randomly with the sample, the former is a definite function of the number of observations, and the student must carefully bear this in mind. When Dr. Campbell lays such stress on terminological exactitude, we read his pp. 192-3 with some surprise. Taking two variates x and y, using a bar to denote mean quantities, and the symbols ξ and η to be given by $\xi = x - \bar{x}$, $\eta = y - \bar{y}$, we have the definition of the coefficient of correlation $r = \overline{\xi\eta} / \sqrt{\overline{\xi^2}\,\overline{\eta^2}}$. He

[1] In English writings 'mean error' means what it says, the mean arithmetical error, regardless of sign.

now supposes all the observations to be repeated and denoted by x' and y'. He then takes :

$$E_x^2 = \tfrac{1}{2}\overline{(x-x')^2}, \qquad E_y^2 = \tfrac{1}{2}\overline{(y-y')^2}$$

as the mean errors of x and y. It is not easy to see why E_x and E_y are really the 'mean errors.' The mean error for any given value of x cannot be found from *two* observations at that point. Does Dr. Campbell suppose the observational error to be the same throughout the range of x? If it be not—and the present reviewer's experience is not in favour of the constancy of error at all points of a physical range—then what is the true physical meaning of E_x and E_y?

Dr. Campbell now writes :

$$Y_1^2 = \bar{\eta}^2$$
$$Y_2^2 = \bar{\eta}^2(1-r^2)$$
$$Y_3^2 = E_y^2 + b^2E_x^2$$
$$\text{and } b^2 = r^2\bar{\eta}^2/\bar{\xi}^2$$

and says :

"Of these, Y_1 measures the *total range* over which y varies ; Y_2 the *part of this range* which cannot be attributed to variation of x ; Y_3 that which can be attributed to errors of measurement." The italics are the reviewer's. What will the student make of the statement that the standard deviation of y, which includes the observational errors of y, is the *total range* over which y varies? What will he understand when he is told the square root mean square distance of individual y's from a certain straight line—a line determined by the Gaussian process—is a *part of this range*? Lastly, how has Dr. Campbell demonstrated that Y_3 is 'that' (presumably 'part of total range') which can be attributed to errors of measurement? Presumably, in obtaining it, he has neglected quantities to which he does not refer. Why b and not b', and why has he assumed that the points x, y, x', y' really lie on a straight line, and that that straight line is the one determined by the Gaussian 'fetish'?

These difficulties are well illustrated on p. 200, where Dr. Campbell applies his formulæ to a special example, and assumes that since r is as big as $+0{\cdot}962$, it suffices to prove perfect correlation that Y_2 and Y_3 are nearly equal. But neither Y_2 nor Y_3 is a measure of the variability of r due to random sampling, and the 'mean error' of r—to which he does not here refer—would not be even for 200 observations—that provided from the Gaussian 'fetish' formula on his p. 192.

One further citation from these statistical pages :

"There always is a limit beyond which increase of number does not improve consistency on repetition. Where the limit lies can be determined in any particular case by subdividing a set of observations ; if the result obtained from each of the two values does not differ appreciably from that obtained from the whole, then the number is sufficient. But what is meant by 'appreciable'? An inappreciable difference is one not greater than that due to the step in the measuring instrument, for differences of this order can never be eliminated ; but again it may be a counsel of perfection (sometimes even of impossibility) to prescribe that such consistency is always to be attained."

This appears to us entirely erroneous and we believe Dr. Campbell will see that it is so, if he will first measure five hundred lengths with a scale with fine micrometer attachment, and then crudely classify his lengths into groups corresponding to, say, centimetres. He will find that the mean of the latter is much nearer to the mean of the micrometer readings than is due to the centimetre step of the crude readings, and the source of this agreement is fairly obvious. A mean is, indeed, far more accurate than the step in the measuring instrument, although we have heard distinguished astronomers ask why the mean is given to two decimal places, while the scale only admits of reading to the first decimal.

We are not writing with any desire of captious criticism. We hope, and believe, that a second edition of this book may be called for ; and should this be so, perhaps Dr. Campbell may be willing to rewrite this statistical portion of his work with the epistemological exactitude he demands in more purely physical conceptions. At least let us have a statement of the limitations the formulæ he provides involve.

Home-grown Sugar.

Sugar Beet and Beet Sugar. By R. N. Dowling. Pp. x + 277 + 24 plates. (London : Ernest Benn, Ltd., 1928.) 15*s*. net.

DURING the War it was realised in Great Britain that there can be great danger in complete dependence upon imported food supplies. When, therefore, the crisis of the enemy submarine campaign was over, increased consideration was given to British agriculture, and the possibilities for home food production. The position of the farmer with regard to the rest of the nation was seen to be one of the greatest importance, and in many schemes of reconstruction emphasis was laid upon the national requirement of a large area of land to be maintained in a highly productive condition. With the passing of the years, however, memories

of crises have become blunted, and there is now a tendency to revert to what seems to be the normal view of agriculture and home food production. The farmer appears once more as an individual whose production and trading must depend for success upon the chances of markets which are open to the goods of the whole world, and not upon a point of national necessity. The value of home produce is measured by the usual standard of free markets, and the great weight of the fear of hunger in a time of war diminishes in the balances of opinion.

Despite this tendency, we have still with us considerable survivals of the War period in the form of regulations, committees, and increased facilities for agricultural research; and it is fair to regard the sugar beet subsidy and the increased acreage under that crop as one of the results of the War and of the trend of thought arising from it. The subsidy, which is a decreasing one, came into operation in the season 1924–25. It has now run through its first four years, and has come to the point where it drops from 19*s*. 6*d*. per cwt. on home produced sugar to 13*s*. per cwt. In another three years it should drop again to 6*s*. 6*d*. per cwt., and then disappear altogether.

The subsidy was intended to act as a shield to a young and growing industry during its early and critical years, and it has coincided in the first stage with a very remarkable increase in the acreage under sugar beet and in the number of factories employed in the extraction and manufacture of the sugar. In 1924 there were 23,700 acres under the crop and 3 factories; in 1925, 51,140 acres and 9 factories; in 1926, 125,000 acres and 14 factories; and in 1927, 222,000 acres and several more factories. The rotations of a good deal of arable land in England have been modified to include this crop, which produces both cash and a considerable amount of food for stock, and there is a large number of growers who have found great benefit from the crop in the farm crisis of the past few years.

We have come now to the first real testing point of the subsidy scheme, and the next three years will show what part of this great increase of interest and acreage is to become a permanent feature of agriculture in England and what part is merely the effervescence of a boom period. It has been known for a great many years that high quality sugar beet can be grown in England with the ordinary technique used in various districts for mangolds and potatoes, and the experiments of Duncan in Suffolk in 1860, and of Lawes at Rothamsted some few years later, were easily confirmed by the Board of Agriculture trials at seven centres in 1911. The main question has always been one of economic expediency and not of cultural possibility, but despite this there is no doubt that the progress of sugar growing in England in future will depend on the technical ability of our farmers in growing and handling the crop and its by-products.

As the economic shelter of the subsidy disappears, the English grower will come into direct competition with the foreign and colonial growers, and his skill will be tested in direct comparison with theirs, and in the beginning of this comparison it is disconcerting to note how low have been our average yields of beets during the past several years. The lowest figure appears in 1923, when about 17,000 acres averaged only 4 tons per acre of washed beets, and the highest in 1926, when with a favourable season 8·7 tons per acre were recorded on 125,000 acres. The average for the eleven years 1912–15 and 1920–26 was 6·16 tons per acre.

Even when the vagaries of season and the inevitable mistakes of growers in the production of a new type of crop have been allowed for, this average appears to be disappointing and compares very unfavourably with the crops obtained in some of the competing countries and by some successful growers in England. Under really favourable conditions, crops up to 20 tons per acre have been obtained in England, while there are very many places where farmers have grown and sold 12-14 tons per acre on large areas of land. It seems that in the growing of this crop the farmer has a very well-marked opportunity for the exercise of technical skill, and the difference between a 12-ton crop and the average of 6 tons must be accounted for in most seasons by the difference in the degrees of skill and judgment found in the growers.

Of course, the ultimate measure of a sugar beet crop must be taken in terms of sugar per acre, and therefore the sugar content of the roots comes to have considerable importance. Of late years the average sugar content in England has been as good as that of the continental crops, and it appears that we have not so much room for improvement in this particular as in the matter of yield of beets to the acre. It is not too much to say that, unless the average crop can be raised from 6·16 tons per acre to 9 or 10 tons per acre, there will be no future for sugar beet growing as a large branch of British agriculture.

Mr. Dowling's book, following upon a smaller work on the same subject, is the first attempt to deal comprehensively with the crop as it appears in England. It is in the nature of a text-book, and is a painstaking piece of work which gives the

general principles for the successful culture of sugar beet in a form which is easily available to both farmers and their many advisers. It has also the advantage of appearing at a time when it can be really useful.

There are considerable opportunities for agricultural scientists of various kinds to extend and improve the information which exists at present in such matters as the special manuring of sugar beet; the breeding of strains suitable to varying conditions of soil and climate; and the design and use of labour-saving machinery, but the immediate problem lies with the growers. The soil, climate, and knowledge already available are good enough to raise the poor yield of the average crop by several tons per acre, if they are only used to the best advantage. Unless this is done in the next three years, we cannot hope to find a strong and important sugar beet industry as a feature of British agriculture at the end of the subsidy period.

CLEMENT HEIGHAM.

Theoretical Physics.

(1) *Handbuch der Physik.* Herausgegeben von H. Geiger und Karl Scheel. Band 5: *Grundlagen der Mechanik, Mechanik der Punkte und starren Körper.* Pp. xiv + 623. 51·60 gold marks. Band 7: *Mechanik der flüssigen und gasförmigen Körper.* Redigiert von R. Grammel. Pp. xi + 413. 34·50 gold marks. (Berlin: Julius Springer, 1927.)

(2) *Lectures on Theoretical Physics delivered at the University of Leiden.* By H. A. Lorentz. Authorised translation by Dr. L. Silberstein and A. P. H. Trivelli. Vol. 2: *Thermodynamics*, edited by T. C. Clay-Jolles; *Entropy and Probability*, edited by Dr. C. A. Crommelin; *The Theory of Radiation*, edited by Dr. A. D. Fokker; *The Theory of Quanta*, edited by Dr. G. L. de Haas-Lorentz. Pp. xii + 410. (London: Macmillan and Co., Ltd., 1927.) 21*s.* net.

(1) THE two volumes before us of Geiger and Scheel's "Handbuch der Physik" contain a complete survey of those portions of the mathematical analysis of the mechanical principles and their applications which have any bearing on physical phenomena and theory in the broadest sense of those terms. After a preliminary short section on the various axiomatic systems of mechanics, the first volume opens with an excellent analysis of all the fundamental principles and methods employed in the attack on the soluble problems of dynamics. This is followed by a short section on the important subject of disturbed motions, the first step towards the solution of more general problems. These two sections on general principles and methods are followed by a number of chapters on the detailed application of the methods to specific problems: the first of these is on the kinematics of a point and rigid body; then there is a chapter on the geometry of forces—including the graphical methods, and one with the usual treatment of the dynamics of mass point systems and of rigid bodies. This volume concludes with a section on the applications of dynamical principles to technical problems, and a final short section on the bearing of the special and general relativity theories on the principles and results of the previous general theories.

The second and smaller volume treats of the mechanics of fluid media. It commences with a section on the formal theory of ideal fluids and the usual problems which are dealt with in that theory; the second section contains the usual and familiar theoretical treatment of viscous fluids. The third and fourth sections deal with the various points of interest which arise in the technical applications of the subject in hydraulics, to such problems as water flow and propeller motions. The fifth section treats of the dynamics of gases—including a discussion of finite streaming—and the book is completed by a long and comprehensive section on capillarity.

In both volumes, but perhaps—from an English point of view—more particularly in the second, the details of the treatment of the separate subjects are on familiar lines, but the choice and arrangement of the matter represents a definite and carefully planned compromise between the intensely mathematical treatment of the larger treatises and the purely descriptive physical ones of the text-books. But it is this careful balance which is everywhere maintained between the mathematical analyses of the subject and the purely descriptive expression of the underlying physical principles and results, which is the most pleasing feature of the whole work, and will therefore commend these volumes to those who are attempting to obtain a sane outlook on these subjects in particular and physics in general—a somewhat difficult matter in these days of wave mechanics and matrices.

In England theoretical physics, or 'applied mathematics,' as some of us like to call it, has unfortunately fallen between two stools—or 'chairs' in our university meaning of that word. On one hand, we have the mathematician, doing it as applied mathematics, that is, as a set of axioms

on which changes can be rung with the instruments of pure mathematics, who has less interest in maintaining a vital contact between the subject and the real facts of life than in obtaining an exact solution of a difficult and artificial problem. On the other hand, we have the experimental physicist with little or no mathematical training and a tremendously suspicious attitude towards anything involving a double integral or the *curl* of a vector, who does not realise, therefore, that the most general mathematical expression of a physical result is probably the most definite, concise, elegant, and illuminating expression of that result that it is possible to obtain.

This unfortunate state of affairs will continue so long as we refuse to recognise that theoretical physics and applied mathematics are really one and the same subjects, and that if it is necessary for the mathematician to do theoretical physics to maintain his mental equilibrium—as many of us feel—it is even more necessary for the physicist to do applied mathematics to enable him to appreciate the full meaning and bearing of his experimental work ; but it is some such compromise between our present views of these two subjects as is offered in these two books that should really be taken by both sets of students.

However, this purely domestic matter has little to do with the two books before us, except that it induces us to commend them to our physicists and mathematicians more strongly than might otherwise be necessary. Apart from this, the two volumes are worthy models of what a 'handbook' really should be, and we may congratulate the authors in particular, and the editors and publishers in general, on the really successful achievement of this part of their plan.

(2) The second volume of Lorentz's lectures is in four sections, dealing separately and respectively with thermodynamics, entropy and probability, the theory of radiation, and the theory of quanta. The first section, on thermodynamics, covers all the usual topics of the text-books on this subject, including the applications to phase theory and the graphical geometrical treatment of the problems that arise therein. The second section, on entropy and probability, commences with Boltzmann's deduction of Maxwell's law, and then discusses Gibbs's method of canonical and micro-canonical assemblages and the statistical definitions of entropy. The third section contains one of the few consistent treatments in existence of the fundamental laws of the theory of radiation, finishing up with Jeans's and Planck's derivations of the fundamental function. The last section, on the theory of quanta, gives in broad outline Bohr's theory of atomic structure with its modifications by Debye, Epstein, Sommerfeld, and others, and also the main applications of the same ideas to the theory of the material states.

This second volume differs somewhat in character from the first volume, in that it deals in a rather less specialised manner with the subjects covered in the titles. The separate sections of the present book are in fact more in the nature of introductions to their respective subjects ; and presented as they are with the generality and all the ease and grace of Lorentz's inimitable style, they combine into a really excellent text-book, admirably suited for use by students commencing a theoretical study of these subjects. Each section contains all the essential theoretical and practical details of the topics it handles and is as complete as possible in the limited space allotted to it.

The translation is unfortunately not quite up to the standard of the previous volume. The desire to be literal has resulted too frequently in clumsy sentences in unusual grammatical form, which could easily have been recast in a clearer and more elegant form ; and occasionally the sense has disappeared entirely from the text. For example, the phrase "the whole can be attributed a definite free energy," which occurs on p. 51, and the italicised phrase on p. 157, namely, "the results of a lottery can acquaint us with the real state of a system," do not convey much to a reader unfamiliar with foreign grammatical form. These blemishes, however, although frequent, are not serious enough to prevent the reader from getting the full sense of the text very easily, and they do not therefore materially detract from the general excellence and usefulness of the book.

G. H. L.

A Record of Physiology in Great Britain.

The Journal of Physiology. Author Index to Volumes 1 to 60. Issued by the Physiological Society and published as a Supplement to *The Journal of Physiology*, June 1928. Pp. ii+235. (London : Cambridge University Press, 1928.) 25*s.* net.

THE pre-eminent position of British physiology is inseparably connected with the *Journal of Physiology*, which was established in 1878 by the late Sir Michael Foster and A. G. Dew-Smith two years after the Physiological Society was started on the initiation of Sir J. Burdon Sanderson.

The interesting "History of the Physiological Society" during its first fifty years (1876–1926), written by Sir Edward Sharpey-Schafer, was brought out as a supplement to the *Journal* last December (*vide* review, NATURE, Mar. 31, p. 491), and now an author index to volumes 1 to 60 of the *Journal* (1878–1928) has been issued as a supplement to its June number. These two supplements have appropriately appeared close together, for they cover practically the same—the Augustan—period of British physiology, during almost the whole of which the *Journal* was under the editorship of the two Cambridge professors, Michael Foster and J. N. Langley.

Turning over the pages of this important record, the reader finds that though no one has contributed to every volume of the *Journal*, the late Prof. Langley's name appears in all but six, being absent from vols. 21, 26, 32, 34, 44, and 55; that Sir Edward Sharpey-Schafer had papers in vols. 3 and 60, with many in between, and that Sir Charles Sherrington's name first appears in vol. 5 and steadily continues to nearly the end. A distinction is made between papers in the *Journal* and communications in the *Proceedings of the Physiological Society*, which first appeared in vol. 4 of the *Journal*; thus among the 128 entries under the late Prof. Langley's name there are no less than 82 papers in the *Journal*, the remaining 46 being in the *Proceedings* of the Society. His successor in the Cambridge chair of physiology, Prof. Joseph Barcroft, makes his first appearance in vol. 25 (in 1900), and so far has made 63 contributions, of which 36 are papers in the *Journal* and 27 communications to the Physiological Society.

A noticeable feature is the large number of combined papers; thus there are thirteen by Profs. Starling and Bayliss. There is also much evidence of the stimulating influence of the senior on the junior worker in combined authorship; this is shown, for example, in 49 out of the 63 entries under Prof. Barcroft's name, in 35 out of Dr. J. S. Haldane's 48, in 41 out of the 128 entries under Prof. Langley's name, in 19 out of Sir E. Sharpey-Schafer's list of 35, and in 20 out of the 45 standing to the credit of the late Dr. Sidney Ringer, a most constant contributor to the first eighteen volumes.

This author index is a most interesting record, an extremely useful source of reference, and a monument, if it were needed, to the work of British physiologists.

H. R.

Our Bookshelf.

What Botany really Means: Twelve Plain Chapters on the Modern Study of Plants. By Prof. James Small. Pp. 200. (London: George Allen and Unwin, Ltd., 1928.) 5*s*. net.

A GLANCE at the illustration at the beginning of this book, which illustrates the adventures of running sap, is sufficient to show that the book is constructed on unusual lines. Upon critical examination, probably any regular reader of NATURE could find some section which might undergo alteration in the interest of accuracy. At the same time, most readers would regretfully disclaim the capacity to produce such a book, and the vast majority would agree with the reviewer that its production is a definite gain to botany as well as to the community.

The text has evolved out of a series of broadcast talks from the Belfast station of the British Broadcasting Corporation, and something of the vividness and spontaneity of the original spoken phrase adheres to this slightly more formal presentation of the subject matter. In trans-Atlantic phraseology, Prof. Small seems to possess the rare faculty of "getting his ideas across" to a general audience of all ages. For one thing, he sees the romance behind the routine task of the grower, the manipulator and the vendor of plants. His book may be recommended very warmly to the general reader. It reminds the average man to what extent his life is based on the growth and activity of the plant, and at the same time it reveals very interesting glimpses of the fascinating and fundamental problems that arise as soon as his interest is aroused in them. The comparison of the plant with an internal combustion engine is particularly well worked out.

Prof. Small claims that only three technical terms are employed in his twelve chapters, enzymes, osmosis, and gametes. The language is certainly very simple and non-technical, in view of the fact that fundamental problems in plant physiology are squarely faced. Diffusion, if regarded as technical, would have been a welcome additional term. It might have avoided the implication on p. 92 that the sugar solution draws not water merely, but salt also, into the osmotic cell.

Electric Rectifiers and Valves. By Prof. Dr. A. Güntherschulze. Translated and revised by Norman A. de Bruyne. Pp. ix + 212 + 10 plates. (London: Chapman and Hall, Ltd., 1927.) 15*s*. net.

ELECTRIC valves have been rapidly coming to the front during recent years for many and varied purposes. For example, the building of large alternating current power stations to replace direct current stations scattered over a wide area has raised the problem of whether it is possible to utilise the old machinery. The invention of the mercury arc rectifier has in several cases prevented the old machines being scrapped. For broadcasting use there has been a great demand for small rectifiers. Valves are also used to produce high frequency

oscillations, to act as cut-outs so as to prevent reverse currents, to measure small alternating currents, and for many other purposes.

The method of producing direct current by rotary converters entails having an attendant to look after the rotating machinery. Electric valves need very little attention. There are many different types of rectifier in use, each involving a different physical process. The best known are the mercury arc, thermionic valve, electrolytic valve, those that produce discharges through gases, and contact rectifiers.

The book under notice is divided into two parts. The first part gives a good account of the physical theory of the action of valves. The second part describes the various kinds of devices used in commerce. The arc valve is the most important in practice, and large mercury arc rectifiers with outputs measured in thousands of amperes are in everyday use. The author gives a very brief account of the mercury jet rectifier invented by Prof. Hartmann. This mechanical device is now well known. An interesting and novel use for valves is for producing electric waves of any desired shape. The method is fully described. This book will be specially useful to research physicists.

The Cable and Wireless Communications of the World: a Survey of Present Day Means of International Communication by Cable and Wireless; containing Chapters on Cable and Wireless Finance. By F. J. Brown. Pp. ix + 148. (London: Sir Isaac Pitman and Sons, Ltd., 1927.) 7*s.* 6*d.* net.

THIS book appears at a timely moment, as the question of the future of international communication is one that must soon be settled. Great Britain has always taken the lead in submarine communication. It still possesses nearly half the total mileage of submarine cables in the world. The price of cabling to New York was originally £20 per message consisting of 20 words and one pound for each additional word averaging five letters. It is now ninepence a word. This can be greatly reduced by the use of codes or by sending deferred messages. Letter telegrams are also coming into use, the communication being sent by post to the sending end of the submarine cable and being sent by post from the receiving end. In the beam radio service between Britain and Canada a post-radio-letter telegram system is used at a charge of 1½*d.* per word. We see no reason to doubt that the prices will be still further reduced.

Notwithstanding the remarkable rate at which radio communication has developed, submarine cables still remain the principal means of telegraphic intercourse between the widely separated countries of the world. The author of the book under notice investigates the inherent costs of radio and cable systems; but it is difficult to arrive at definite conclusions, as the radio public companies do not separate the financial results of their communication services from their manufacturing activities. The desirability of having State or private ownership of long-distance telegraphy and telephony is also discussed. Many interesting data are given, and the book can be commended to all interested in long-distance communication.

Cain; or, The Future of Crime. By George Godwin. (To-day and To-morrow Series.) Pp. 108. (London: Kegan Paul and Co., Ltd.; New York: E. P. Dutton and Co., 1928.) 2*s.* 6*d.* net.

A VERY strong plea for the humanitarian and scientific treatment of the criminal. At the same time, the author's wholesale rejection of the death sentence for murder is a matter for considerable argument. He thinks that the deterrent effect of hanging is of small moment. Let him visit a few of the London bars and study the occupants, and say if fear does not keep some of them from taking the lives of their fellow-creatures. Why do race-course gangs work in gangs? For one reason—because of the individual's fear of punishment and hope of avoiding it in the crowd. There is, however, much very good sense in the book, and the author's plea for the delinquent child is sound and his peep into the future of crime not far off what will be truth.

The Phase Rule and its Applications. By Prof. Alexander Findlay. (Text-books of Physical Chemistry.) Sixth edition, revised and largely rewritten. Pp. xv + 326. (London: Longmans, Green and Co., Ltd., 1927.) 10*s.* 6*d.* net.

FINDLAY'S "Phase Rule" is too well known to call for a lengthy review on the appearance of a new edition. It is now five years since the *format* was changed in a new post-War edition of the book, and the subject is too well established to require a similar drastic revision at the present stage. The present edition is, however, 28 pages longer than its predecessor, and includes a new chapter on the practical application of equilibrium diagrams, in addition to the modifications and additions that have been made elsewhere. The revision has therefore been sufficiently thorough to ensure that the book shall be kept up-to-date, and the purchaser of the sixth edition need have no fear that he is securing a mere reprint of a former issue.

Outlines of Scientific Anatomy: for Students of Biology and Medicine; designed to Supplement the usual Text-book Teaching. By Prof. Dr. Wilhelm Lubosch. Translated from the German by Prof. H. H. Woollard. Pp. xiii + 392. (London: John Bale, Sons and Danielsson, Ltd., 1928.) 21*s.* net.

IN this book Prof. Lubosch attempts to deal with the facts of anatomy in such a way as to bring them into the widest possible correlation with learning in general. Or perhaps it would be more correct to describe his essay as the creation of a system of philosophy based upon speculations concerning the structure and developmental history of the human body. To many biologists such a mode of approach to the study of living creatures may seem far too transcendental to be of serious value; but the philosophically-minded student may discover a new interest in the dry bones of anatomy by indulging in such day-dreaming as Prof. Lubosch's fantasies provoke.

Letters to the Editor.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, nor to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Evidence of Survival of a Human Personality.

I HAVE just been able to see NATURE of Aug. 18 before leaving America for Australia, and must ask permission to reply to the editorial article in that issue referring to my report, which, as you were good enough to admit, established at least a *prima facie* case for the supernormality of the Margery phenomena.

The article referred to is fair but weak. The supernormal does not mean the supernatural. Everything must be accordant with Nature when properly understood, but for lack of experience some things that occur may seem to us strange and exceptional. That is no reason for refusing scientific attention to them when reasonably evidenced. A century ago, the breaking down of a chemical element would have been regarded as supernormal—there is no need to multiply instances of things which would have been discarded at one time, though as knowledge grew they were accepted and incorporated into the body of organised science.

The purport of my article is to show men of science that supernormal phenomena *do actually occur* in Nature and ought therefore to be studied by them. I cannot accept the plea that science has too much to do to attend to them: such an attitude would have excluded many now recognised discoveries. The discovery of radium ultimately broke up the old physics and opened up a new atomic theory. Biology will never progress so long as it is built on the foundation of the material cell and molecule and atom: psychical phenomena clearly point the way to a deeper understanding of the meaning of life. My call is not to the older biologists but to the younger men, feeling confident that some of them have the courage and vision to follow up the new path into unexplored territory.

On page 230 complaint is made of the "inadequacy and oddity of the tests." The tests were not inadequate, though they may appear so after the rigorous pruning and shortening of my report on which you insisted; and it is not their oddity which should surprise you, but the evenness of the results.

On page 230, par. 4, the phrase "my number" only signified that it was the number selected by Walter out of my lot of sheets. A reader could see that that was all I intended to convey.

You also ask in the same paragraph whether we signed "all the sheets under instruction." The answer is No. Other misapprehensions would have been removed by my full report. I had made secret signs on some of them, and otherwise had taken every precaution to prevent fraudulent substitutes of my sheets, but these details had to be cut out for brevity in the version you admitted. The object of the test was to see whether Walter could select and cognise numbers in the dark and then convey those numbers mentally to Mrs. Litzelmann, eighty miles away. Even assuming that Margery was awake and could see in the dark, you have not even begun to offer an explanation of how Mrs. Litzelmann simultaneously wrote those numbers, eighty miles away, in a tiny village without any quick means of communication with Boston. As to what the writer of the article thinks may have been Mrs. Litzelmann's successful 'shot' at a square and a circle, it must be remembered that she did not even know that it was to be a drawing test, and that Mr. Evans might have drawn anything—flowers, fruit, animals, anything; so it is unreasonable to attribute success to mere chance.

As a further test of Walter's power to see and do things in the dark, I may mention that, at a subsequent sitting on Aug. 9, Dr. F. Muir, of Honolulu, was with me, having brought some pieces cut out of a magazine to see if Walter could decipher them and pass a knowledge of them to Mrs. Litzelmann sitting simultaneously in her own home in Cambridge. Two of these fragments he took out of his pocket and gave to Walter in the dark. After the séance, Margery wrote the words "The Moon" and "No Joke"; and these words were afterwards found to correspond with the slips presented at random. I took a telephone call to Mrs. Litzelmann's house, and they reported that she had drawn a crescent moon followed by some hieroglyphics (see Fig. 1), which when held to a mirror reads as the word "joke."

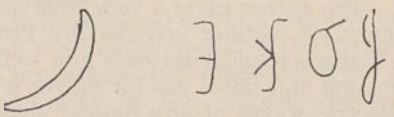

FIG. 1.—Copy of what Mrs. Litzelmann wrote at a distance of 80 miles from the séance of Aug. 9.

At the same sitting Walter chose the numbers 4, 1, and 14 from a calendar, and said that he would make Mrs. L. write it backwards. She wrote 41. I ask you what normal reason could she have had for writing this rather than any other combination of two digits. The suggestion that this lady, sitting simultaneously, miles away from the Crandons, can be an accomplice of theirs in fraud is really too wild to be taken seriously.

With regard to thumb-prints, the writer of the leading article in NATURE says that few of us could draw the pattern of our thumb-prints even while we have our thumbs. Exactly, that is what makes the thumb-print test so cogent as an individual character. He implies that it can have nothing to do with survival; but some psychical researchers, including myself, hold *as a possibility* that a surviving personality might possess a psychic body or soul, having a psychophysical parallelism with the physical body which is dead. If we can prove this, we also prove at the same time that *living men* are not mere physical bodies only, but psychic bodies (spirits, if you like) clothed temporarily in physical bodies, just as our physical bodies are covered with clothes. The problem is a greater one than that of mere survival; it concerns the basic nature of our existence *here and now*, as well as *hereafter*. Now it is an indubitable fact that Walter, dead for sixteen years, does give a consistent thumb-print in wax, which is not that of the medium or any of the sitters. He claims that it is his own thumb-print. The print agrees exactly with that afterwards found on the razor used by Walter on the morning of his death, though the latter shows only a portion of the ulnar area. Either, then, these prints are really those of Walter's psychic thumb, or they are produced fraudulently. It is my business as a researcher to eliminate all possibilities of fraud, so as to present this tremendous truth with irresistible force to the scientific world.

Finally, on my return to America, in order to eliminate every chance of collusion unless I myself were the culprit, Dr. Crandon allowed me to have a sitting alone with Margery; he and my assistant being outside the door. Under these conditions Walter came through, talked while Margery's mouth was prevented from speaking by Dr. Richardson's

'voice machine,' and finally gave me three excellent thumb-prints. Margery was bound hand and foot by adhesive medical tape, and otherwise fully controlled, her feet being in shoes and stockings.

This 'solus' sitting is unanswerable. It is the crown and triumph of my work in psychical research. It now only remains for sceptics to accept the proof or to attack my own competence and veracity.

R. J. TILLYARD.

San Francisco, Cal., U.S.A.,
Sept. 4.

[WHEN on his way to New Zealand, Dr. Tillyard sent a long letter in reply to the leading article in NATURE of Aug. 18. Space could not, however, be found to publish the letter in full, and as much delay would be involved if it had to be sent to him for abridgment, we decided to ask a friend who is an expert in the subject to condense it and yet include the salient points. The letter represents this abbreviated version of the original communication.

We cannot think that in his letter Dr. Tillyard has added any cogency to his article. He does not attempt to reply to the very pertinent remarks we tentatively made, and above all to the suggestion that the experiments were not devised by himself. Moreover, his attempt to show that he had tried to prevent substitution of the calendar sheets by making secret signs is entirely beside the mark. No substitution whatever was necessary. Dr. Tillyard provided the critic with a normal explanation by using *all* the calendar sheets and then handing over the whole packet when told to do so by the 'Control,' as also did Mr. Evans by drawing *ten* diagrams when *one* playing card drawn haphazard from his own pack would have been sufficient. Instead of explaining why he did these things, he speaks of new experiments at subsequent sittings, both alone and with others, on which we do not propose to comment.

Before these alleged 'psychic' phenomena can be accepted by the scientific world, the method by which experiments are conducted will have to be wholly revised. The novel atmosphere of the séance room and the unexpected events which take place there are often apt to blind the newcomer to the faulty scientific procedure that prevails. The observers are never really the experimenters. They are the obedient servants of the 'Controls,' who direct their actions, their tests, and their general behaviour. If they attempt to assert their authority, either their presence is considered undesirable, or the 'phenomena' cease. The conclusions of the Sorbonne Commission a few years ago that 'psychic' phenomena tend to decrease in proportion as control conditions are applied, admit of few if any exceptions; and until Dr. Tillyard's results are independently confirmed under much more rigid conditions, and without the flaws indicated above, it would be rash to suppose that this case provides better evidence for the supernormal than those hitherto reported.—EDITOR, NATURE.]

Capillary Properties of Moist Granular Media.

THE following experiment may be of interest as providing a very simple and direct means of demonstrating the behaviour of a granular medium in regard to capillary properties and the Osborne Reynolds effect. An excellent material for the purpose is the tinsel known as 'glistening dew,' which consists of minute spherical beads of glass of considerable uniformity.

A U-tube arrangement is set up with one arm formed by a burette with double-bored stop-cock, while the other arm terminates in a Buchner funnel containing the glistening dew or other medium. The apparatus is filled with water so that the glistening dew in the funnel is flooded. Then by simple manipulation of the burette stop-cock the water level can be lowered in stages and the water in the voids of the glistening dew subjected to a pressure deficiency increasing at each stage. The water drawn out of the medium can be observed on the burette scale at each stage. In a particular case the mean particle radius was $r = 0{\cdot}019$ cm. and the material showed a pore-space of about 36 per cent of the total volume. If the pressure deficiency is expressed in terms of T/r (T = surface tension of liquid), this allows of direct comparison between cases in which different materials and liquids are used. The following points can be observed:

(1) The first stage, which covers suction values from zero to about $3T/r$, is marked by a tightening of the water film round the surface layer of particles. The surface appearance changes from shiny to matt in consequence. The material remains saturated, the amount of water yielded by this surface change being very small.

(2) Over this same range the Osborne Reynolds effect may be demonstrated (namely, the anomalous dilatation of a granular medium under compression). If the surface of the glistening dew is loaded an expansion takes place causing an increase in the volume of voids. The conditions allow the material to remain saturated so that water is drawn out of the burette with a slight increase in suction value. On removing the load, recovery takes place, the excess water released causing a momentary glistening of the surface.

It may also be observed that the change of the water film from the relaxed to a tensed condition over this range causes a very marked increase in rigidity in the material, the increased stress between the particles increasing the internal friction.

All the above phenomena are familiar in the behaviour of sea-shore sand drained by a receding tide and compressed by the foot. Under suitable conditions the regional increase in suction due to compression and dilatation may be considerable.

(3) As the suction rises above the value $3T/r$, the water film begins to enter the material at the points of least resistance, *i.e.* at the largest surface pores. The character of the pore space is that of a number of cavities communicating by comparatively narrow passages. Hence the entry of the film into a cavity is sudden, an expansion of the film taking place as soon as it has passed the narrowest point of the entry passage. In other words, the atmosphere 'blows a bubble' into the cavity. This entry of air causes an increase in internal reflection of the neighbouring particles, so that the process is evidenced visually by sudden scintillations of the surface particles. It may be watched in detail with the aid of small magnification.

(4) The entry of air in the above manner does not become general until the pressure deficiency reaches the region of $6T/r$, which may be regarded as the average 'entry value.' This is evidenced by the fact that less than 1 per cent of the moisture in the glistening dew is lost up to this point and that about 70 per cent drains out with but a slight increase in the pressure deficiency. The material now becomes white and glistening—a change which corresponds to the lightening of colour when any wet granular medium dries.

(5) When the water is allowed to flow back by reducing the suction to zero again, bubbles of air are retained in the pores to the extent of about 19 per

cent of the total space. The tendency is always for narrower places to fill first with water, which has the effect of trapping bubbles in the larger cavities. These bubbles may be made to rise to the surface by jarring the flooded material. The increments of moisture take place at lower values of pressure deficiency than those for decreasing moisture, so that the suction–moisture curve when plotted passes round a hysteresis loop.

A fuller treatment of the subject, particularly in relation to soil studies, has been given in the *Journal of Agricultural Science* (**17**, p. 264; 1927).

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Theory of Electrical Migration of Ions.

THE object of this note is to show that the theory of moving boundaries as developed by Kohlrausch and Weber overlooks the unequal transfer of the common ion at the boundary and consequently rests on a misconception of the conditions on the 'indicator' side of the boundary. For a stable boundary it is necessary that the slower moving ion follows the faster moving one and both should move at the same speed. This happens when the concentrations of the two electrolytes AR and BR on the two sides of the boundary are related as in the equation (1) $\alpha/n_A = \beta/n_B$, where α and β are respectively the concentrations of the electrolytes AR and BR, and n_A and n_B are the transport numbers of the ions A and B in the electrolytes AR and BR.

In deducing this relation it is assumed that the electrolytes are completely dissociated and that the ionic mobilities are constant and independent of the concentration. Kohlrausch's differential equations are only true for continuous transitions of concentrations in the liquid through which an electric current is passing, and cannot be extended as such to the discontinuous transition at the boundary between AR and BR. Both Kohlrausch and Weber recognise this. Of discontinuous transitions they consider in detail the transference of ions across boundaries between two concentrations: (i) of a single electrolyte AR, and (ii) of a mixed solution of several electrolytes with a common ion.

The fundamental assumption of Kohlrausch is the validity of Ohm's Law at all points in the electrolyte, and Kohlrausch shows that the total number of ions of any sign entering or leaving a layer during the interval dt is the same whether the change in concentration is continuous or discontinuous. Both Kohlrausch and Weber conclude that they are justified in treating discontinuous transitions, including that at the boundary between AR and BR, as being a limiting case of continuous transitions, and the mistake which has been overlooked since then consists in considering that the differential equations are applicable to the boundary between AR and BR.

Let us consider a cylindrical tube of unit cross-section containing the boundary and assume that the electrodes are situated at a great distance such that the products of electrolysis do not enter the tube. The concentration of the two electrolytes are related as in equation (1). Now, if a current passes through the tube, there will not be any mixing of the ions A and B, and the condition of electrical neutrality underlying the validity of Ohm's Law would be maintained at and in both sides of the boundary had it not been that more of the ions R leave the layer of the electrolyte BR just contiguous to the boundary than enter it from the layer AR. In other words, there will be an excess of ions B in this layer, which means that Ohm's Law cannot be valid. As a result of this there would be a drag and an adjustment of potential gradient, which for the steady state would mean an equal number of ions R entering and leaving the same layer during the interval dt.

The magnitude of the excess is obviously given by $i.\{(n_R)^{BR}(n_R)^{AR}\}$, where the terms within the brackets are respectively the transport numbers of the ion R in the electrolytes BR and AR. Overlooking for the present the consequent drag on the ions in this layer, we find that a layer of thickness which is equal to $H \,.\, V_R \,.\, dt$, where H is the potential gradient, in the layer BR, and V_R is the mobility of the ions R, will be depleted of all the ions R if we put in these equations the current densities and concentrations used in such experiments. In contrast to the condition in the layer BR, the A ions always move in a 'uniform ionic environment,' as the ions R which move past them always come from the layer of electrolyte AR, and the number thus crossing past the ions A are little, if at all, affected by the drag on the BR side of the boundary.

This consideration also explains why it is necessary to distinguish the electrolyte with the slower moving ion as the 'indicator' solution. This distinction is based on experience, but is not contemplated in the theory of Kohlrausch and Weber. These considerations also explain the observations of Steele, of Abegg and Gauss and subsequent workers, that equation (1) is not sufficient to define the conditions of a sharp boundary even when proper precautions have been taken against the disturbances resulting from the heating effect of the current and from the differences in density. MacInnes has in recent years shown that the adjustment of concentration postulated by Kohlrausch takes place only within a small range of concentrations. A paper containing a fuller treatment has been communicated for publication.

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Porbeagle Shark in the River Towy.

ON Oct. 2 I had a letter from Mr. George M. King, Superintendent of Water Bailiffs for the River Towy Fishery District, recording the capture of an unusual fish in the Towy on Sept. 30. He enclosed a photograph, here reproduced (Fig. 1), from which it was clear that the fish was *Lamna cornubica* Gm., the Porbeagle shark. At my request the fish was afterwards sent on to the National Museum of Wales, where it will be mounted.

There are, of course, not a great many definite records of the Porbeagle round our coasts, though the fish is probably not uncommon in some areas. Day, in "The Fishes of Great Britain and Ireland," gives about twenty-four records for Great Britain and five for Ireland. Dr. J. Travis Jenkins, in "The Fishes of the British Isles" (1925), adds several more.

As regards Welsh records, Pennant described one from the Menai Straits, whence the species has sometimes been called the Beaumaris shark; one was washed against a pier at Swansea in a storm in October 1835 (Dillwyn), and picked up nearly dead; J. J. Neale, in a paper entitled "Surface Fishes of the Bristol Channel" (*Transactions of the Cardiff Naturalists' Society*, vol. 21, part I.; 1889), lists the Porbeagle, but does not refer to any particular instance of its occurrence; Walton, Fleure, and Wright, in an account of the fauna of Cardigan Bay,[1]

[1] "Aberystwyth and District"; a guide prepared for the Conference of the National Union of Teachers, 1911.

include the Porbeagle, but observe that "of course *Lamna cornubica* is merely a very occasional visitor." It is taken from time to time in the Menai Straits (Forrest, "The Vertebrate Fauna of North Wales").

The chief point of interest about the present specimen is that it was caught in a shallow below the point known as the Black Pool—a distance, according to Mr. King, of approximately ten miles from the mouth of the River Towy. According to the statement of the coracle fisherman who caught it, he was returning about 5.30 P.M. from Llanstephan on the first of the tide, which was a 'big spring'—high water at Carmarthen 7.20 P.M.—when he noticed the dorsal fin of the shark cutting the water. He states that he

Photo] [*George Weaks.*

FIG. 1.

anchored his boat and went in pursuit; that the fish first retreated into still shallower water, then, to use his own words, "came for me like a bull, but I kicked it." Eventually he finished it off by a blow with an oar.

My informant adds, "It will no doubt interest you to know that several netsmen now inform me that they caught fish during July and August which were so badly scarred as to be unsaleable."

The stomach of the shark was examined here when the fish was received, but was found to be empty. This is not the place to enter into a discussion as to the probability or otherwise of a connexion between the poorness of the Towy fishing during the latter part of the present season and the presence of predatory species in or near the estuary. This note is intended simply to direct attention to the unusual circumstance of a shark being found at such a distance from the sea.

The specimen was 44 inches in length, 33 inches maximum girth, and 36 lb. in weight. It is therefore a small one of its kind, the Porbeagle commonly attaining a length of 8 feet and sometimes of 9 or 10.

COLIN MATHESON.

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National Museum of Wales,
Cardiff.

The Origin of the Dermis.

IT has been shown by morphological studies that the dermatome of the somites of the vertebrate embryo breaks up into mesenchyme, which becomes the dermis underlying the ectodermal component of the skin of the dorsal and dorso-lateral regions at least. It is frequently assumed in text-books that these same cells spread out under the whole of the epidermis of the embryo and so give rise to the dermis of all regions. In the case of the chick at least, this assumption is not justified, for the mesenchyme derived from the dermatome is indistinguishable from, and becomes mixed with, that derived from other regions. In the course of certain experiments carried out with another object, I have obtained evidence which indicates strongly that the dermis of the limbs and lateral regions, and by implication of the ventral regions, is derived from cells of the somatopleur, not of the dermatome.

The experiments consisted in the grafting upon the chorio-allantois of eight-day chicks of certain regions taken from two-day chicks. The regions used as grafts came from the side of the posterior end of the embryo and were bounded by an anterior line running transversely to the axis of the embryo a little behind the level of the last somite formed, by a line running antero-posteriorly parallel to the axis of the chick and just lateral to the unsegmented vertebral plate, by a posterior line transverse to the axis of the chick and just anterior to the relic of the primitive streak, and by a lateral line parallel to the axis of the chick and lying at or near the periphery of the area pellucida. The grafts thus contained ectoderm, somatopleur, splanchnopleur, and endoderm, but no somites nor somitic derivatives, and no part of the vertebral plate. Obviously no median structures were present.

In addition to cartilages representing an attempt to form limbs, and segments of intestine (in two cases rounded to form tubes), there were present in three cases areas of skin with a definite underlying dermis and young feathers. Evidently, from the nature of the experiment, this dermis cannot have come from dermatome material. Therefore it came from either intra-embryonic somatopleur, chorionic somatopleur, or allantoic splanchnopleur. A number of considerations, the discussion of which would occupy too much space in NATURE, indicate that the dermis was not derived from any chorio-allantoic mesoderm. The main point in this connexion is the inability of chorio-allantoic mesoderm to give rise to feathers even in the presence of epidermis (Hoadley, *Jour. Exp. Zool.*, **43**, p. 179; 1926). Hence the dermis must have come from the grafted somatopleur. The conclusion is drawn that dermis has two sources of origin in embryos: that of the dorsal and dorso-lateral regions is derived from the dermatomes of the somites; that of the limbs, lateral regions, and by implication also of the ventral regions, is derived from the somatopleur.

The question is discussed at greater length in a forthcoming number of the *Australian Journal of Experimental Biology and Medical Science*. I wish to express to the management of this journal my thanks for permission to publish this note.

P. D. F. MURRAY.

The University of Sydney.

Galton's "Life History Album."

IN 1902 the second edition of "The Life History Album," by the late Sir Francis Galton, was published by Messrs. Macmillan and Co. Ltd. This album contains blank tables and squared paper by means of which to record the physical and mental development of 'children' from the ages of 0 to 100 years. I have kept (and am continuing) such records of my two daughters from 0 to 22 in one case, and 0 to 15 in the other. Such individual records are of interest to those concerned, but are of little value to biologists unless there are many of them. As the second edition was published twenty-six years ago, there are probably by now several hundreds of these albums containing records, and it would be well if, say, the Galton laboratory had a list of the names and addresses of the owners so that the albums could be borrowed by that laboratory for some particular investigation.

I propose to prepare such a list for presentation to the Galton laboratory, and consequently shall be obliged if those who know of the existence of such albums will kindly send particulars of them to me at 17 Victoria Street, London, S.W.1. It is suggested that the particulars should include:

(1) The name and address of the owner.

(2) The limits of the age of child covered by the records.

(3) The sex of the child.

A. S. E. ACKERMANN.

17 Victoria Street, Westminster,
London, S.W.1, Aug. 10.

A Simple Method of Distinguishing Plotted Points for Reference.

IN plotting the results of experiments it is often necessary to use different marks for points, to distinguish between the results obtained by different investigators or to allow rapid reference to numbered experiments. Circles, dots, triangles, crosses, and coloured inks are commonly used for this purpose, with or without the addition of identifying letters or numbers.

In the case of diagrams, and especially those for small-scale reproduction, the use of coloured inks and letters is often impracticable, so that the stock of distinguishing marks is sometimes quite inadequate.

In work now in hand, I have successfully got over the difficulty by what is believed to be a novel application of the semaphore system. The plotted point is marked in the usual way by either a dot, a small circle, or a large circle, but to its periphery is attached a short line, like the arm of a semaphore. I find that eight positions of the arm at 45° angular displacement can be distinguished quite easily, thus giving twenty-four distinctive marks.

The number can be doubled by adding a short line at right angles to the end of the semaphore arm, thus ♁, and can be increased to seventy-two by a similar addition to the left, thus ♁.

W. BEVAN WHITNEY.

The British Electrical and Allied Industries
Research Association,
36 and 38 Kingsway, London, W.C.2,
Sept. 26.

Hybrids of *Ægilops*.

DURING the last four years I have been engaged in the study of crosses between species of *Ægilops*. One of these, which I wish to record at present, is the hybrid between *A. ovata* L. and *A. cylindrica* Host.; this possesses all the morphological characters of *A. triuncialis* L. and cannot be distinguished from it except that the hybrids so far have proved sterile I hope shortly to complete the cytological study of the crosses.

I also discovered that the hybrids of *A. triuncialis* with *A. cylindrica* exactly resemble *A. persica* Boiss., now classed by Zhukovsky as a subspecies of *A. triuncialis*. *A. triuncialis* is one of the most widely distributed species of *Ægilops*, its range extending from Portugal throughout the Mediterranean region to Persia and Afghanistan. Systematists recognise a large number of varieties, differing chiefly in the number and length of the awns on the glumes.

I have little doubt that *A. triuncialis* is of hybrid origin, the typical form being the result of hybridisation between *A. ovata* and *A. cylindrica*; the short-awned form, *A. persica*, appears to arise from the back-crossing of the hybrid with the *cylindrica* parent, while the long-awned varieties are doubtless the product of back-crossing with the *A. ovata* parent.

JOHN PERCIVAL.

The University, Reading,
Sept. 25.

Can the Hand be thrust in Molten Lead without Injury?

IN NATURE of Sept. 8, p. 349, Mr. A. S. E. Ackermann asks this question. For many years it has been the practice in this Department to dip the fingers into molten lead when lecturing on the 'spheroidal state' of liquids. No special precautions are taken to free the fingers from grease, as is commonly advised; they are rinsed under the water tap and shaken to remove drops of water. It is even sufficient, if one finger only is to be used, to moisten it by putting it into the mouth. Of course, the fingers do not remain long in the lead, being withdrawn immediately they are covered, though undue haste in dipping and removal spoils the demonstration.

The existence of a badly conducting layer of vapour can also be shown by dipping the dry finger into liquid air. In this experiment, as the hand is hot relative to the liquid, the latter forms its own protective film, whereas in the former case the protection from injury is due to a layer of water vapour.

J. R. CLARKE.

Department of Physics,
The University, Sheffield.

Change of Resistance of Lead by the Action of Radium.

WHILE engaged in an investigation to determine the number of free electrons in metals, we have noticed a change in resistance when β particles and γ rays from radium are allowed to impinge on an insulated thin plate of lead. We have further noticed that the change is not permanent and that the resistance varies with time, returning to its original value.

Recently we have noticed that M. Rienci (*Accad. Lincei, Atti*, 7, pp. 400-405, March 1928) has found that the resistance of a thin pellicle of matter increases or decreases according to the nature of the charge, and for the most part the change is permanent.

Any real change in resistance, under the conditions of our experiment, has to be clearly distinguished from thermal effects due to the radiations. As the paper above referred to is not available to us, we are not in a position to know the details of Rienci's experiment.

Work on the subject is proceeding and the results will be published when ready.

K. PRASAD.
S. BASU.

Science College,
Patna.

The Nature of Skill.[1]

By Prof. T. H. PEAR.

THE CONCEPT OF SKILL.

THE word 'skill' is used in many ways. It is therefore reasonable that for scientific purposes its connotation shall be slightly limited. The following is proposed as a definition: *Skill is an integration of well-adjusted performances.* In such a terse statement all the words need explanation and illustration. First, it is useful to contrast skills which come within the range of this definition with that type of adjustment which is a collection of mere habits. I would suggest that the outstanding feature of habit is *specificity*. The experimental work upon transfer of training has made a belief in general habits untenable.

A habit may be defined as an acquired specific response to a specific situation. As soon as we cease to respond specifically, or the situation loses its specific character, our behaviour ceases to be habitual. Skill is dependent upon habit, but not completely. The present suggestion is that, treating the term skill with respect, we should apply it only to the higher types of well-adjusted performance.

Some so-called skills are a fortuitous concourse of habits; and many of these are bad. Often no single habit in the number is well adapted to the task, and the whole collection is only a makeshift, though a makeshift for the whole life of its possessor. Contrast this with the higher skills; integrations, not mere collections of responses, and not necessarily of habits only. Then to describe as skill some industrial occupations, and some forms of domestic service in England, would be flattery.

One of the first analyses of skill was made by Mr. Frank B. Gilbreth. Studying a bricklayer, he found that his eighteen movements in laying a brick could be reduced to five. One may conclude, therefore, that the original performance which he analysed could be called skilled only in the popular sense.

SKILL, CAPACITY, AND ABILITY.

Skill must be distinguished from *capacity* and *ability*. To possess a delicately discriminative inner ear and muscles under perfect control is to have capacity for musical performance. Obviously, such gifts may exist in a person who as yet has shown no musical ability. For he proves his ability to do a thing by doing it. Even by failing he does not necessarily demonstrate his lack of capacity. For if untaught he usually will have tried to do it in the wrong way.

Skill is clearly ability, but ability to do a relatively complicated series of actions easily and well. A man who can run need not be skilled in running. But if he has learnt to move his legs well, to regulate his breathing, to sprint at a particular point or moment, to estimate the time in which it is wise to run a particular lap, to adapt himself to different tracks, different lengths of race, different classes of competition, and different competitors, he possesses skill in running races.

Skill, therefore, implies discrimination of the situation and graduation of the response. But to this should be added what I suggest as the essential characteristic of skill—the ability to *integrate* responses, and in the highest skills to substitute, instantaneously if necessary, one type of integrated response for another. In man, this integration of well-adjusted performances is acquired and fused with natural aptitude, the nature of which will be discussed in a moment.

Those reflex mechanisms which contribute to balance, to the maintenance of posture, and to the efficient co-ordination of action are an important basis of skill. In this sphere we honour the famous contributions of Sherrington, Head, Magnus, and Pavlov, to whose great work, "Conditioned Reflexes," we stand too near to see it in perspective.

Can the physiologist regard skill as entirely an integration of conditioned reflexes? Eventually, perhaps. More than that we cannot say. We are warned not to exaggerate their interpretation. An impressive fact is that to ensure the certain conditioning of a reflex the control of external surroundings must be complete. The necessity, for example, of a sound-proof laboratory, of the absence of the experimenter, to say nothing of spectators, emphasises the specificity both of situation and response. Skill, on the other hand, typically shows itself in the rapid adjustment to a changing environment and to unforeseen conditions.

Comparison of human and animal behaviour has always offered great attractions—and risks—to members of the British Association. Yet I believe that the present comparison is not difficult. While many animals inherit high-grade skills, man does not. Birds inherit skill in nest-building, the kingfisher making one type, the swallow another, and, moreover, selecting different materials.

At birth, man is spectacularly unskilled. The skills which he afterwards acquires are almost entirely determined by his social and material environment. But he compensates for his start from scratch by the number and complexity of the skills which he soon acquires; and of these, language, the raw material of which is speech-habits, is an amazing example.

PATTERNING A CHARACTERISTIC OF SKILL.

The term 'pattern' has appeared frequently in recent psychological writings. But its meanings have been different and not easy to equate. It will be used here simply and objectively to mean an arrangement of human movements in time and space which shows *integrated order*.

Always in theory, and often in practice, such a pattern could be recorded, for example, by Gilbreth's moving, interrupted light fastened to any salient part of the body. Such a pattern could be

[1] From the presidential address to Section J (Psychology) of the British Association, delivered at Glasgow on Sept. 7.

left by the shoes of a dancer, if they were suitably treated. The ice and the snow record beautifully some movements of the skater and the ski-runner. But they receive a trace only of one part of the body. Usually, however, many other parts are simultaneously moving in unison, in harmony, perhaps even in counterpoint. All these spatial and temporal characteristics of pattern could be recorded. But equally important would be the delicate variations in force, corresponding to accent. This integration of the part-actions into wholes usually expresses the individuality of the performer. It is unlikely, for example, that the separate steps of a dance are ever fused into a whole without being changed.

SKILL AND AWARENESS.

Unless and until a highly skilled action has become really automatic, the performer is aware of its integral character. This awareness, unclear though it may be, determines the character of the part-actions. Examples are stress, accent, and intonation in speech. As the sentence is initiated the whole, of which the speaker is aware, determines the parts. To speak a foreign language well, one must raise and lower the voice at points quite different from those which would receive the stress in one's own tongue. To acquire such skill, the learner must attend not so much to the single words as to the whole sentence. This patterning, which dominates corresponding bodily and mental events, acts upon reflex, instinctive and habitual mechanisms. When it employs habits it usually transmutes them into actions less fixed and more adapted to the situation.

'PROPRIA' AND 'ACCIDENTS' OF SKILL.

(*a*) *In Sport.*—One may pertinently inquire if some of the features of ordinary sport-skills are essential or accidental. Borrowing terms from logic, we may inquire if skill has its *propria* and its *accidents*. He who would answer this should purge himself of local and topical prejudices. Many persons assume that skill must consist in the delicate co-ordination of hand and eye and in the timing of complex actions to coincide with a momentary combination of external events. Both these gifts are often indispensable in dealing with a moving ball. But the hurling of missiles is not the only skill to which man aspires. Certain skills are proudly possessed by the blind. Delicate timing enters scarcely at all into many kinds of postural skill, and is seldom necessary for industrial tasks. So probably those subjects which an Englishman would naturally want to study, moving-ball games, should be put late in the programme. More may be hoped at present from the study of postural skills, depending little upon the athlete's 'eye.' Such are swimming, gymnastics, ski-ing, skating, dancing, and eurhythmics.

Sometimes competition in skill is a proprium, sometimes not. The most obvious kind of competition is *destructive*, where A tries to spoil the effect of B's skill, or to prevent it, as in boxing, fencing, football, and hockey. Cricket and tennis involve semi-destructive competition, through prohibitions of space. Your cross-court shot may merely amuse your opponent, but at least it lived from your racket to the net.

In many sports the competition is non-destructive. The performances may even be successive, with every chance for the competitor to do his best; and for this reason I believe they will the sooner repay study. Smith's six-foot high-jump can never be spoiled by Jones collaring him low at the take-off.

These distinctions may be obvious. But I have never seen them made in scientific discussions of skill. A little less obvious, perhaps, is the thought that different types of competition are excelled in by persons of different temperaments. Too much of the fighter's spirit and too little of the artist's and thinker's may lose many games.

In many skills emotion is an 'accident.' Obviously a player should keep his head. But coolness may be but indirectly related to skill. Some play better when keyed up, fearing nerves less than stodginess; some wilt at the thought of spectators; others admit, even seek, the inspiration of a friendly and understanding crowd. Though emotion as an accidental factor may help or hinder the expression of skill, yet in music and acting it may blend with and form an integral part of the expression. Actors, for example, sometimes genuinely feel the emotion which they are portraying.

(*b*) *In Work.*—Thus far an attempt has been made to filter the general concept of skill and to reject irrelevant meanings. In dealing with industrial skill I am indebted to an article by Miss Anna Bezanson. She writes (*Quarterly Journal of Economics*, vol. 36, pp. 626-645; 1921–22): "Considering the glibness with which workmen are pigeon-holed as 'skilled,' 'semi-skilled,' and 'labourers' in many industries, it is surprising to find little definition of what constitutes skill or lack of skill. Everyone takes it for granted that precisely what he means is understood by referring to a workman as possessed of 'skill.'"

We may utilise Miss Bezanson's collection of 'accidental' factors in industrial skill.

(1) *Accepting Responsibility for many Independent Decisions.*—Though arriving at these decisions may involve skill, the acceptance of responsibility is due to other factors.

(2) *Learning about the Capabilities of Materials.*—This involves the ordinary processes of acquiring knowledge. Muscular or kinæsthetic knowledge can only be obtained by doing. But with the progress of science it is every day easier to get from books knowledge which was formerly locked up in the skill, real or alleged, of the professional.

(3) *The possession of judgment and knowledge concerning apparently 'outside' jobs* may rank a person as skilled in the primary occupation. In practice this may be important. Its theoretical meaning is simply that other things, including intensity, being equal, the greater the extensity of skill the better.

(4) *The Ability to transfer Knowledge and Skill to a Different Industry and to Different Material.*—This

raises the question of the relation between general and specific training in a pleasingly concrete and useful form. Actually it does so twice, once in the realm of knowledge and once in the realm of power.

A special instance of the interrelations between mental abilities (and bodily ones) is raised in the consideration of

(5) *Keenness of Perception.*—In theory, keenness of perception, which means fine sensory discrimination, for example, of colours and tones, or perceptual discrimination, for example, of shapes or patterns (not, of course, visual only), might or might not be linked to superlative skill. The method of correlation makes it possible to investigate this relationship. Pioneer work has already been done by Prof. Carl E. Seashore in the investigation of musical talent. But, while it is unlikely that superlative skill will ever be found linked to subnormal discrimination, a high correlation between them cannot be assumed; and the correlation between sensory discrimination and general intelligence, though usually positive, is very low.

(6) *Appreciation of the Interrelation of Factory Processes.*—This involves intelligence rather than skill. But success in appreciating any relations may depend upon the way in which the data have been vouchsafed, and the extent to which they are obscured or illuminated by well-meant and enthusiastic 'explanation.' Explaining complex matters usually requires a skilled explainer. The skilled performer often does it especially badly.

A General Classification of Skills.

We may now attempt to classify skills, working upwards from the lowest type.

(1) *Collections of imperfectly adapted Responses.*—This class includes much domestic work, the skill of most labourers and of workers in the semi-skilled trades.

(2) *Perfectly adapted Responses which do not exhibit Personality.*—Such are the movements on parade of the perfectly drilled soldier. Military skill of this kind may be compared with the skill which would result in industry if a stereotyped series of actions, however efficient, were rigidly prescribed to the worker. Its advantages and defects are clear in military organisation.

(3) *Responses resembling Habits, but less Specific and Automatic.*—The importance and distinctive nature of such responses make one doubt the wisdom of classing them with habits. For habitual actions are inadequate to the situations which these others meet so very perfectly. Such responses are exemplified in sport when rapid, delicately effective complex adjustment is made towards the surface upon which the player is moving, for example, wet and dry, hard and grass tennis courts, heavy and light football grounds, hard, soft, smooth, and bumpy ice, and different hardnesses and elevations of snow-slopes. Such adjustments appear neither to the understanding external observer to be mechanical, nor subjectively to their performer to be unconscious.

This adaptation may be effected to conditions both outside and inside the body. A performer who is feeling ill, without decreasing control, may modify his movements so that less strain is put upon his muscles. A first-class automobile driver's adaptive behaviour in traffic makes the average motorist look like the bundle of habits which some pessimists declare man to be.

(4) *Responses like those in* (3), *but exhibiting in their Totality a Pattern characteristic of the Individual.*—This pattern may be original or unoriginal. A style which appears to the spectator to be unique may have been imparted by a teacher, though to it the pupil usually adds some personal touches.

Types (3) and (4) shade into each other, though in (4) an aspect implicit in (3) is emphasised. Probably these are in the minds of the protesters against the standardisation of industrial tasks.

(5) *Creative Skill.*—In this realm two kinds of creation may be distinguished. One is unconscious, or nearly so, as when a pioneer declares that his work finds its way out of him. Perhaps we may call it the artistic kind. The other results from deliberate analysis of earlier attempts, satisfactory to the ordinary person (a host of problems are covered by the word 'complacency'), but provoking to the genius.

Such analysis may involve recall in memory (visual, muscular, and verbal) of various skilled feats, comparison and discrimination between them, selection of their relevant aspects, re-comparison with some aim in view, re-combination, and, as a result, an unanalysed — perhaps unanalysable — polish which fuses the movements into a dazzling new unity. This is inventive creation in skill resulting from analysis. It is seen and will be seen oftener in the world of play and art. It may increase in the world of industry, if industry desires and deserves it.

Relation between Different Motor Abilities.

Tests of intelligence give results which correlate highly with each other. But there is no justified single concept enabling us to explain why some persons seem generally clever with their muscles. While there seems ample evidence for the existence of general intelligence, the results of simple tests for isolated motor performances from which intelligence has been excluded, so far as possible, give extremely low or negative correlations with each other. Moreover, these results do not warrant belief in any special connexion of simple motor abilities with intelligence.

From these results far-reaching deductions have been made by some writers. One is that there is no general capacity, no 'motor type' of person. The conclusion concerning vocational tests has been drawn that tests for ability in any performance give valid results only when the test performance is identical with that for which the test is being administered. They support the 'sample' as against the 'analogous' test.

Yet an alternative explanation of Perrin's and Muscio's findings is possible, based upon a suggestion made by Sir Henry Head to the present

writer. Their tests involve the simplest muscular co-ordinations. Many of them were confined to limited parts of the body. From the tests used by Muscio, demands upon intelligence were excluded.

As a consequence, the bodily mechanisms involved may have been controlled by relatively low levels of the nervous system. The significance of the test results, therefore, would not exclude the possibility that in *skilled* performances a higher, more complex power might employ and co-ordinate the simple mechanisms.

The above tests, therefore, being concerned with simple motor abilities, are important for the study of skill, rather as suggesting lines of inquiry than as affording data.

Transfer of Training between Motor Abilities.

Another method of attacking this problem is to re-set it in the well-known form of the transfer of training. Subjects are intensively trained in some skilled activity until their curves of practice have shown a marked rise over a fairly long period. One discovers then if the undoubted ability gained in the test activity has been transferred to apparently related or similar performances. Many 'controls' are needed in such an experiment.

An extensive investigation into transfer of training in a low-grade skill was recently carried out in the Manchester laboratory by J. N. Langdon and Edna M. Yates. Possibly for the first time in such experiments a number of conditions were rigidly observed. These were the domination of the learners' motives, the selection of a really skilled performance, though a simple one, as the test activity, the testing of similar control subjects in strictly comparable conditions, and the simultaneous provision of 'analytic' tests, that is, tests of simple powers which appeared to be components of the training activity.

The operation selected for intensive training was modified from one in the driving-chain industry. The subject sits before a small turntable. It carries fixed pairs of spindles upon which links have been placed. As he brings each of these in turn before him, he removes it from the turntable, dropping the link into a box at his right hand. Simultaneously he takes another link from a box at his left and places it upon the pair of spindles, reinstating the whole upon the turntable. He then rotates the turntable, bringing the next unit into position, and repeats the whole operation.

Thirty-two unemployed boys aged sixteen, paid at a high piece-rate, were thus trained, each for two weeks. These constituted the 'trained group.' Before training, each boy's performance was measured in the various tests designed to detect the presence of transfer, if any. These had been selected after a careful observational analysis of the operation with the links and spindles. Most of them were simple tests of manual dexterity, such as inserting matches in holes, filling a box with matches, slipping curtain-rings over a rod, threading links with twine, reproducing from memory the angle of an arm movement, or the force with which a recording anvil had been struck by the subject's hammer, static and dynamic steadiness, and—to discover if the training in the skilled action had affected more purely 'mental' functions—tests in mental arithmetic and tests involving the rapid and accurate cancellation of specified letters in a page of print.

This series of tests was given on three occasions: (1) before training, (2) at the end of the first week, (3) at the end of the fortnight. They may be called transfer tests, 1, 2, and 3. Identical tests were given, in the same order and at the expiration of the same three periods, to twenty-eight similar subjects who meanwhile received no training. These were the control group.

Since the trained group contained thirty-two, and the control group twenty-eight subjects, statistical treatment is justifiable. In no instance was the difference between the trained and the control group, with regard to their improvement in transfer test 3 as compared with 1, of such a magnitude as to exclude the possibility of its being due to chance factors. In some results the brief practice afforded by the test itself was definitely shown to have had more effect than the intensive training in an apparently analogous performance.

The experiment supports the view that in such conditions training in a low-grade skill is specific rather than general. These manual habits did not transfer. How may such a clear-cut result be explained? The following considerations may be suggested: Writers upon transfer of training who know the experimental evidence believe that one of the chief agents of transfer is the formation of a sentiment. In the present experiment there was no encouragement to form a general sentiment about the acquisition of skill, which might spread to other skills.

The conditions were as unsentimental as might be. The workers were never exhorted to do their best. The only encouragement was the very real one of immediate personal gain. Conversely, slack work automatically caused less pay. This was made known to the learner with little delay. The personal influence of the experimenters was as little and as unchanged as possible. The workers were paid, and highly paid, to transfer. Yet demonstrable transfer did not occur.

The evidence seems now to establish that the problem of transfer may be divided into two parts:

(*a*) Transfer resulting from and due merely to exercise of any particular function.

(*b*) Transfer resulting from extension of attitudes, sentiments, ideals, or knowledge of methods, where the particular function trained was the vehicle of these mental powers.

It now seems certain that (*a*) is rare, and that (*b*) definitely can occur. But in educational institutions, where subjects or parts of subjects are taught by different persons, the chances of transfer through common applicable methods discovered by the learner himself, or through sentiments, is much less; and the automatic occurrence of transfer can never in the future be *assumed* by anyone conversant with the facts.

The World Fuel Conference.

THE purpose of the World Power Conference is to consider how the industrial and scientific sources of power may be adjusted nationally and internationally; and the sectional meeting of this Conference which was held on Sept. 23–Oct. 6 to deal with fuel problems has undoubtedly contributed materially towards the furtherance of this object. The first plenary World Power Conference, held at Wembley in 1924, dealt in the broadest possible manner with power and its uses, and was a real attempt to see the world as an economic whole. Problems of the greatest importance were raised, which indicated the desirability of further meetings to discuss various sections of the subject in a more specialised manner. Thus, in 1926 a sectional meeting, limited to the discussion of water-power problems, was held appropriately at Basle. The recent Conference was devoted to the subject of fuel, the winning, preparation, transport, and utilisation of which are subjects commanding the attention of industrialists and technicians throughout the world.

Coal is the chief basis of the world's fuel requirements, and in Great Britain, perhaps more so than in any other country, it constitutes the main driving force in our industrial civilisation. That delegates from 48 different countries attended the conference, and that 175 papers, written by the world's leading authorities, were presented, testify not only to the universal interest taken in the subject, but also to a clear recognition of the value of a pooling of knowledge as a powerful weapon of attack against world-wide problems such as, for example, the present depression in the coal-mining industry, which is not confined to Great Britain alone, but is international in scope.

At the inaugural meeting on Sept. 24, over which the Marquess of Reading presided, Sir Robert Horne in his opening speech made no secret of the great importance which the British Government attaches to the question of fuel and its economic use. As he pointed out, Great Britain, of all countries, stands perhaps to gain most from the accumulated experiences laid before the Conference by the world's experts; for "the modern prosperity of Great Britain was created by coal, and by coal it will be saved," declared Sir Robert, "but it will only be by adopting improved and more economical methods of using it."

The undoubted success of the Conference was largely due to the most efficient manner in which it was organised. No effort had been spared to ensure the smooth running of the meetings and the comfort and convenience of the visiting delegates. The papers, many of which will rank as valuable monographs on the subjects dealt with, were divided into appropriate sections, to each of which a session was devoted. At such meetings the papers were taken as read, the proceedings being opened by the reading of a résumé of the material contents of the papers under consideration. These were drawn up by the general reporter appointed to each section and, without exception, they summarised clearly and concisely the subject matter dealt with, though occasionally the reports may have tended to be slightly coloured by the reporter's own views. The ensuing discussions which, thanks to the linguistic abilities of the foreign delegates, were conducted almost entirely in English, were likewise well organised and there was little, if any, straying from the real matter in hand.

The scope of the Conference was wide, embracing, first of all, the economics of the coal industry and the storage, transport, and treatment of coal; secondly, the oil industry in relation to the preparation and use of liquid fuels; thirdly, the carbonisation industries, with special reference to high and low temperature carbonisation and the better utilisation of coke oven gas, of which a large surplus supply is available in Great Britain.

Further sessions were devoted to the generation of steam and electricity, both for industrial and domestic purposes. Research and development in all countries have been brought to bear on the attainment of higher thermal efficiencies, particularly in the generation of electricity from low-grade and waste fuels, and also on the co-operation of separate industries in the linking up of energy in all forms with the view of avoiding waste. In connexion with this, great progress was foreshadowed in suggestions put forward for a more rational grouping and centralisation of units concerned in the manufacture of iron and steel; for example, coal mine, coke-oven, blast and reheating furnaces, steel-works and rolling mills, and possibly even town's gas supply plant. The achievements of the Dunston plant of the Newcastle Electric Supply Company, where low-temperature carbonisation and electricity generation have been successfully combined during the past three years, afford convincing evidence of the advantages of such grouping.

The subject of pulverised coal aroused much interest, and it seems that its introduction, where circumstances are favourable, may lead to greatly enhanced efficiencies; in marine steam generation, in particular, great possibilities are predicted. Attention was also directed to the economic advantages of both high pressure and high temperature steam, upon which intensive research is being prosecuted on an international basis. It is hoped that the results will be available shortly.

As perhaps was to a large extent unavoidable in a conference of this nature, one important consumer of fuel received less sympathetic attention than his case undoubtedly merits; we refer to the domestic user, who in Great Britain burns 23·0 per cent of our total coal production and

thus consumes more raw coal than all the railways and gas and electrical undertakings put together. The layman may or may not be aware of the fact that he pays more than twice as much for coal as the large industrial consumer; he certainly does not know that at the same time he pays more than double for an inferior product. Scientific classification, analysis, and quantity form the basis upon which industry buys coal; the domestic user just buys coal, so many hundredweights or tons at a time, with no indication as to its quality other than some usually meaningless fancy name, and without any guarantee as to its ash (and stone!) contents, its calorific value, or its nature. He must also buy his 'pig in a poke,' whether he likes it or not; the middleman, while more than doubling the cost of the private consumer's coal, also sees to it that he is steered clear of all such queer new-fangled notions as calories and so forth.

Coal alone does not form, however, the sum of the private consumer's fuel and power requirements; the gas and electricity undertakings are there to push their goods. How pathetic is the domestic user's attitude of indecision when coal, gas, and electrical interests, each and all for themselves, and with all the highly organised and well-trained powers of persuasion at their command, set about convincing him that theirs is the one and only satisfactory solution of his heating problems? It seems to us that the time has come when the domestic user should be able to turn to some disinterested body for unbiased advice as to when, how, and where to use coal and other solid (or liquid) fuels, gas, and electricity; a body which would also see to it that the fuel he bought was purchased on a basis not only of quantity but also of quality. It is useless to attack the domestic open grate fire and to demand its abolition. It is true that when burning raw coal it is the arch polluter of the atmospheres of our cities: but the blood of fire-worshipping ancestors still flows in the Englishman's veins, and to him central heating is an insidious and stuffy abomination and the gas fire a glaring and inhospitable object; the open fire alone can minister satisfactorily to his physiological and psychological needs in the home. Thus, the only remedy for smoke pollution lies in giving the householder a fuel which will burn as well as coal but without smoke, not only on special but also on existing open grates. Up to the present no such fuel has been available, and, until it is, the politician's parrot cry of 'the wicked waste of raw coal on open fires' is meaningless.

A wider interest than the purely technical attaches to the World Power Conference. The proceedings have afforded ample evidence of the efforts that are being made to combine the spirit of individual enterprise with the spirit of co-operation in the examination of all problems besetting those interested in fuels and their utilisation. This spirit of co-operation is being fostered not only between industries which, like the gas and electrical undertakings, were formerly considered to be antagonistic, but also in industry the world over. It would be difficult to overrate the value of this aspect of the Conference towards the firmer establishment of international goodwill; for, as Sir Thomas Holland pointed out in his opening address to Section F of the Conference, the surest basis of a world peace lies in a mutual understanding and co-operation of economic interests and resources.

Foot-and-Mouth Disease.

PROGRESS in the prevention and cure of foot-and-mouth disease is hampered by the fact that no method has yet been devised for cultivating the virus *in vitro*; and since it cannot be seen, it can only be propagated and recognised by the inoculation of susceptible animals. Further, the control of the disease is rendered more difficult by the fact that at least three types of the virus are known: immunity produced by an attack due to one type does not render the animal any the less susceptible to attack by one of the other types; and, finally, the immunity produced is only relatively short-lived. In spite of these handicaps, the Third Progress Report of the Foot-and-Mouth Disease Research Committee, 1928,[1] gives a detailed account of much research work directed towards increasing our knowledge of the natural history of the disease, and of methods of destroying the virus and of producing immunity in susceptible animals. Owing to the reconstruction of the Experimental Station at Pirbright, the work has been confined to experiments on small laboratory animals—guinea-pigs and rabbits,—other rodents possessing a high degree of natural resistance,—carried out at New Haw, the Lister Institute, and the National Institute for Medical Research.

Some attempts to cultivate the virus *in vitro* were uniformly unsuccessful, even when the oxygen tension of the medium was reduced to nil by the addition to it of small quantities of cysteine (Y. M. Burbury).

The distribution, localisation, and disappearance of the virus in animals after inoculation have been studied by M. C. Maitland, and I. A. Galloway and S. Nicolau: the latter authors have also made an extensive histological study of the lesions in the tongues of rabbits and guinea-pigs. It appears that the predilection of the virus for the soles of the feet and the mucous membrane of the mouth is associated rather with the fact that these areas are subjected to movement and pressure than due to their freedom from hair. If a strip of hairy skin is transplanted on to the sole of a guinea-pig's foot,

[1] Ministry of Agriculture and Fisheries. Third Progress Report of the Foot-and-Mouth Disease Research Committee. Pp. 141+22 plates. (London: H.M. Stationery Office, 1928.) 5*s*. net.

vesicle formation will occur in it, whether the virus is inoculated intradermally into the transplant or intramuscularly elsewhere, although lesions scarcely ever occur in hairy skin elsewhere. If, on the other hand, a foot is immobilised and protected by a pad from pressure, vesicle formation does not occur in it following the intramuscular injection of a large dose of virus.

Multiplication of the virus is associated with this vesicle formation, and occurs in both the primary vesicle at the site of inoculation as well as in the secondary vesicles developing upon the feet and tongue within twenty-four hours: infection can be caused by a drop of vesicle fluid diluted a million times. On the other hand, although the virus can be found in the blood and certain of the internal organs for the first three days after infection, it does not apparently multiply in these situations, and no lesions can be discovered in the latter on microscopic examination. In the case of the feet and tongue, virus can be recovered up to the eighth day after infection. It thus appears that in these small animals a process of natural cure takes place, with disappearance of the virus after a few days: very rarely does an animal act as a carrier of the virus for a longer period.

Histological examination of the tongue shows that the earliest evidence of a lesion is degeneration of a small group of epithelial cells: the degenerated area increases in size, a few polymorphonuclear leucocytes wander in and also degenerate, and these disintegrated cells, together with some fluid, form a vesicle, which increases in size and finally bursts, leaving an ulcer, which heals under a scab. Some polynuclear infiltration occurs also in the corium, but a severe inflammatory reaction only occurs if secondary infection of the ulcer takes place.

The immunity produced by an attack of the disease is only short-lived, about 6-12 months: in addition, three distinct types of virus are now known to exist, and an infection by one type will not produce the slightest immunity to either of the others. The blood of an animal recovered from the disease contains antibodies, which can be demonstrated by its power of destroying the virus *in vitro*.

Adequately to control outbreaks of the disease, knowledge of the power of survival of the virus outside the body and of methods of destroying it is essential. It is known to survive in vesicle fluid, in the epithelium from blisters, and in the internal organs, for months, if chilled, provided the animal was killed during the first few days of infection, since later, as mentioned above, the virus rapidly disappears from the tissues. On a glass slide it will survive for at least two years in chemically dry air; in ordinary moist room air it dies within a week: survival under ordinary conditions is longer on hay and bran than on cotton-wool and filter paper, but in all cases a damp atmosphere has a deleterious influence; thus on moist hay or bran it only lives five days, on dry hay it may survive for several months. In these circumstances methods of sterilising materials likely to be contaminated with virus are of great importance. In vesicle fluid, formalin, phenol, and mercuric chloride have a relatively low disinfectant power as compared with free chlorine or iodine, or potassium permanganate. In the presence of particulate organic matter, however, the value of the oxidising disinfectants is considerably reduced, whilst that of phenol, cresol, or formalin is comparatively unchanged. It was found that spraying hay with one per cent formalin and allowing the solution to evaporate, destroyed the virus dried on it (F. C. Minett). Hides could also be disinfected by soaking for forty-eight hours in the same solution, but unfortunately this treatment affected them deleteriously.

The virus is fairly easily destroyed by heat, a very short exposure to water at 60° C. being effective: at 50° C., blood is rendered non-infective after about four and a half hours at this temperature.

The control of the disease, apart from the slaughtering of infected animals, must be based on disinfection of infected material, treatment of infected animals both by specific and non-specific remedies, and finally by prevention of infection by artificial immunisation: it is obvious that if all animals could be rendered immune, the disease would vanish. The fact that immunity is short-lived will always militate against the success of immunisation: on the other hand, there is no evidence at present that wild rodents can carry the disease and act as a source of infection for cattle: rabbits, for example, can be inoculated with the virus and develop the disease, but will not pass it on to others of the same species kept in close contact with them. The problem, then, is that of immunising the larger animals in which the disease naturally occurs.

The method of immunisation by injection of virus of low virulence cannot be of wide application owing to the danger of spread of the infection: injection of serum from an immune animal will only protect for 10-14 days: injection of virus and serum together may produce satisfactory results, but they are too variable for the method to be of much practical use. Vaccination by means of killed virus is the method of choice, provided that a satisfactory vaccine can be obtained. H. B. Maitland has found that a vaccine prepared by exposing the virus to 0·1 per cent formalin at 26° C. for 48 hours at *p*H 7·6 gives satisfactory results in guinea-pigs: the immunity is fully established in four days, and is effective for four months, but is not so complete as that produced by injection of living virus, since local inoculation of the feet will produce vesicles, although further generalisation of the disease does not occur. The results, however, suggest that a suitable method of vaccination will soon be discovered. It is also probable that progress in the application of specific prophylactic and therapeutic methods will be aided by the recent observation of Prof. A. Ciuca that the method of complement fixation can be used to show the presence or absence of immunity in susceptible animals.

News and Views.

THE Mathematical Tripos list of 1880 is probably the only list of its kind which has produced three professors for the University of Cambridge—Sir Joseph Larmor, Prof. H. F. Newall, and Sir Joseph Thomson. Happily, all three are still actively at work, though Prof. Newall has announced his coming retirement. Formerly assistant to the Cavendish professor and demonstrator in experimental physics in the Cavendish Laboratory, he became Newall observer in charge of the 25-inch Newall refractor when, in 1890, his father, Mr. R. S. Newall, F.R.S., presented it to the University of Cambridge. In his hands the Newall dome became an active centre of pioneer astrophysical research and the seed of a large and growing department in the University. First of all, in 1907, a Littrow spectrograph fed by a cœlostat and a lens of 60 ft. focal length was provided from the bequest of Mr. Frank McClean; then, in 1908, the telescopes with which Sir William Huggins had carried out his pioneer investigations on stellar spectra were presented to the University by the Royal Society, while the whole establishment under Prof. Newall's direction was greatly increased when, in 1911, the University accepted the charge of the Solar Physics Observatory on its transfer from South Kensington, and Prof. Newall became its director. He had already, in 1909, become professor of astrophysics and a fellow of Trinity College. In addition to astrophysics and solar physics, Prof. Newall has throughout actively fostered in the Observatory research in meteorological physics. He has been for many years an elector to the Isaac Newton Studentships, and in that work, as also through the Observatory Club which he founded in 1909, he has exercised a marked influence on generations of the younger students in astronomy. In his retirement, with greater freedom from administrative cares and more time to complete his own work, it may be hoped that his knowledge and influence may make themselves felt for many years to the continued benefit of the science to which he has devoted himself.

BY unanimous choice Dr. Robert Ranulph Marett was elected Rector of Exeter College, Oxford, on Oct. 9, in succession to Dr. L. R. Farnell, who resigned that office recently. Dr. Marett, who was educated at Victoria College, Jersey, and was a Domus Exhibitioner of Balliol College, was elected a fellow and tutor of Exeter in 1891, after taking first classes in Classical Honour Moderations and Literæ Humaniores. He won the Chancellor's prize for Latin verse in 1887, and the Green prize in moral philosophy for an essay on "The Ethics of Savage Races" in 1893. From 1893 until 1898 he served his college as subrector and was one of the University proctors in 1918. Dr. Marett's interest in the culture of primitive races, which had been shown in his Green prize essay, though outside the straiter lines of academic philosophy, gave his lectures a breadth and unconventionality which was not without effect on the men who came under his hand, and marked him as the obvious man for the appointment of secretary of the Committee for Anthropology when that body was formed some twenty years ago. He was also made reader in social anthropology. In both capacities he has exercised considerable influence in the movement for the training in anthropology of officials who administer native affairs in the dependencies of Great Britain. Dr. Marett is the author of "Anthropology" in the Home University Library, "The Threshold of Religion," "Psychology and Folklore," and a number of papers in scientific periodicals. He has been president of the Anthropological Section of the British Association and also of the Folklore Society, and took a prominent part in the excavation of the palæolithic cave of St. Brelade, Jersey, in which a tooth of Neanderthal man was found.

AMONG the questions of general scientific interest likely to engage the attention of the British Association when it visits South Africa next year, one of the most widely discussed is the origin, history, and purpose of the prehistoric ruins at Zimbabwe and similar sites chiefly, though not exclusively, in Southern Rhodesia. These monuments have been repeatedly described and partially explored; and on the British Association's previous visit to South Africa in 1905 many points were cleared up by the very careful studies of Dr. Randall MacIver. But since 1905, besides the valuable work of local archæologists, and Government measures of conservation, discoveries elsewhere of monuments claimed as comparable, have made further excavation desirable. Accordingly, as soon as the South African meeting was arranged, the British Association appointed a committee on South African archæology: ascertained that the government of Southern Rhodesia would welcome such an investigation; and in response to a similar suggestion on the part of the Rhodes Trustees, guaranteed the necessary funds. The council of the Association has now appointed to conduct the investigation, Miss Gertrude Caton Thompson, who has varied experience as an excavator in Egypt and Malta. Miss Caton Thompson will probably arrive in South Africa early in 1929 and visit sites and museums until the season permits of excavation on the site selected as most likely to yield evidence as to the history of the whole group of monuments. As it is understood that there is already one other expedition in South Africa engaged in prehistoric studies, and that communications may be expected on remains of similar character in other parts of the continent, it will be seen that at the British Association's meeting full justice is likely to be done to this obscure and fascinating problem.

THE third and largest of the hydro-electric power generating stations of the North Wales Power Company at Maentwrog was formally opened on Oct. 15. This station is the direct outcome of the work done by the Electricity Commissioners in 1923, when they surveyed the requirements of North Wales. The Company has already 340 miles of main transmission lines in operation, and bulk supplies are given to 15 large and 21 smaller electric supply companies and local authorities, and to 23 large industrial undertakings.

These include slate and granite quarries, cement works, collieries, and the L. M. and S. Railway engineering works at Crewe. The Company supplies an area of over 4000 square miles, and so great is the demand for electric power that a supplementary bulk supply is taken from the Mersey Power Company's steam station at Runcorn. The new power house will supply immediately over 20,000 kilowatts. An artificial lake about two square miles in area has been constructed by damming the river Pryson in the Vale of Festiniog. At present the depth of the water behind the main dam is only 25 feet, owing to the low rainfall this year, but after the winter rains it is expected to reach the spillway level, and it will then be 48 feet deep. The effective head of the water obtained at the foot of the high pressure pipe line at the power station is 630 feet. Under this pressure the water turbines, which are of the double jet type, run at 333 revolutions per minute. For Wrexham and Crewe the voltage is transformed up to 66,000. The mains are carried by white-painted, latticed-steel towers, spaced 180 feet apart, and every care has been taken to make them as artistic as possible. The steel-cored aluminium conductors hang in graceful curves between them. The artificial lake is considered to add to the beauty of the Vale of Festiniog.

AT a meeting of the Eugenics Society, held on Oct. 10 in the rooms of the Linnean Society, Major Leonard Darwin was presented with his portrait in oils as a token of appreciation of his services during the seventeen years he has acted as president of the Society. Prof. E. W. MacBride, who made the presentation, said that Major Darwin has seen the Society grow from a handful of people, who might justly be described as a group of eccentrics, to an earnest, level-headed body intent on facing the social problems of the day. This change has been largely due to Major Darwin's wise and moderating influence. Bringing to the Society the prestige of a name universally honoured in biological science and the practical sense of a politician, he saw that the improvement of social affairs is not to be attained by the selection of persons of exceptional abilities, their forced mating and the endowment of their offspring at the public expense, but by the gradual elimination of the unfit, as this is the method universally adopted by Nature for keeping the populations of the lower animals in a healthy condition. This elimination in the past has been effected by the awful toll exacted by disease on young children, and such a toll will continue to be exacted if the reckless reproduction of the unfit goes on. Major Darwin has never wearied in his insistence on the necessity of adopting measures to prevent the unfit from marrying, and there are signs that the essential truth of his position is forcing itself on public opinion. Prof. MacBride predicted that in times to come Major Darwin will be regarded as the founder of sane views on population and society, just as his father is justly regarded as the founder of modern biology.

THE American Institute of Weights and Measures in pursuance of its main policy of defending the use and preserving the legal status of the system of weights and measures based on the yard and pound, has declared itself ambitious to secure that material official standards be sent from the United States of America for comparison with the British Imperial Standards in 1932, when the next decennial comparison of the latter with their Parliamentary copies takes place. As mentioned in these columns on Aug. 4, p. 179, the Institute regards the present official recognition of the superior status of the metric units as constitutionally irregular and suspects the administration of fostering pro-metric tendencies. In a paper entitled "A Precision Value for the Inch," published as one of the Scientific Papers of the Institute (in format closely resembling those of the U.S.A. Bureau of Standards), Luther D. Burlingame proposes that the United States of America, Great Britain, Canada, and other British Commonwealths should accept the International Metre as stabilised at 1,553,164·13 times the wave-length of the red ray of cadmium and agree to define a precision inch as a fundamental unit for practical use, equal to 25·4 millimetres or 39,450$\frac{1}{3}$ wave-lengths. Whatever practical virtues this proposal may possess, the arguments employed in its justification are not altogether sound. For example, it is stated that the Order in Council of 1898 *defines* the yard as 0·914399 metre, whereas it merely authorised this value as a conversion factor, resulting from the most reliable experimental results then obtainable, without any prejudice to the definition of the yard in terms of the material standard bar as laid down in the Act of 1878.

THE *Graf Zeppelin* (LZ127), which started from Friedrichshafen on Oct. 11, arrived at Lakehurst Naval Airship Station in the United States on Sunday last, after a stormy voyage of 112 hours. The attempt to avoid the bad weather of the northern route across the Atlantic, covered by the R34 in 108 hours, was not successful, and the stabilising surface was damaged seriously by a squall. The excitement in Germany over the safe arrival is a measure of the anxiety which accompanied the fragile giant on its voyage, and of the intense hopes which have been placed in a legendary 'freedom of the air.' The German constructors have very much wider and more continuous experience in the design, construction, and handling of airships than the rest of the world, as is evidenced by the serial number LZ127. The *Graf Zeppelin* is larger, more powerful, and more costly than its predecessors, and will in turn be surpassed by the British airships R100 and R101 now under construction. The damage to the stabiliser was not vital, but is a serious symptom of structural weakness. The delay in starting, the slowness and stormy nature of the passage in spite of meteorological information, the limited number of passengers and the heavy cost of building and running, all lead to a belief that a commercial service of airships is impracticable with the materials at disposal.

THE following details of the *Graf Zeppelin* are given in the German technical press: Length, 237 metres; mean diameter, 32 metres; power, 5 × 400 k.w.

Maybach engines in separate external gondolas; volume, 105,000 cubic metres; gross lift, 110 metric tons; speed, 110-130 km. per hour. Experiments have been carried out on a gaseous fuel of the same density as the air with some success, but difficulties of supply have prevented its adoption for the *Graf Zeppelin*.

Two flying expeditions are now on their way to the Antarctic by steamer. A dispatch from Sir Hubert Wilkins to the *Times* announced that he had arrived at Monte Video and intended to sail on Oct. 24 in a Norwegian whaler for Deception Island, the whaling base in the South Shetlands. He is taking with him two Lockheed Vega seaplanes. Accompanying him are Lieut. Eielson, Mr. J. Crossan, and two mechanics. Sir Hubert Wilkins' plan, as originally announced, was to take off from a whaler in the Ross Sea and fly across the edge of the Antarctic continent to Deception Island, a distance of some three thousand miles. Com. R. E. Byrd is now on his way to the Ross Sea with another expedition. He proposes to make his base at the Bay of Whales on the Ice Barrier, and fly southward towards the Pole.

ON the evening of Tuesday, Oct. 16, the president, council, and fellows of the Royal Anthropological Institute were entertained at a conversazione at the Wellcome Historical Medical Museum, by invitation of the Director, Dr. Henry Wellcome. A large number of fellows and other distinguished guests, who had been invited to meet them, were present. In the course of the evening Miss Blackman gave a demonstration of the magico-medical methods of the fellahin of Egypt, using for the purpose specimens which for the most part had been collected by her for the Museum. The fellows and other guests had then an opportunity of examining the collections, which to a great extent have been, and still are, in process of rearrangement under the present conservator, Mr. L. W. G. Malcolm. Originally started by Dr. Wellcome as a collection to illustrate the history of medicine, the Museum is now one of the most important collections in the world illustrating both the history of medical and surgical science and the magico-religious ideas from which those sciences have developed among savages and as they survive among the folk of civilised peoples. Owing to lack of space, only a small part of Dr. Wellcome's collections can at present be inspected by the public; but when fully displayed they will illustrate the development of human thought and culture in a manner which will be unrivalled even in public institutions.

ANOTHER violent earthquake occurred off the Mexican coast on the night of Oct. 8 (local time), by which nine States were shaken. It was recorded at Kew at 3 hr. 13 min. 29 sec. G.M.T., on Oct. 9. The record indicates that the epicentre lay about 70 or 80 miles off the coast in lat. 16° N., long. 101° W. Seven earthquakes from the same neighbourhood have been recorded at Kew this year, the shock of Oct. 9 being the most violent. According to a message published in the *Times* for Oct. 10, the shock caused some damage at Acapulco (90 miles from the centre), Oaxaco (230 miles), and Mexico city and Chalco (270 miles), and the total disturbed area cannot have been less than 350,000 square miles. An interesting point about this earthquake is the westerly migration of the origin since the great earthquake of June 16, the epicentre of that earthquake, according to the Kew bulletin, lying in lat. 16° N., long. 100° W., or about 65 miles to the east of the last epicentre.

THE warming of passenger trains is a problem on which much thought has been expended by railway engineers. In making estimates of the running costs, the time required for the preliminary heating of the train before it starts has to be taken into account. At least half an hour has to be allowed for this preliminary heating. This necessitates increasing the working hours of the employees, which always cause difficulties. In large railway stations in Switzerland, according to the *Brown Boveri Review*, central heating plants are provided for heating the trains by steam. This method, however, is objectionable, as steam escaping from insecure couplings often makes disturbing noises and causes unpleasant vapours. To get over these difficulties, the Swiss Federal Railways have been making experiments on doing the preliminary heating electrically. The large station at Zurich has a transformer plant with eleven heating connexions and the auxiliary station has eight heating connexions. The current is taken directly from the 15,000 volt contact lines and transformed down to 1000 volts. In an extensive railway network, frequent short circuits causing excessive voltage drops are to be expected. A device is therefore provided which recloses the heating switch automatically once or several times after the switch has opened due to a sudden voltage drop. The plant at Zurich has now been in continuous operation since December 1927 and has given complete satisfaction.

AFTER the formal business had been concluded at the annual meeting of the British Horological Institute on Oct. 10, Mr. B. T. Greening, who presided, presented to Sir Frank Dyson, the Astronomer Royal, the first gold medal awarded by the Institute. The medal is awarded for the greatest advance in the science of horology in each year or some achievement of merit beneficial to the science or practice of time measurement. Sir Frank Dyson has been Astronomer Royal since 1910, and has devoted particular attention to precision in time measurement. In presenting the Institute's medal in recognition of this and other work, the chairman referred to the Greenwich time-signals, to the inauguration of the six-dot seconds through the British Broadcasting Corporation, and last, but not least, to the initiation by Greenwich of the first official government service throwing a girdle round the earth in the form of the Rugby rhythmic transmissions, which are unique in character and unsurpassed for accuracy. Reference was also made to the adoption by the Astronomer Royal of a novel form of precision clock which had recovered for the British Empire the record for accuracy in time measurement. In the course of a short speech Sir Frank said that he had encouraged his colleagues

at Greenwich to get the best out of clocks that could be secured and to determine time with all possible accuracy: he regarded the presentation not only as a tribute to himself personally, but also to his co-workers at Greenwich and, particularly, Dr. Jackson and Mr. Bowyer.

IT is now stated that at the Second International Conference on Bituminous Coal to be held at Pittsburgh, U.S.A., under the auspices of the Carnegie Institute of Technology, on Nov. 19–24, more than a hundred speakers, representing twelve countries, are expected to be present. Major subjects of discussion will include coal preparation, pulverised fuel, gas production and purification, liquefaction and hydrogenation of coal, carbonisation and combustion, tars and ammonia. The chief purpose will be to present the results of recent studies that have to do with improved methods of utilisation and combustion of bituminous coal. The speakers expected include many with international reputations in their respective fields, and more than sixty of them will come from countries outside the United States. The British delegation, as anticipated, may include about fifteen prominent chemists and engineers, while Lord Melchett will also speak.

THE Report of the Fuel Research Board (Department of Scientific and Industrial Research) for the period ended Mar. 31, 1928, which has been issued (H.M. Stationery Office, 1928. Pp. 70. 1*s.* 3*d.* net), covers the activities of about two years. It shows that the survey of national coal resources—one of the original objects of the Fuel Research Department—is now in operation in coalfields producing 85 per cent of the British output. The work of standardising methods of sampling and analysing coal has been taken up by the British Engineering Standards Association with the view of reaching national and possibly international agreement. Several plants for the low temperature carbonisation of coal have been tested and reported on, while plant embodying the retort system developed at the Fuel Research Station and now being erected by the Gas Light and Coke Company, is expected to be in operation shortly. It is pointed out that low temperature carbonisation is important rather as a source of smokeless fuel than of liquid fuel, while its effect in creating useful employment is not negligible.

LOW temperature carbonisation processes can scarcely be expected to render Great Britain self-supporting in the matter of liquid fuels. Hydrogenation when commercially feasible would be much more effective. The Report of the Fuel Research Board states that work on hydrogenation of coal is being continued on an intermediate scale, and the staff is studying the chemical changes during the process, development on commercial lines being now undertaken by Imperial Chemical Industries, Ltd. Great attention is being paid to the properties of coke for all purposes, especially for domestic use, here in collaboration with the Building Research Board. Briquetting, coal purification, internal combustion engines are dealt with, but the prospects of a large production of power alcohol in Britain have been shown to be unpromising. Reference is also made to work carried out with the financial assistance of the Board by workers in the universities and other institutions throughout the country. The report shows that the original objects of the establishment of the Board are being fulfilled in a large measure.

THE Irish Tourist Association has made arrangements with Mr. George Fletcher, until recently assistant secretary of the Department of Agriculture and Technical Instruction in Ireland, to deliver lectures on Ireland in various centres during the period Oct. 1–Mar. 31. Mr. Fletcher has a close personal knowledge of Ireland, extending over more than a quarter of a century, and is well known as a writer on Irish matters and as editor of five volumes on "Ireland and the Irish Provinces" (Cambridge University Press). The subjects of the present lectures are: (1) Ireland: its scenery and people; (2) the art and antiquarian treasures of Ireland; (3) the evolution of Irish scenery; (4) the economic and industrial resources of Ireland. The lectures will, if desired, be fully illustrated by lantern pictures, and, in addition, Mr. Fletcher can give short addresses to interested local organisations where this can be arranged. No charge will be made for the services of the lecturer, but all local expenses, such as provision of suitable lecture room, with optical lantern and operator, must be borne locally. Particulars of the lectures can be obtained from the Secretary, Irish Tourist Association, American Chambers, Lower O'Connell Street, Dublin.

THE courses of lectures arranged at the Royal Institution during November and December will commence with the Tyndall Lectures to be delivered by Prof. H. L. Callendar, who will give three lectures on co-aggregation versus continuity in the change of state from liquid to vapour, beginning on Tuesday, Oct. 30, at 5.15 P.M.; and on Tuesday, Nov. 20, Sir William Bragg delivers the first of four lectures on diamonds. On Thursday afternoons, beginning on Nov. 1, there will be lectures by Captain G. Pitt-Rivers on the clash of culture: (1) Race and culture; (2) culture-clash in a Maori village; (3) the Empire and the native problem; two by Dr. E. D. Adrian on the mechanism of the nerves; and two by Sir Richard Paget on human speech as (1) a method of expression by gesture, (2) a musical phenomenon. On Saturday afternoon, Nov. 3, at three o'clock, the Rev. T. E. R. Phillips will deliver the first of two lectures on recent observations and discoveries respecting the planets; on succeeding Saturdays there will be three lectures by Dr. W. G. Whittaker on (1 and 2) North Country folk music, (3) violin sonatas of William Young, with musical illustrations. The Juvenile Lectures this year, the one hundred and third course, will be delivered by Mr. Alexander Wood on sound waves and their uses: (1) Waves (Dec. 27); (2) signalling in air and water (Dec. 29); (3) notes and noises (Jan. 1); (4) how sounds are analysed (Jan. 3); (5) the ear and what it does (Jan. 5); (6) how sounds are recorded and reproduced (Jan. 8).

A RECENT issue of the *Chemisch Weekblad* contains a detailed account of the proceedings of the chemical section of the Sixth Congress of Czechoslovak Naturalists, Physicians, and Engineers, which was held in Prague from May 25–30. This congress, which is a continuation of the pre-War Czech scientific congresses, was a scientific celebration of the tenth anniversary of the Czechoslovak Republic and was attended by about 2300 members, including 400 foreign visitors, chiefly from Slavonic States such as Poland, Yugoslavia, Bulgaria, and Russia. The congress was under the patronage of President T. G. Masaryk, and its chairman was Prof. E. Votoček, the distinguished organic chemist from the Polytechnic High School at Prague. In the five sessions dealing with chemistry, 111 communications were presented from 98 authors. The foreign guests included Profs. W. P. Jorissen (Leyden), T. Miłobędzki (Poznań), St. Tołłoczko (Lwów), and G. Urbain (Paris). Summaries of all the communications were published in Czech and also in English or French; copies may be obtained from Prof. J. Heyrovský, Prague-II, Preslova ul. 1, who presided over the Chemical Section.

THE executive committee in charge of the centenary celebrations of the Faculty of Medicine in Cairo and the International Congress of Tropical Medicine and Hygiene has issued a circular giving details of the programme for the week Dec. 15–22, and the list of guests from all parts of the world who will then assemble in Cairo. The most significant ceremony will take place on Dec. 16, when, in the presence of King Fuad, the foundation stone of the new medical school and hospital will be laid. As the first serious study of ankylostomiasis and bilharziosis was begun in Cairo, it is fitting that the most prominent place in the comprehensive programme of the scientific proceedings should be occupied by discussions of these worldwide scourges. Arrangements have been made for a series of excursions in Egypt, Palestine, and Syria. The Tourist Development Association of Egypt has issued a beautifully illustrated guide entitled "Egypt and the Sudan," containing a series of articles by Prof. George A. Reisner and other well-known archæologists and authorities on Egyptian and Oriental subjects, ranging from the beginning of architecture and sculpture to the practice of aviation in Egypt and Mesopotamia, duck-shooting in the Delta, and the presentation of Shakespeare's plays in the Cairo theatre. Correspondence relating to the Congress should be addressed to the Congress Bureau, 1 Sharia Mazloum Pacha, Cairo.

THE Council of the Institute of Metals has just issued the new session's programme of the Institute and of its local sections in Birmingham, Glasgow, London, Newcastle-on-Tyne, Sheffield, and Swansea. An outstanding meeting is that planned for Mar. 6, when the 'coming-of-age' celebrations of the Institute will be held in London under the presidency of Dr. W. Rosenhain. Another interesting feature is the annual autumn meeting, which will be held in Düsseldorf in September. This is the first occasion that any British scientific society has held a meeting in Germany since 1914, and it is expected that the meeting will be largely attended by members from the continent as well as from the British Isles. The programmes of the six local sections of the Institute include 42 papers and meetings. Several of the papers will be discussed at joint sessions with other bodies, notably the Institution of Engineers and Shipbuilders in Scotland, the Institute of British Foundrymen, the Birmingham Metallurgical Society, and the Staffordshire Iron and Steel Institute. These joint meetings constitute an important new feature in the work of the local sections which were first developed by the Birmingham Local Section. The London Local Section has arranged a discussion on "Some Present-Day Metallurgical 'Tools' and Methods," the latter including the X-ray spectrometer, quantitative spectroscope analysis, high-magnification microscopy, the dilatometer, and the preparation of some unusual metallographic specimens. Short addresses by various experts on each of these subjects will be given. The North-East Coast Local Section strikes out a new line in planning an exhibition of metallurgical preparations and products. Membership of the Institute is now approaching 2000. Particulars of the meetings and invitations can be obtained from the secretary, Mr. G. Shaw Scott, 36 Victoria Street, London, S.W.1.

THE Right Hon. Earl Fitzwilliam has consented to act as president of the fortieth Congress and Health Exhibition of the Royal Sanitary Institute, to be held at Sheffield on July 13–20, 1929.

THE twenty-fifth anniversary of the foundation of the Faraday Society will be celebrated on Friday, Nov. 9, at a meeting at the Royal Institution, when Sir Oliver Lodge will deliver the first Spiers Memorial Lecture, on "Some Debatable Problems in Physics." The chair will be taken by Sir Robert Hadfield. The Lecture, it will be recalled, was established in memory of Mr. F. S. Spiers, one of the founders of the Faraday Society, and its secretary and editor until his death on May 21, 1926.

THE Lord President of the Council has appointed Sir David Milne-Watson and Mr. Robert Whyte Reid to be members of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research, in the place of members who have retired on the completion of their terms of office. Sir James Hopwood Jeans has been reappointed a member of the Advisory Council for a further period of one year.

THE presence of living micro-organisms in the centre of ancient rocks is claimed to have been demonstrated by Prof. Charles Lipman of the University of California (*Science*, Sept. 21, p. 272). He states that certain organisms of a strikingly different type from any usually associated with soils and rocks were cultivated from specimens of pre-Cambrian and Pliocene rocks after drastic sterilisation of the exterior and all precautions to avoid contamination. We shall await with interest the further detailed studies of the subject which are promised.

THE *New Coal Age* is a monthly periodical (price 6*d.*) published at 1 Buckingham Street, Strand, London, W.C., under the editorship of R. W. Johnson. It is described as a journal of low temperature carbonisation and the scientific treatment of coal. The first number contains open letters to Mr. Baldwin and British industrialists pleading for a national policy of coal carbonisation. There is also general and historical matter, and some account of a plant to be installed by Continuous Carbonisation, Ltd., at Erith. Mr. D. Brownlie contributes a survey of developments abroad, and there are a few short articles on steam-raising on land and sea.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned :—An assistant lecturer in physics and electrical engineering at the Municipal College of Technology, Belfast—The Principal, Municipal College of Technology, Belfast (Oct. 23). An assistant pathologist at St. Thomas's Hospital—The Secretary, St. Thomas's Hospital, S.E.1 (Oct. 29). An assistant bacteriologist in the department of pathology and bacteriology of the University of Sheffield—The Registrar, the University, Sheffield (Oct. 29). A junior lecturer in electrical engineering in the University of the Witwatersrand, Johannesburg—The Secretary to the High Commissioner for South Africa, Trafalgar Square, W.C.2 (Nov. 1). A woman lecturer in education in the Department of Education of the University of Bristol—The Secretary, The University, Bristol (Nov. 2). A research officer in the Civil Veterinary Department of the Government of Burma to carry out researches in connexion with the diseases of elephants, draught buffaloes, and other domestic animals in Burma—The Secretary to the High Commissioner for India, General Department, 42 Grosvenor Gardens, S.W.1 (Dec. 31). A chief librarian of the University of Birmingham—The Secretary, The University, Birmingham. A chemistry master at the Sandown County Secondary School—The Director of Education, County Hall, Newport, Isle of Wight.

Our Astronomical Column.

COMETS.—Taylor's Comet of 1915 is now due at perihelion. Prof. G. van Biesbroeck and Mr. Chang, of the Yerkes Observatory, have computed the perturbations by Jupiter, which were very large, the distance between comet and planet in June 1925 being less than a quarter of a unit. They give the following elements and ephemeris (*Harvard Announcement Card*, No. 73) :

T 1928 Oct. 22·38 U.T.
w 355° 31′·8
Ω 108 15′·3 } 1928·0
i 20 44′·9
ϕ 29 10′·1
Period 6·7580 years

Ephemeris for 0^h U.T. :

	R.A.	N.Decl.	log r.	log Δ.
Oct. 16	8^h 54^m 59^s	14° 44′	0·263	0·281
24	9 13 18	14 44	0·263	0·264
Nov. 1	9 31 12	14 46	0·264	0·246
9	9 48 30	14 54	0·265	0·228

The magnitude may be about 13. It will be remembered that the comet divided into two portions in 1915, so both should be looked for.

Dr. Baade obtained a photograph of the comet 1927*i* (Schwassmann-Wachmann) at Bergedorf as follows: 1928 Sept. 21^d 0^h 52^m·1 U.T., R.A. (1928·0) 3^h 48^m 41^s, N. Decl. 30° 31′, mag. 16·5.

It will be remembered that this comet has a remarkable orbit, which lies entirely between those of Jupiter and Saturn ; the new observation is seven months later than the previous ones, so will greatly strengthen the determination of the orbit. It appears, however, that the elements of Messrs. Berman and Whipple are not much in error, as the ephemeris by C. Vick, based upon them, represents the place within 4′.

THE PERIOD OF THE VARIABLE STAR TT HYDRÆ.—The variability of this star was discovered by Dr. H. E. Wood from Johannesburg photographs taken between March and May 1926. He found that it was of the Algol type, with a period of about 6·96 days. With the aid of Prof. E. Hertzsprung, who examined old Harvard Observatory plates, and found images of the star going back to 1894, it is now possible to deduce very accurate elements which are published in *Union Observatory Circ.*, No. 77. The period is 96·53401 days, with a probable error of 0·000008.

The range is from 7·5 mag. to 10·1 mag. ; the minimum is apparently quite flat for $\frac{1}{16}$ of the period, or nearly 6 hours, indicating total eclipse of the brighter component. Once a fairly exact period was found it was possible to improve it by considering photographs taken at the time of most rapid light-change.

The article affords a good example of the value of the Harvard storehouse of plates, and of the methods for using them to the best advantage.

THE COMPANION OF SIRIUS AND THE EINSTEIN SPECTRAL SHIFT.—Prof. W. S. Adams's investigation of the spectrum of the companion of Sirius was of such extreme difficulty, and led to such important conclusions both as to the Einstein shift and the high density of the star, that an independent verification of the result is welcome. This has now been obtained by Mr. J. H. Moore, using the 36-inch Lick reflector, and a one-prism spectrograph with a camera of 16 inches focal length (*Pubs. Astr. Soc. Pacific*, Aug. 1928). The investigation is based on four spectrograms obtained last February and March. The type of the companion's spectrum was studied. Its type is slightly later than that of Sirius ; it is classified as *A*5, possibly *A*3 or *A*4, but certainly not so late as *F*0, the value adopted by Eddington. One of the four results was excluded from the mean, as it was seriously affected by scattered light from Sirius ; the mean of the other three gives 24 km./sec. as the radial motion of the companion relatively to Sirius ; deducting 5 km./sec. for orbital motion, the remainder 19 km./sec. is in exact accord with Adams's result. No correction has been applied here for the superposed light of Sirius ; if corrections were applied according to Adams's formula the result would be increased to 21 km./sec., but the agreement is still good considering the difficulty of the research.

Research Items.

MARGIDUNUM.—Dr. Felix Oswald reviews the results of his excavations on the Roman site of Margidunum in a paper published in the *Transactions of the Thoroton Society*, vol. 31. Margidunum was situated on the Fosse Way, half-way between Leicester and Lincoln, and in the early days of Roman occupation was of considerable strategic importance. When, however, the frontier was pushed north, it ceased to be of value in this respect, and, being off the trade routes, it became merely a posting station. It revived under Constantine, when in the then flourishing condition of Britain it became a seat of much activity. At the close of the occupation it suffered no violent end but sank into decay. It was never occupied by the Saxons. Owing to the long period of its continuous occupation, its history, as revealed by excavation, affords numerous illustrations of changes in Roman practice and culture. The name is probably a Romanised form of a Celtic denomination meaning 'the plain of the king,' and the adjacent eminence on which Belvoir Castle is situated may have been a hill-fort of the king of the Coritani. Sporadic relics of prehistoric times have been found—flint arrow heads, polished axes, and bronze socketed celts. That the Roman occupation was early is indicated by the rhomboidal form of the first camp. It was protected by a wooden palisade and a system of trenches or ditches, six in number. In later times, when the Romans abandoned this system of defence for a stone rampart with a single ditch, the marshy ground of the early site was filled in with stone and rubbish and gravelled over. In the early days the soldiers may have lived in leather tents or in the underground cellars which have been found. After the burning of the camp by Boudicca in A.D. 61, stone barracks were erected. There are other signs of this consequence of the disastrous defeat of the Ninth Legion, then stationed at Lincoln, by the British queen. Moulded stones much calcined by fire were found in the ditch. These, it is conjectured, are parts of the stone gateways which gave access to the original camp within the wooden palisade.

SEX OF EELS.—Grassi's presumption that the so-called 'male' freshwater eels, less than 30 cm. in length, are not sexually defined has been experimentally confirmed by J. J. Tesch (*Jour. du Conseil Perm. Int. pour l'Exploration de la Mer*, vol. 3, No. 1, April 1928). The remarkable fact that as a rule males are to be found in estuaries and river-mouths, whereas females are most numerous in the upper reaches, has long attracted attention. Further, females outnumber the males wholesale in samples of the larger eels, though they are almost absent in those of smaller individuals. This cannot be explained altogether by the supposition that females grow more rapidly than males, thus telescoping the earlier stages. Tesch took a large number of small eels (20-25 cm.) from the Zuiderzee and kept them for three years in concrete tanks. A sample of these when first taken consisted entirely of 'males.' After a year there was no change, but after another two years, three in all, the survivors, twelve in number, were *all females*, with numerous ova developing in their ovaries. This experiment is being repeated on a larger scale. Further investigations on age determination confirm the fact that males do not become silver eels, that is, ready for the spawning migration, until their sixth year, and the vast majority not until their seventh or later, when they are 30-42 cm. in length. Female silver eels are not found less than about ten years old, and reach a much greater size.

RESEARCHES ON EARTHWORMS.—Three papers in the *Science Reports of the Tohôku Imperial University* (Fourth Series (Biology) Sendai, Japan, Vol. 3, No. 3, Fasc. 3, May 1928) deal with the biology and anatomy of Japanese earthworms. Mr. Takeo Imai's work describing the nervous system of *Perichæta megus-colidioides* Goto and Hatai is valuable; the large size, toughness of body wall, and peculiar behaviour of this worm when stimulated making it an exceedingly good object for various researches; and as it represents the commonest genus of earthworms in Japan, knowledge of its anatomy is eminently desirable. Although the general scheme of the nervous system agrees with that of other earthworms which have been described, there are certain differences, especially in the number of cerebral nerve trunks arising from the cerebral ganglion which supply the prostomial region and buccal cavity. "The Effect of Inorganic Salts on Photic Orientation in *Allolobophora fœtida* (Sav.) (3). Nitrates," is described by Mr. Ekitaro Nomura and Mr. Shinryo Ohfuchi, who have previously dealt similarly with chlorides and sulphates in earlier work in this same journal (No. 2 and 3, Vol. 3). *Allolobophora fœtida* is also the subject of Mr. Sataro Kobyashi's paper on spectroscopic observations on porphyrin in the integument of this worm. The object of this research was to decide whether the pigment belongs to hæmoporphyrin, the conclusion being that it differs spectroscopically in certain important particulars.

FEEDING MECHANISM OF *CHIROCEPHALUS*.—Prof. H. Graham Cannon describes (*Trans. R. Soc. Edin.*, 55; 1928) the feeding mechanism of the fairy shrimp *Chirocephalus diaphanus*. This animal normally swims on its back and feeds on minute particles which it separates from water-currents produced by its trunk-limbs. Water is drawn into the mid-ventral space between the trunk-limbs mainly from in front and above, passes out laterally between the limbs and is swept backwards in two powerful lateral swimming currents. The rhythm of the limbs which produces the swimming stream and the food current is carefully described. The food-particles, drawn into the mid-ventral space by the suction produced during the forward stroke of the limbs, are carried towards the mouth and passed by the maxillules on to the mandibles and probably entangled by the secretion of the labral glands. The view that the phyllopodium represents the primitive crustacean limb is criticised, and it is suggested that a flat, biramous, paddle-like limb, such as occurs in the posterior trunk-segments of *Lepidocaris*, represents the constitution and arrangement of the primitive crustacean limb.

HUMUS-LIVING MILLIPEDES.—O. F. Cook and H. F. Loomis give an account (*Proc. U.S. Nat. Mus.*, vol. 72, Art. 18, 1928) of millipedes of the order Colobognatha from Arizona and California, with descriptions of six new genera. A special interest is claimed for millipedes of this order as examples of interrupted or residual distribution in widely separated regions which could not be reached by any method of transportation now at the disposal of these animals. The explanation of such facts of distribution is to be found in the vegetation and the surface conditions in former ages, which must have been very different from those of the present time. The Colobognatha are delicate, fragile, slow-moving millipedes, unable to burrow in the soil or to withstand surface exposure; the legs and other appendages are very short and unspecialised, and the mouth parts rudimentary. The outstanding requirements for these humus animals is a continuous

supply of moisture. A study of the distribution of the humus fauna may throw light on the natural conditions in the south-western area of the United States before the period of human activity, for there can be little doubt that the surface conditions have been greatly changed during the human period.

A BACTERIAL DISEASE OF PINEAPPLES.—F. B. Serrano describes a brown-rot of pineapples in the *Philippine Journal of Science*, vol. 36, July 1928. On the basis of inoculation experiments, he decides that the causal organism is a primuline yellow bacterium, a new species *Erwinia ananas*, which is fully described with particulars of its behaviour in culture. Whilst the disease does relatively little damage to the native pines, 54 per cent of the fruits of the 'Smooth Cayenne' variety examined were attacked, and one-third of these were a total loss. As is so often the case with bacterial diseases, the flowering stage is the susceptible stage. The stigma, with its sugary surface ready for the pollen, provides an inviting opportunity for the pathogen, which also enters by natural lesions in the placenta and near the base of the stamens. As the fruit matures, inoculation experiments show that the tissues become more resistant to the organism, a fact which explains the important observation of the author that the disease does not seem to make headway upon fruits in storage.

EARTHQUAKES DURING 1918–24.—The catalogue of earthquakes for the seven years 1918–24 which has been prepared for the British Association by Prof. H. H. Turner, will be greatly valued by seismologists ("Catalogue of Earthquakes 1918–24: being a Digest of the International Seismological Survey (1918–24)". Pp. 64. London: British Association, 1928. 2*s*.). Based on the *International Seismological Summaries*, the catalogue gives for every important earthquake its date in Greenwich time, the position of its epicentre, the number of stations at which it was recorded, thus suggesting a rough measure of its intensity, and the previous dates at which the same origin was in action. Earthquakes in which the preliminary wave *P* was observed at distances of at least 80° from the epicentre are indicated, as well as those earthquakes with focal depths that differ much from the normal. As many as 29 earthquakes appear to have a focal depth of 0·05 or more of the earth's radius below the normal depth, which is taken to be about 0·008 of the radius or 30 miles. In two earthquakes the depth is given as 0·08 radius below the normal. It is worthy of notice that no day in the whole seven years is without a record, though on some days an earthquake was registered at only one or a few places.

GEOLOGY OF ZANZIBAR.—During the years 1925–26, Mr. G. M. Stockley made a detailed geological investigation of Zanzibar and Pemba, and his results are now handsomely published by the Government of Zanzibar (*Report on the Geology of the Zanzibar Protectorate*, March 1928, price 12*s*. 6*d*.). It is shown that the present East African coastline was determined in Neogene time, Pemba being separated from the mainland towards the end of the Miocene as a result of rift faulting. This severance is reflected in the difference between the living fauna of Pemba and those of Zanzibar and the mainland. Zanzibar became individualised very much later. Originally a sandbank fringed with corals, the advance of the Azanian Sea in early Pleistocene times converted it into a group of small islands. Retreat of the sea followed by recent encroachment produced the present outlines. Pemba has also been affected in recent times by a relative rise of sea-level. The Tertiary and Recent deposits are described in adequate detail, and a particularly valuable chapter deals with the correlation of the Indo-Pacific Neogene. Water supply and other economic questions are naturally discussed fully, since they were among the primary considerations which led up to Mr. Stockley's appointment.

FLOW OF WATER THROUGH THE STRAITS OF DOVER.—Dr. J. N. Carruthers has written a memoir entitled "The Flow of Water through the Straits of Dover as gauged by Continuous Current Meter Observations at the Varne Lightvessel," Pt. 1 (Fishery Investigations Series 2, Vol. 11, No. 1. London: H.M. Stationery Office, 1928), dealing with the mechanism and the results obtained with a drift indicator which he has designed on the principle of the Ekman current meter, but which can be left working for 3 days or more, even in the roughest weather. The indicator is well adapted for the heavy service of obtaining continuous records, one instrument having been worked continuously for a year by the personnel of a light vessel. The run of the north-east going tidal stream through the Straits of Dover was usually found to exceed the return south-west going stream. During the course of a lunar day the excess flow amounted on an average to 2·7 miles, from the Channel into the North Sea. At times this was greatly exceeded, the extreme being 16·8 miles, associated with strong south-westerly winds driving the water up the English Channel, southerly winds in the North Sea and spring tides. In this case each 'flood' or north-east going tidal stream ran about 11 miles while the ebb stream only ran about 2½ miles. At other times the ebb or south-west going tidal streams exceed the 'flood' or north-east going streams, resulting in an over-all flow of water, or residual current, from the North Sea into the English Channel. The extreme so far recorded of this reversal of the usual current is 11·9 miles per lunar day from the North Sea into the Channel. These reversals are brought about by the tractive force of north-easterly winds in the Channel, usually in conjunction with northerly or north-westerly winds over the North Sea which tend to pile up the water towards the south. The author has estimated from records extending over a year that enough water comes through the Straits of Dover annually from the English Channel to form a layer 13¾ feet deep over the whole superficial area of the North Sea.

FIXATION OF SAND DUNES.—Many countries are faced with the problem of controlling and reclaiming sandy wastes in order to check destruction of arable land. Some account of the successful work in Cyprus is given in the *Bulletin of the Imperial Institute* (vol. 26, No. 3) by Dr. A. H. Unwin. The areas of sandy waste in Cyprus are small—the largest is a little more than five square miles—and the meteorological conditions are favourable. Most of the year is moist, but August–September and December–January are dry periods. The sand consists mainly of silica, but there are sufficient mineral salts to allow a fair growth of trees. Water is provided from wells and is raised by an air motor to a tank from which irrigation channels lead. When the channels are ready, the seedlings are planted, and when the area is completely planted the air motor is moved to another site. In some cases ploughing and drilling is a sufficient preparation of the ground, but for at least the first five seasons the seedlings must be watered in the dry seasons by carts or gravitation channels. Under these conditions growth is quick. The wattle was mainly used, but other useful trees are the Aleppo and stone pines and the cypress. Several other trees, including the eucalyptus, carob, olive, false acacia, and juniper, have been tried.

OSCILLATIONS IN IONISED GASES.—During the last few years, several instances have been reported of the occurrence of electrical oscillations the origin of which could not be traced with certainty, in thermionic and other similar devices. These have been particularly noticeable in discharge tubes containing gas, which often possess an intrinsic natural period which is independent of the circuit connected to them. Dr. I. Langmuir has, however, now published in the August issue of the *Proceedings of the National Academy of Sciences* a theoretical analysis of the possible modes of vibration of what he refers to as a *plasma*, a highly ionised gaseous medium at low pressure which contains, when undisturbed, equal numbers of positive ions and of electrons, and appears to have accounted for the majority of these hitherto unexplained observations. Waves in the component electron gas should be of high frequency, with a zero group velocity, and so be incapable of transmitting energy; these appear to be identical with some oscillations of small amplitude first noticed at Eindhoven in discharges from a hot filament through a gas, and since obtained at Schenectady with a frequency as high as 10^9 cycles per second. Similar vibrations of lower frequency should theoretically also occur in a beam of electrons, and have in fact been detected, whilst the electrical analogue of sound waves has been found in a vibration of the heavier positive ions, and tentatively identified with the type of ionic oscillations which is supposed to be associated with moving striations. The question of amplitudes still presents some difficulties, but on the whole the agreement between theory and experiment is good, and may well lead to advances in the technical use of 'soft' thermionic valves and of gas-filled rectifiers.

THE RAMAN OPTICAL EFFECT.—The issue of the *Zeitschrift für Physik* for Sept. 19 contains several papers upon the changes in wave-length which occur when light is scattered by certain transparent media, one from Moscow, by G. Landsberg and L. Mandelstam, being of special interest in that it appears that a positive result had already been obtained with quartz before the appearance of Prof. Raman and K. S. Krishnan's first note on the subject in NATURE last March. The other researches which are described by C. E. Bleeker in Utrecht, and by Prof. Pringsheim and B. Rosen in Berlin, were undertaken primarily to test the reproducibility of the Indian results, and only the German workers have reported upon their observations in detail. They find that the fundamental vibration of the C-H group at 3·3 μ can be superposed on the incident light by all the compounds which they have used that possess it, but also that although all the modified scattered rays from organic liquids can be referred to known infra-red frequencies of these liquids, not all of the infra-red vibrations give rise to Raman lines. In this connexion they point out in a footnote that many of the conclusions that have been drawn from measurements in the infra-red are quite unwarranted, because of the small accuracy that can be attained in the spectroscopy of this region. Two further results that they have obtained are also somewhat unexpected, namely, that the light scattered from fused silica shows no trace of the strong satellites produced by the action of crystalline quartz, and that the Raman spectrum of silicon tetrachloride is very weak and quite unlike the well-developed spectrum of carbon tetrachloride. It is noticeable that all three groups of investigators are agreed that it is important to measure both the position and the intensity of the Raman satellites.

RADIO TRANSMISSION AND SOLAR ECLIPSE EFFECTS.—Advantage was taken by the Radio Research Board of the opportunity provided by the solar eclipse of June 29, 1927, to investigate the influence of the eclipse on radio transmission. The experimental results have now been published by the Department of Scientific and Industrial Research (Special Radio Report, No. 7. London: H.M.S.O.). As exact quantitative results were desired, the experiments were limited to long waves the wave-length of which was about 13,000 metres and medium waves of about 400 metres. The observations show that the eclipse produced a definite effect on the properties of the ionised layer which deflects waves back to the ground. A striking effect was the large increase in the intensity of the down-coming ray. This was detected at both near and distant receiving stations. This effect is probably due to two causes: first, the increase in the height of the stratum responsible for bending the ray back to the earth; and secondly, the rapid removal of ionisation in the lower layers consequent on the removal of the solar ionising agents. The increase in the height of the stratum was so large that it could be detected without difficulty. The more southerly of the receiving stations experienced the maximum eclipse influence a little earlier than the northern stations. It is curious that the eclipse effects seem to have lasted only for periods of from 20 to 50 minutes, although the total time taken for the moon's shadow to pass across the sun was nearly two hours. This shows that quite an appreciable fraction of the sun's radiation can be cut off before the effect can be detected by ordinary radio methods. It is worth mentioning that the morning after the eclipse was exceptional, as night-time conditions persisted for an exceptionally long time after sunrise. The direction-finding observations carried out during the eclipse gave results which may be ascribed to changes in the effective height and reflection coefficient of the ionised layer.

CRACKING HYDROCARBONS IN THE PRESENCE OF HYDROGEN.—The North British Association of Gas Managers arranges annually a lecture in memory of William Young, prominent at one time in the coal gas industry and a pioneer in the distillation of oil. This year the lecture was given in Edinburgh by Mr. E. V. Evans, joint manager of the South Metropolitan Gas Company, who discussed what might be described as Young's discovery of the secret of carbonisation, namely, the carefully controlled cracking of hydrocarbons in the presence of hydrogen. Young had a remarkable intuition for the essentials of the problem, but was hampered by the necessity for evaluating his products according to their illuminating value. Mr. Evans stated that it has been found possible to bring into colloidal dispersion 90 per cent of a coal. The results of a special method of distilling coal in the laboratory were mentioned, whereby a primary tar, equivalent to 50 therms per ton of coal, was obtained, together with 25 therms of very rich gas. By heating the coke further to 1000°, 35 therms of gas could be obtained, or in all 110 therms in the volatile products—an unusually high result, not however to be anticipated in large-scale practice. The action of hydrogen in preserving from decomposition gaseous hydrocarbons is indicated by results of distilling low temperature primary tar at 800° in a stream of water gas. By this means as much as 106 therms of gas of calorific value 500 B.T.U. were obtained per ton of coal carbonised, together with a normal yield of low temperature coke and high temperature tar. This suggests a way in which low temperature processes might be fitted into the town's gas industry. The experiments emphasise the need for maintaining an adequate proportion of hydrogen during carbonisation, a need which Young himself realised many years ago.

Sheffield Laboratories for Safety in Mines Research.

By H. F. Coward.

THE special dangers of the coal-miner's work have always aroused sympathy from the public, who have been generous in helping the families of miners killed in great colliery disasters. Preventive measures to avoid these dangers have been based on the occasional assistance of students of natural science, as when Humphry Davy invented a safety lamp, and on the continuous efforts of mining engineers. The methods of experimental science were not applied systematically until about twenty years ago, when the Mining Association of Great Britain—a body of colliery owners—set up a full-scale gallery at Altofts, in Yorkshire, to demonstrate the explosibility of a cloud of coal dust and to test the efficacy of stone dust as a means of preventing coal-dust explosions. The success achieved led the Home Office to build a more elaborate station at Eskmeals, on the Cumberland coast, for the experimental study of dust and gas explosions with the view of the development of means for preventing such disasters underground. The War brought this work almost to an end, but it was revived by the Miners' Welfare Fund Committee, which has enabled the Safety in Mines Research Board to build a large-scale experimental station near Buxton and laboratories in Sheffield.

Fig. 1.—New laboratories of the Safety in Mines Research Board at Sheffield.

On Thursday, Oct. 11, the Sheffield laboratories were formally opened by the Prime Minister, who made a tour of them, accompanied by Mrs. Baldwin, and witnessed a number of experiments. In his address, Mr. Baldwin said that he had been assured that the mines of Great Britain to-day are the safest in the world, and asserted that "they have got to be a great deal safer—both our mines, and mines throughout the world." He met an American research worker in the new laboratories. "There is already with America an interchange of personnel and information, similar arrangements have been concluded with France, and preliminary inquiries are being made as to the possibility of extending this system to other countries. . . . There may yet come a day when the great mining industry may be as safe, as far as danger to life and limb is concerned, as any industry on the surface of the earth."

The valediction of Mr. Herbert Smith, president of the Miners' Federation, was equally plain: "Compensation can't put limbs on or give life back. . . . When the miners lost about 100 per month through fatal accidents, when 400 a month were lamed seriously, and when about 16,000 played more than 3 days a week, they were anxious that research should go on . . .," he would say, "Go on with your good work and God bless you."

Other speakers at the ceremony were Commodore King, Secretary for Mines (in the chair); Lord Chelmsford, chairman of the Miners' Welfare Committee; Mr. Evan Williams, president of the Mining Association of Great Britain; and Sir Edward Troup, chairman of the Safety in Mines Research Board.

The new building (Fig. 1) is adjacent to the Department of Applied Science of the University of Sheffield, thereby securing for the staff close contact with the varied activities of a university. It has four floors and a basement, and the construction is such that two more floors can be added if required. As arranged at present, most of the twenty-four laboratories are small, and only adequate to house one investigator in each. Their size is, however, adjustable; for the partitions are light and can readily be removed if it becomes desirable to form larger rooms. The fittings and services have also been designed so as to enable quick and economical readjustment to meet the changing needs of research.

A portion of the new building has been allocated to the Fuel Research Board for use by the South Yorkshire committee for the survey of the national coal resources. The work of the investigators on the composition and properties of coal is closely allied with one part of the Board's work, and the association will be of mutual benefit.

The new laboratories, as well as the large-scale station at Buxton, are under the direction of Prof. R. V. Wheeler, who has been responsible for the scientific direction of such work in the twenty years since its inception at Altofts, by the Mining Association of Great Britain, under the general direction of Sir William Garforth.

Research in Progress in the New Laboratories.

Coal-Dust Explosions.—The experiments at Eskmeals proved that when sufficient incombustible matter is mixed with coal dust, an explosion of a cloud of the mixture is impossible. What research and experience recommended as the best practice was, in 1920, embodied in coal-mining regulations, and the happy result has been that no serious coal-dust

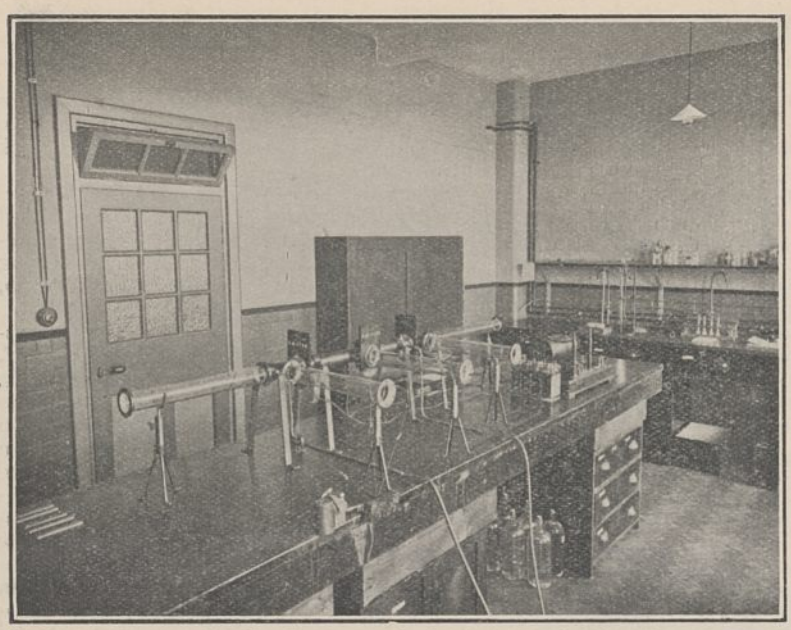

FIG. 2.—A laboratory fitted for flame research. Apparatus for observing the projection of flame in branched galleries; glass and metal tubes represent galleries which may be shut off at desired points by sliding partitions.

explosion has yet occurred in Great Britain in a pit treated with the required amount of stone dust.

The outstanding question to be answered is, whether the means now used to prevent coal-dust explosions always give adequate safety, and, if not, what improvements are possible. Different samples of coal dust differ greatly in explosibility, according to their physical state and chemical composition. One line of research is therefore planned to determine the effect of fineness on explosibility, another to compare the explosibility of a series of different coals ground to a powder which, so far as can be determined, is of the same average fineness for all. To save the time and cost of much of the large-scale experimentation which might be conducted for these objects, laboratory methods are being examined and have proved, so far, to give results parallel to those obtained in the full-scale galleries at Buxton. Both laboratory and field experiments on dust explosions, however, are empirical; a concentrated effort is therefore in progress to determine the composition of coal, not only for the sake of measures for preventing coal-dust explosions, but also for controlling the self-heating of coal in the wastes and in crushed pillars of coal in the mine.

Spontaneous Combustion of Coal.—Many mining engineers have experienced the difficult and dangerous task of fighting underground fires which have originated in the spontaneous combustion of some part of the coal substance. Experience has shown that certain seams are more liable to fires than others, and that some methods of mining lead to much less frequent fires than others. The experimental study of the spontaneous combustion of coal is a laboratory supplement to the engineer's observations underground.

Of the four macroscopic constituents of coal, namely, vitrain, clarain, durain, and fusain, the last named is the least readily oxidised and would therefore appear to contribute least to spontaneous heating. It is, however, the most porous and friable constituent, and therefore permits air to diffuse to the more oxidisable parts when a mass of coal is crushed. The function of pyrites is not yet fully understood, but its oxidation produces crystalline products of greater volume than the pyrites from which they were formed, and thus breaks up the mass to make way for the entrance of air.

The most readily oxidisable ingredient of coal has proved to be the ulmin fraction, which forms the major part of a vitrain and a clarain and a high proportion of a durain. The ulmin fraction is, however, not of constant composition, and variations in the oxidisability of coal are largely attributable to variations in the composition of the ulmins present.

Firedamp Explosions.—In the early days of coal-mining the danger of firedamp was met by the hazardous method of igniting the gas before it had accumulated in formidable amounts. This primitive procedure has long been superseded by improved ventilation designed to keep the amount of firedamp everywhere below the explosive limit, and by safety lamps designed in such a manner that they will not pass flame into the air in the event of the atmosphere becoming abnormally charged with firedamp. These precautions have enormously reduced the danger, but explosions still occur, sometimes with fatal results.

Research on firedamp explosions is directed towards discovering the conditions of ignition of firedamp and the mode of propagation of flame in mixtures of firedamp and air, so that suitable measures can be taken to avoid ignition underground and to prevent the spread of flame. Mining equipment, such as lamps,

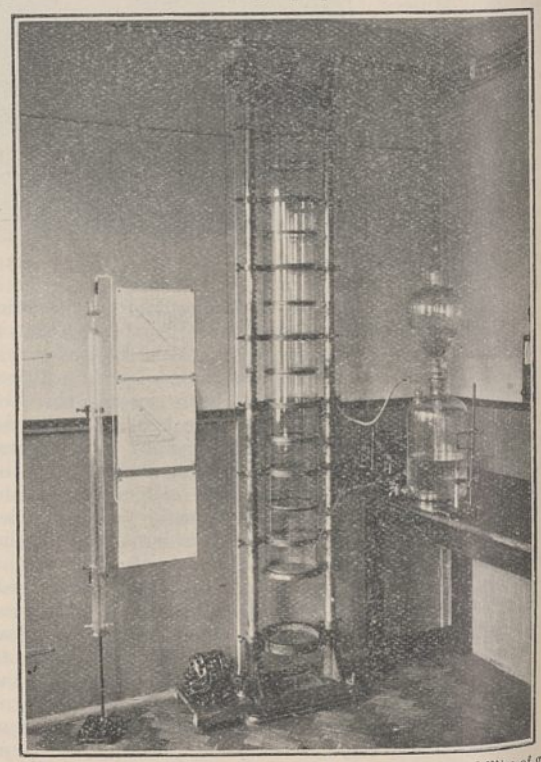

FIG. 3.—Apparatus for determining the limits of inflammability of gas mixtures. The narrow tube on the left is used for long series of experiments, and the applicability of the results to practical conditions is tested by the larger tube in the centre.

switches, and motors, are fitted with the safety devices suggested by research, and are tested in explosive atmospheres composed of firedamp and air in the proportions which give the most stringent test in the circumstances. For underground signalling by bells and telephones, the design of electric circuits has been so improved as to render the spark at break unable to ignite firedamp.

An extensive investigation of the danger of friction sparks from picks and coal cutters, and of electric sparks due to the spontaneous generation of electricity in a cloud of coal dust, is approaching completion.

Electrical Researches.—Apart from the investigations named above, the chief object of the electrical researches in the new laboratories will be to improve the safety of the electrical equipment necessary for increased illumination of the mine; for better illumination will not only enable the collier to avoid many accidents, but also will, it is believed, prevent the eye disease called miners' nystagmus.

Mining Explosives.—The official safety test for mining explosives was designed to be more severe than the conditions of the pit, but explosives which have passed the test have proved not to be safe in all circumstances. It seems impossible, at the moment, to propose any improvement on the test, for want of exact knowledge of the mode of ignition of gas by an explosive. The subject is under investigation by the Board, but the work has been mainly transferred to the Buxton station.

Safety Lamps.—Flame safety lamps have been studied in detail during recent years, and much improved illumination obtained by suitable modifications in design and suitable blendings of lamp oils. The results of these researches are in the hands of manufacturers, and experimental lamps are receiving trial underground.

Mine-Rescue Apparatus.—Self-contained breathing apparatus provides a supply of oxygen independent of the atmosphere, and is necessarily somewhat heavy and cumbrous. It may frequently happen that a suitable gas mask could be substituted, and attempts are being made to produce one which contains sufficient absorbents to remove all noxious gases, including carbon monoxide, and yet not to offer so much resistance to the passage of air that the wearer is hampered. A study of carbon monoxide estimators, and the construction of a portable oxygen estimator, are also contemplated.

The University of Leeds.

EXTENSION OF THE TEXTILE INDUSTRIES DEPARTMENT.

ON Thursday, Oct. 12, the Master of the Worshipful Company of Clothworkers of the City of London opened the new extension of the Clothworkers' Departments of the University of Leeds, the buildings of which have cost approximately £12,000, and the equipment, largely provided by donors in the textile industry, another £10,000. The extension has been designed to facilitate (1) the installation of an experimental wool plant covering all the processes for the woollen and worsted industries; (2) the extension of museum and laboratory accommodation to fulfil the requirements of a much larger number of post-graduate and degree students attending the department; and (3) to provide additional accommodation for the Silk Research Association which is housed within the University precincts.

It is fifty-four years since the Clothworkers' Company gave the first donation which enabled the Textile Industries Department to be installed alongside the Science Departments in the then Yorkshire College of Science. Largely owing to the traditional character of the wool industries and the complexity of the wool fibre and wool processes, the bearings of science upon the technology of the subject have not yet been completely realised, but an additional grant from the Clothworkers' Company of £4000 a year has made it possible to appoint, within the Department of Textile Industries, a science staff which, working along with the technological staff, is already showing promise of that association between science and technology which was the primary object of the Clothworkers' Company.

The complete equipments in the woollen and worsted manufacturing processes will enable the technological staff to define clearly many of the fundamental problems of the industry which in normal practice are hidden owing to a conglomeration of varying factors; and then, with the more refined 'tools' now available, the scientific worker is at hand either to solve the problems in question or to suggest the scientific tools which will help the technologist towards more perfect methods of manufacturing.

At the opening ceremony the Master was supported by a large gathering of representatives from the whole of the woollen and worsted industries and by other supporters of university developments in Yorkshire. The Pro-Chancellor of the University of Leeds, in introducing the Master, gave a history of the association of the Clothworkers with the University, which showed that grants of £100,000 for accommodation and equipment and £165,000 for maintenance had already been made, and that in addition to these a grant of £4000 a year had been raised to £7000 a year.

The Master, in declaring the buildings open, spoke of the intense interest the Clothworkers' Company takes in the extension of their departments of the University, and expressed his appreciation that the generosity of the Company has met with such a hearty response from the machine makers of Yorkshire and elsewhere. He congratulated the University on the progress it is making, and hoped that the present scheme would fulfil the anticipations of its promoters. The Vice-Chancellor, Dr. J. B. Baillie, and the chairman of the Advisory Committee, Mr. A. Michael Lupton, thanked the Clothworkers for their munificence, and the latter, in seconding the vote of thanks, emphasised the large amount of graduate and post-graduate work which is now being undertaken in these departments. Prof. A. F. Barker, on behalf of the staffs of the departments, and Mr. George Blackburn, on behalf of the past and present students of the departments, also supported the vote of thanks. The architect, Mr. Waterhouse, presented the Master with a key of the building, and the guests then made a tour of inspection.

In the equipment it is interesting to note the comprehensive display of such things as electric driving and lighting, air conditioning, floors and other matters appertaining to recent developments in factory construction and running. In other respects the equipments are representative of the latest practice, and almost without exception the firms involved have agreed to keep this equipment thoroughly up-to-date. Thus, not only will the equipment be used for teaching purposes, but also for experimental purposes on lines which will make a very strong appeal to those who are endeavouring to keep the textile industries of Great Britain well ahead in all manufacturing processes.

The Sixth Congress of Russian Physicists.

THE Russian Physical Society usually meets in one of the larger university towns, but this year a new departure was made, and in order to visit some of the more remote universities the congress became itinerant, in much the same way as is done by the British Association when it visits the Dominions. A number of foreign physicists were invited to become the guests of the society, and those who were fortunate enough to be able to do so were treated with the most generous hospitality. We have undoubtedly had as interesting a journey as we are ever likely to make.

The meeting began on Aug. 5 in Moscow under the presidency of Prof. Ioffe, of Leningrad. Here most of the papers were read, but there was no time for the Russian papers to be translated, and so those of the visitors who could not understand the language had plenty of opportunity for seeing the sights. Apart from the monuments and museums, we were shown a number of scientific institutions, among them the Biophysical Institute of Prof. Lazarev, where experiments over a most unusually wide field are being carried on. From Moscow we went to Nijni-Novgorod, where the great fair was in progress, though rather fallen from its former importance, and after a day there, including a meeting at the University, we took ship on the Volga. A special boat had been chartered, and this provided a great opportunity for the informal discussion of physical questions. It also made it possible to stop at any places of interest on the river, or when the weather turned hot to see the beautiful sight of two hundred physicists simultaneously enjoying a bathe.

We were most hospitably entertained by the University at Kazan, a beautiful city and the capital of the Tartar Republic, and we shall always think of Kazan as the culminating point of the whole tour. From there we moved on to Saratov, where the closing session was held on Aug. 15. Though this was the formal end of the congress, a continuation had been arranged in which many of the Russians and nearly all the visitors took part. We went on down the Volga to Stalingrad (formerly Tsaritsin) and then took train across the steppes to the Caucasus. From Vladikavkas we were carried in motors over the wonderful Georgian Road to Tiflis, where we were again entertained by the University. There the party broke up, most returning by various ways to Moscow, but a few of us found a ship going from Batum to Constantinople, and so returned by the Mediterranean.

For one who knows no Russian it is not possible to give a detailed account of the subjects of the papers, but physics certainly appear to be in a flourishing condition in Russia. Perhaps the most interesting work is that of Prof. Ioffe on the reflection of electrons —including an unsuccessful attempt to detect polarisation—and that of Profs. Mandelstamm and Landsberger. The latter described how they had independently discovered Raman's phenomenon, the scattering of light with changed frequency. This was predicted some years ago by the dispersion theory of Kramers (and still earlier by Smekal), and the verification is made by scattering the light from a solid or liquid and observing the change of frequency. This change is a measure of the wave-lengths of the infrared absorption of the scattering material, and so, apart from its direct interest, the phenomenon promises to be important for the spectroscopy of solids. In addition to the Russian papers, lectures were given by the visitors on various subjects; among them may be mentioned Prof. Ladenburg's verification of the 'negative dispersion,' also predicted by Kramers (see NATURE, Sept. 22, p. 438).

The general condition of Russian scientific workers seems to be more favourable than it was reported to be a few years ago. Their labours are very directly encouraged under the present regime, and, apart from the general impoverishment of the country, their chief hardship appears to be a sense of isolation due to the great difficulty they have in visiting other countries. Their guests will certainly all try to mitigate this difficulty in return for such a delightful tour.

C. G. DARWIN.

Research in Aeronautics.[1]

THE keynote of the policy of the Aeronautical Research Committee during the year 1927–28 appears to have been a recognition of the importance of close co-operation with the aircraft industry and the Services on one hand, coupled, on the other hand, with a consistently scientific attitude to test and research in the problems associated with these two branches. The numerous advances recorded and the high quality of the experimental work are a full justification of this policy.

The general progress in Great Britain resulting from research is exemplified in the performance of the British seaplanes competing for the Schneider Trophy. The immediate results are of course attributable to the designers of the machines and engineers, and to the splendid piloting by the R.A.F. officers, but a great deal of preliminary ground work was covered by close co-operation between the individual designers and the trained research staff at the National Physical Laboratory. Several models of each racing type were tested in the duplex tunnel at the N.P.L. in the endeavour to obtain results at the highest possible Reynolds' number, that is, as close to full scale conditions as possible, and the conclusions arrived at, after consultations between the designers and the N.P.L. staff, led to definite improvements. The Committee quite rightly stresses the importance of close co-operation between the designer and the actual research worker, as a vital factor in progress of this nature.

The part played by joint action of a similar kind is exemplified by the development of mechanisms for avoidance of control failure during stalling. The Committee has now spent some considerable time in a close study of the forces operating during the stall, and of the actual motion of the aeroplane in that condition, in the hope of preventing the serious type of accident which frequently follows an inadvertent stall. This hope has been fulfilled, and out of the original slot system there have developed several methods for reducing this danger. In particular, the use of a slot which automatically closes at low wing incidences, and so avoids the loss of performance due to an open slot, has greatly assisted this development. Meanwhile, various methods of using slots at the wing tips are being extensively tried in the Services and upon civil aeroplanes.

Valuable work is also recorded on the problem of wing flutter; the aerodynamic and structural factors

[1] Aeronautical Research Committee. Report for the Year 1927–28. Pp. 63. (London: H.M. Stationery Office, 1928.) 2s. net.

that originate it have been analysed, and studied experimentally on models, while modifications in design have been suggested with the view of its reduction, if not actual elimination.

So far as the power unit is concerned, the Committee records many important advances. Distinct progress has been made in the determination of the torsional vibrations of crank shafts in a form suitable for design routine, and there is a first indication that a critical speed lower than the normal running speed may safely be allowed. The question of compression-ignition engines has been examined. The advantages offered by an engine of this type are substantial: they include such features as the diminution of fire risk by use of a fuel of high flash-point; a fuel consumption possibly lower than that of a petrol engine; a cheap fuel; and a diminution of the heat that must be dissipated by the cooling system. On the other hand, there is the disadvantage of high maximum pressure and a greater weight per engine h.p. Starting difficulties are also experienced, but it is anticipated that these may be overcome.

Close co-operation with the Services is evidenced by the fact that measurements are being made of the fuel consumption in Service squadrons, and these indicate very wide variation as between one engine and another in the same flight.

Pure aerodynamic research also finds its place. Problems of fluid motion have been attacked both theoretically and by experiment. In particular, a detailed experimental analysis of the state of eddying flow being a two-dimensional body has been carried through, the results being in general agreement with Kàrmàn's theory of vortex streets. Thus, step by step, closer insight is being afforded into the complicated state of turbulence in the wake of a moving body, and the part this plays in relation to the aerodynamic forces that arise. It is clear that an important desideratum for the future study of air-flow problems is the construction of an instrument capable of following and recording the rapid velocity fluctuations in an air-stream. Up to the present, it is only at low frequencies of about four per second that the wave form can be accurately determined, although the actual frequency can be measured up to eighty per second.

Year after year has witnessed the evolution of a special aerodynamic technique both experimentally and instrumentally. This year yet another step is to be taken which may have the effect still further of replacing full scale experiments by those on models. A compressed-air tunnel is under erection at the N.P.L. and a high-speed tank at the Royal Aircraft Establishment. The new air tunnel will be approximately 17 ft. in diameter and 50 ft. long, and a pressure of 22 atmospheres will be attained. This will enable a large amount of experimental work to be done under controlled conditions in the laboratory, which otherwise could only be conducted much more slowly and at a greater cost in free flight. Ample facilities must, nevertheless, remain for full scale experiments, as an ultimate standard of reference. In the new high-speed tank, models of seaplane bodies and floats will be tested at speeds up to 40 ft./sec.

It is impossible in such a brief notice to do justice to the manifold activities of the panels of the Aeronautical Research Committee or of the numerous individual workers associated with them. The mere titles of the sub-committees speak for themselves: accidents, aerodynamics, air transport, alloys, compressed-air tunnel, design, elasticity and fatigue, engine, flutter, interference, relations with industry, seaplane, symbols, wind structure. The scientific problems that arise are of no mean order. The success recorded in this report is in no small measure due to the effectiveness with which the scientific work has been co-ordinated in the administration.

The British Industries Fair.

THE next British Industries Fair, organised by the Department of Overseas Trade, is to be held at the White City, Shepherd's Bush, on Feb. 18–Mar. 1, 1929. The Government has again made a grant of £25,000 for the purpose of advertising the fair. The fair is to be restricted to trade buyers from 10 A.M. to 4 P.M. each day, but to enable the general public to see this thoroughly representative display of products of the home country and the Empire overseas, they will be admitted daily from 4 P.M. to 8 P.M.

The number of exhibitors increased from 914 in 1927 to 1223 in 1928, and the increase in the home buyers visiting the fair was 40 per cent in 1928, and the increase in foreign buyers 24 per cent. Moreover, the attendance of the general public showed an increase of 15 per cent. It is hoped, and indeed expected, that the fair of 1929 will show a marked increase on these figures, and, to meet this growth, the total area available will be increased from 257,000 square feet in 1928 to 400,000 square feet in 1929.

The scientific instrument section of the British Industries Fair was formed as a separate section in 1926, when about 18 firms exhibited, occupying 750 square feet. Last year these numbers had grown respectively to 52 firms and a space of 6000 square feet. For 1929 applications have already been received from 45 firms for a space of approximately 5600 square feet, without taking into account about 2000 feet reserved for the British Photographic Association.

It is to be hoped that the various branches of the British Scientific Instrument Industry—optical, electrical, mechanical, and other—will not neglect the opportunity thus provided of bringing to the eyes, not only of home and foreign trade buyers, but also of the general public, a representative display of British products in these fields. Only goods manufactured within the British Empire may be shown, and then only by the actual manufacturers or by firms who control the complete output.

There have been marked advances in the design, quality, and performance of British scientific instruments, as well as of the production of optical glass, in Great Britain in recent years, and the British Industries Fair affords not only a useful, but also an almost indispensable, means of bringing vividly before potential buyers and users the nature and the extent of the progress that has been made.

The British scientific instrument industry has undoubtedly been hampered in the development of certain of its specialised products, by a current legend or prejudice, for some classes, in favour of the products of this or of that foreign country. Even where such a prejudice may have been based originally upon a superiority in fact, it tends to live on and to influence purchase long after it has ceased to be true, and the British manufacturer thus gets less than the credit due to him for the improved quality and performance of his productions. The Fair is one way, and an excellent way, to remove or to lessen the handicap which British manufacturers suffer.

University and Educational Intelligence.

CAMBRIDGE.—More details are now available of the munificent offer which the International Education Board has made to the University. The University's scheme in its entirety includes a sum of £500,000 for the new University Library, of which the University has found half from its own resources. The remaining £679,000 of the scheme is made up as follows: (*a*) Agriculture. For teaching and research staff in animal physiology, plant genetics, and soil science, £92,900; for building and equipping a laboratory for genetics, mycology, bacteriology, cytology, etc., £40,000; for further research endowment, £30,000. (*b*) Biochemistry. For teaching and research staff, £24,000; for research endowment, £22,200. (*c*) Colloidal physics. For teaching and research staff, including a professorship, £50,300; for research endowment, £25,000. (*d*) Physics. For the establishment of a professorship of mathematical physics, £30,000. (*e*) Botany. For plant physiology, £57,250; for mycology and bacteriology, £51,250. (*f*) Physiology. For teaching and research staff, £33,000; for research endowment, £22,200; for buildings and equipment, £32,500. (*g*) Zoology. For teaching and research staff in entomology, experimental zoology, and protozoology, £77,900; for buildings and equipment, £90,500.

For the eighth year in succession, Trinity College announces the offer of a research studentship open to graduates of other universities who propose to come to Cambridge in October next as candidates for the degree of Ph.D. The value of the studentship may be as much as £300 a year if the pecuniary circumstances of the successful candidate require it. Dominion and Colonial Exhibitions are also offered to students of Dominion and Colonial universities who wish to come to Cambridge next October as candidates for the degree of B.A., M.Litt., M.Sc., or Ph.D. These Exhibitions are of the titular value of £40, but their actual value is such sum (if any) not exceeding the titular value as the College Council may hold to be justified by the Exhibitioner's financial circumstances; the Council also has power, if funds are available, to award an additional payment. Candidates must apply through the principal authority of their university. Applications for the Research Studentship and for the Dominion and Colonial Exhibitions should reach the senior tutor by July 1, 1929.

The Henry Sidgwick Memorial Lecture at Newnham College will be given by Prof. G. Elliot Smith, professor of anatomy in the University of London, on Saturday, Nov. 3, at 5 P.M., in the College Hall. The title of the lecture is "The Pursuit of Truth."

The Vice-Chancellor has announced that Prof. H. F. Newall is resigning the chair of astrophysics in December next.

LONDON.—The second course of the series of Gow Lectures, on "Colloid Chemistry and its Relation to the Rubber Industry," will be given by Dr. Paul Stamberger, of Budapest, at University College, London (Gower Street, W.C.1), on Nov. 12, 14, 16, 19, and 21, at 5.30 P.M. At the first lecture the chair will be taken by Mr. William Duncan, chairman of the Rubber Growers' Association. A short syllabus of the lectures may be obtained on application to the Academic Registrar, University of London, S.W.7.

MANCHESTER.—The Council has accepted the following resignations: Mr. Geoffrey Lapage, lecturer in zoology, on his appointment to the lectureship in that subject in University College, Exeter; Mr. C. J. Polson, assistant lecturer in chemical pathology, on his appointment to the lectureship in pathology in the University of Leeds; Mr. Walter Cartwright, assistant lecturer in metallurgy, who has received an industrial appointment.

Mr. F. R. Curtis has been appointed lecturer in experimental physiology.

The following appointments have been made in the Faculty of Technology: Dr. H. Lowery to be lecturer in physics; Mr. Albert Johnson to be lecturer in municipal and sanitary engineering.

THE Loughborough College Calendar for 1928–29 offers diploma courses in the faculties of engineering and pure and applied science and gives particulars of its school of industrial and fine art, in which diploma courses are about to be established, and of an extra-mural adult education department affiliated to University College, Nottingham. The diploma courses in mechanical, electrical, and automobile engineering involve five years' residence, including workshop training, given concurrently with academic studies during the whole period of residence, in the College shops, which are fully capable of producing all types of engineering components upon a productive basis, thus rendering superfluous any separate apprenticeship. In civil engineering the course covers four years, the workshop training being given in alternate weeks during the first and second years; in commercial engineering and in pure and applied science the course covers three years. The College awards annually five open British Empire scholarships of £75 a year, tenable for the full period of the diploma course: of the scholarship holders last year, two were from Palestine, and the others, ten in number, from various parts of England.

THE Carnegie Endowment for International Peace has three divisions: (1) Intercourse and Education, (2) International Law, and (3) Economics and History. In his recently published report for the year 1927, the Director of the first division, Dr. Nicholas Murray Butler, who is also president of the Carnegie Endowment, remarks that the work of influencing public opinion so as to build up the habit of thinking in terms of peace has been carried on with exceptional energy. Conspicuous among these activities were international visits of editorial writers, university professors and students, and members of parliaments, and other representative men. Last year the Endowment inaugurated a system under which it appoints, with the concurrence of the institutions concerned, "visiting Carnegie professors of international relations." Arrangements are made by correspondence with the university authorities, on whom no financial or other obligation is imposed, for the delivery of a few public or academic lectures, but more especially for series of intimate conferences and discussions with professors and advanced students. Of sixteen professors appointed under this system, one or more visited almost every country in Europe and in South America, while others visited South Africa, Australia, New Zealand, and Japan. Special attention is directed to the way in which one of them, Dr. M. T. Bogert, professor of organic chemistry at Columbia University, New York, using his specialty, chemistry, "as an entering wedge" at Prague, succeeded in winning a general appreciation of American culture and science, "a genuine and warm response on the part of the Czechs, notably of those who are playing an important rôle in the upbuilding of this new State." Of a total disbursement for 1926–27 of 295,000 dollars, about two-fifths was by or in connexion with the European centre, including ten thousand dollars devoted to arrangements for rendering more accessible to scholars the great collections of the Vatican Library.

Calendar of Customs and Festivals.

October 23.

ST. SURIN, OR ST. SEVERIN.—A saint held in veneration as one of the great patrons of Bordeaux, of which he was a native. On his return from Cologne, St. Armand gave up the bishopric to him. It is a tradition that the cemetery belonging to the church of St. Surin was consecrated by Christ himself accompanied by seven bishops, who founded the principal churches in Aquitaine and were afterwards canonised.

October 25.

ST. CRISPIN AND ST. CRISPINUS.—Martyrs who came from Rome to preach at Soissons towards the middle of the third century, working with their hands in the night and making shoes for the poor at a very low price, an angel supplying the leather. They, therefore, became the patron saints of shoemakers, cordwainers, and cobblers, who observed this day as a holiday on which no work could be done. At Hexham they held a dinner at which a King Crispin, a queen, prince, and princess were elected from their number and from their families. They afterwards went in procession through the streets with banners, etc. At Newcastle the cordwainers held a coronation of St. Crispin at the Freeman's Hospital, and walked in burlesque procession through the streets. At Cuckfield and Hurstpierpoint in Sussex the day was kept with much rejoicing and bonfires were lit, though a suggestion connected the celebration with Agincourt. At Tenby, in Wales, an effigy was hung on some prominent place the night before. On the saint's day it was taken down and carried about the town. A mock will was then read, distributing articles of its dress among the shoemakers until nothing remained.

October 26.

In Macedonia the month of October, the month of seed time, is known as the month of St. Demetrios from the observation of his feast on this day—a feast specially devoted to the celebration of marriage. The month is also known as ' the second little summer.'

October.

At about this time of the year a number of festivals are observed in India for the promotion of fertility in animals and crops. On the first day of the bright half of the month of Kārtik (October-November), a festival in which cattle play a leading part, is widely prevalent in northern India, but with many local variations. In Bihār and parts of Bengal the cattle are incited to worry and gore a pig or made to chase a mock pig, a bag or blankets stuffed with straw or chaff. In these provinces it is essentially a festival of the Ahirs, a cowherding caste now practically confined to northern and north central India. One of the most peculiar features is the eating of the pig, which is not the wild boar, but the village pig, the flesh of which is eaten by the despised classes only.

About mid-day the cattle, gaily decorated, are all turned out by the villagers, who carry big red sticks. A pig is purchased and brought to where the cattle are. A rope is attached to it and it is then dragged backward and forward while the cattle are incited to attack it. The owner of any cow or buffalo that gores it with its horns is praised ; any timid beast that runs away is brought back and forced to attack with its horns by its owner. The pig is killed and eaten at a feast at which there is a good deal of intoxication, dancing, singing, and playing. The festival lasts about a week, and while it is going on the villagers go round to the houses of the owner of the village and others and sing and dance before their doors, for which they receive presents.

DIVALI.—The Feast of Lamps, held at the new moon of the month of Kārtik, is intended to promote the fertility and prosperity of the cattle. The Bhīls of northern India offer a thanksgiving to their godlings near the cattle sheds. A lamp and seven balls of rice are placed with a circle of rice grains. Five chickens are sacrificed and wine offered. Then the cattle, with their horns painted red, are released from their stalls and driven over the body of a Bhīl lying face downward, for which he receives a present of a cloth or turban. In the Deccan cattle racing is used to foretell the prospects of the coming season.

The Divali is followed by the Govardhan, when cowherds, half drunk, collect gifts from their employers, singing " May this house grow as the sugar cane grows." In the Punjab the women make an image of Krishna lying on his back surrounded by little loaves of cow-dung which represent mountains, and cattle with cattle-men watching. On this structure the churn staff, sugar cane, and a lighted lamp are placed. The cowherds are then invited to come and salute the images as they feast on rice and sweets. The ceremony is connected with the sugar cane crop, for until it has been completed by a Brahman eating a bit of sugar cane, no one may eat, cut, or press the sugar cane.

In Bihār the Gwala cowherds at the Divali tie a pig by the feet and drive their cattle over the animal until it is crushed to death, after which they boil and eat the flesh in the fields. Both the Baigas of the Central Provinces and the Gonds sacrifice pigs to the sun-god, Narayan Deo, by laying the animal on a threshold and crushing it to death under a beam. That the pig has replaced a human victim is clear. In Madras a pig was buried at the boundary of a Telugu village and killed by cattle being driven over it ; and this method of sacrifice, it is reported, had at one time been followed by the Todas in the case of a human victim.

In South Canara, Madras, certain Rakshasas (demons) known as Kambla Asura, who preside over the fields, are propitiated by buffalo races before the second crop is sown. If these are omitted the crop will fail. A ceremony called *panikkuluni*, or sitting under the dew, is performed the night before. Field labourers sit up all night singing songs to a band about their devil, Nicha, and offering toddy and rice pudding in an earthen pot, which is broken to leave the pudding a solid mass. The field in which the race is to take place is manured and ploughed in the morning, and the seed sown the next day. Cock-fighting follows for some days to propitiate various demons.

In a very interesting ceremony of the earth goddess among the Kazis, after the harvesting of the zonna (*Sorghum vulgare*) crop in the Godavery district, all the men had to go out to hunt and bring back some description of game, while the women dressed in men's clothes. Any man who did not bring back something, be it only a bird or mouse, was driven out with dung and mud, and did not dare return to the village until next day. This festival seems to revert to the primitive division of labour as between the sexes, hunting to men and agriculture to women.

Addendum.

Oct. 18, St. Luke's Day, was also known in York as Whip Dog Day, from the custom of whipping dogs as at Hull (*see* Oct. 10). The same custom was observed at Manchester on the first day of Acres Fair held at about this time. At Dish Fair held at York on Oct. 18, a wooden ladle was borne in a sling on two stangs by four labourers, each supported by another.

Societies and Academies.

LONDON.

Society of Public Analysts, Oct. 3.—**G. W. Monier-Williams**: Polarimetric determination of sucrose in milk and sucrose mixtures. A method has been based on the work of Jackson and Gillis and on the observations of Vosburgh and of Zerban, on the effects of concentration and temperature on the specific rotation of invert sugar. Angular notation is used as being more suitable for general work than the saccharimetric notation commonly used by sugar chemists.—**T. McLachlan**: The analysis of starch sugar degradation products by selective fermentation. The method of selective fermentation by different yeasts is the most satisfactory. The yeasts used are *S. Frohberg*, *S. Saaz*, and *S. exiguus*; the difference between the total solids of the blank and the solution fermented by *S. exiguus* gives the amount of dextrose and lævulose; the difference in total solids in the solutions fermented by *S. exiguus* and *S. Frohberg* represents maltose; whilst the difference between the total solids after fermentation by *S. Frohberg* and *S. Saaz* gives other fermentable sugars. The amount of dextrins is calculated from the optical rotation.—**W. R. Schoeller** and **E. F. Waterhouse**: Investigations into the analytical chemistry of tantalum, niobium, and their mineral associates. (13) A new method for the separation of zirconium and hafnium from tantalum and niobium. The process is based on the precipitation of the oxalo-earth acids by tannin in weakly acid solution, zirconyl oxalate remaining dissolved. The method described earlier of fusion of the mixed oxides with potassium carbonate, has been perfected; a single fusion may be sufficient for the separation of the bulk of the earth acids. The balance is then separated from the zirconium residue by the tannin procedure. The latter is a delicate test for the detection of the smallest quantities of earth acids in zirconia.

SHEFFIELD.

Society of Glass Technology (Bournemouth meeting), Sept. 21.—**I. Kitaigorodsky** and **S. Rodin**: The value of the expansion factor of aluminium oxide in glass. The thermal expansion coefficient of glass depends upon its composition and rises with the increase in the percentage of alkali and lime, and falls as the content of alumina and silica increases. In calculations of the theoretical thermal expansion coefficient of glass, the value of the factor for alumina must be taken as 0·52, as previously determined by S. English and W. E. S. Turner, and not as 5·0, the value given by Winkelmann and Schott.—**D. Starkie** and **W. E. S. Turner**: A study of the ultra-violet light transmission of glass. Photographs of the light transmitted by seven commercial ultra-violet glasses were obtained. They were Corex, Vita-, Sanalux, Holvi-, Helio-, Quartz-Lite, and Uviol glasses. The percentage transmission at each point of the spectrum for these seven glasses was also determined, a platinised-quartz wedge photometer being used. Transmission curves extending from a wave-length of 7000 A. to 2000 A. have been drawn. The transmission of solar ultra-violet rays is roughly proportional to the iron content. The amount of ferrous iron was roughly 30 per cent of the total iron. Six glasses were exposed, under the conditions to which an ordinary window pane is subject, for 3 months, and the decrease in transmission of the solar ultra-violet rays was measured. Four specially prepared laboratory glasses containing only iron and platinum as impurities, showed no change in transmission when exposed to the sun's rays or to those from an artificial source of ultra-violet light. Measurements of transmission were also made for a series of specially prepared soda-lime glasses. The parent glass was 75 per cent SiO_2, 10 per cent CaO, and 15 per cent Na_2O, and ferric oxide was added in increasing amounts as the series progressed. As the iron content increased, the limit of transmission in the ultra-violet moved progressively towards higher wave-lengths. Plotting iron content against wave-length limit yielded a smooth curve, from which it could be deduced that a glass perfectly free from iron and platinum would have a transmission limit of 2200 A. approximately.

PARIS.

Academy of Sciences, Sept. 17.—**A. Lacroix**: The genesis of the jadeite of Burma.—**Bigourdan**: The observatory of Delambre, at the rue de Paradis. Delambre made observations at this observatory in 1798 and 1799 for determining the latitude of Paris.—**Georges Giraud**: A method of solving the problem of Dirichlet for linear equations.—**J. Chokhate**: The approximation of continuous functions by the aid of polynomials or of limited trigonometric series.—**D. Menchoff**: The conformal representation of plane domains.—**M. Winter** and **Paul Lévy**: Vibrating spaces.—**G. Delépine**: The marine fauna of the Carboniferous of Asturia (Spain).—**A. Guichard**: The existence of fibro-vascular bundles with inverse orientation in the leaf of *Cladium Mariscus*.—**Jules Amar**: The question of alcohol. From a survey of experimental work on the behaviour of alcohol in man, two facts are regarded as proved. Alcohol from wine or beer, in moderate doses, is a heat-producing agent: under no conditions can muscular or nerve energy be derived from the consumption of alcohol.

ROME.

Royal National Academy of the Lincei, May 20.—**P. Burgatti**: Properties of the axial homographs in a Euclidean S_n with application to Frenet's formula.—**A. Bemporad**: Observations made during the solar eclipse of June 29, 1927, at the Royal Capodimonte Observatory. The results obtained with two pyrheliometers of different types confirm the law of diminution of the radiating power of the solar disc in passing from the centre to the periphery, formulated by the author on the basis of observations made by Secchi, Vogel, Langley, and Frost, but fail to confirm the law deduced by Julius, which would indicate a more rapid diminution. The recent observations of Schwarzschild, Villiger, and Abbot are also in good agreement with the results obtained, which also support the author's hypothesis that the absorptive power of the atmosphere increases in the neighbourhood of the maximum phase of a solar eclipse.—**Q. Majorana**: A photo-electric phenomenon detected by means of the audion.—**L. A. Herrera**: Cellular figures in rhyolite. Specimens of rhyolites from the Contepec district of Mexico exhibit an abundance of distinct cellular figures, produced by imperfect crystallisation of the silica. Solution and other influences have modified the form of the figures which, by mutual compression, have assumed the appearance of the hexagonal structure of tissues and of imperfect mitosic figures. Silica, which is widespread in Nature, both in organisms and elsewhere, appears to be an antagonistic colloid which plays a part in modelling living and pseudo-living forms and in breaking down the barriers between the different departments of Nature.—**T. Boggio**: Homographs and differentials relating to a curved space. In conjunction with C. Burali-Forti, the author has given in "Espaces courbes et critique de la relativité" proofs of certain well-known properties of curved spaces. It is now shown that simpler proofs are

possible by considering the curved space itself, rather than the Euclidean space representing the curved space.—G. Colonnetti: New contribution to the theory of elastic co-actions and its technical applications.—C. Ferrari: The plane lamina and the Kutta-Joukowski law. The considerations recently advanced by the author are extended to furnish a proof of this law.—A. Signorini: The Kutta-Joukowski theorem.—Elena Freda: The formation of stationary electric currents in a conductor subjected to the action of a uniform magnetic field (2).—N. Siracusano: New contributions to the spectrum of bromine in the discharge without electrodes.—F. Rasetti: Wave mechanics of an alkaline atom in the electric field (1).—G. Malquori: (1) The system $KNO_3 - HNO_3 - H_2O$ between 25° and 60°. The behaviour of this system at 40° and at 60° is similar to that previously observed at 25°, the amount of potassium nitrate passing into solution at first diminishing and then gradually increasing as the acidity is increased. The depression of the solubility of the nitrate produced by small proportions of acid is more marked at the higher temperatures, whereas the augmentation in solubility due to larger amounts of acid shows the opposite behaviour. The influence of nitric acid on the solubility of potassium nitrate cannot be regarded as an indication of the existence in solution of complex compounds diminishing in stability as the temperature rises.—(2) The system $KNO_3 - Al(NO_3)_3 - H_2O$ at 0°, 40°, 60°. In this system the only solids in contact with the solutions are the two salts, KNO_3 and $Al(NO_3)_3, 9H_2O$. The amount of potassium nitrate in the solution saturated with the two salts increases slightly as the temperature is raised.—A. Ferrari and A. Baroni: The importance of the crystalline form in the formation of solid solutions (1). Thermal analysis of the anhydrous system, $LiCl - CoCl_2$. The solidification curve of mixtures of these two salts is continuous and exhibits a maximum corresponding with the compound Li_2CoCl_4. In the supposed solid solutions between chlorides of divalent and univalent metals, the crystallisation interval is found to be zero, and the hypothesis is advanced that this is due to the preservation of the individuality of the unit cells of the components. The melting points of ferrous and cobalt chlorides are respectively 673° and 724°.—B. Castiglioni: Circulation in the southern Adriatic. Investigation of the exchange of water between the southern part of the Adriatic and the Ionian Sea by way of the Straits of Otranto reveals the existence in the straits of two main currents flowing in opposite directions.—G. Brunelli: Cancer and impurity of races. The hypothesis here advanced to explain the causation of cancer is based on the supposition that the characters of impure races, not completely fused, give rise, especially at the age when the internal equilibrating defences of the organisation decline, to anomalies in the rhythm of growth and to differentiation of certain cellular elements; at the same time, the regulating power of growth is disturbed by the lack of chemical equilibria in the internal liquids, the antagonisms of the hereditary patrimony are exerted more violently, and an ascending curve of anomalous growth is interpolated in the regular descending growth curve at the expense of some of the cellular elements.—G. Brunelli and Lina Rizzo: Hermaphroditism in *Perca fluviatilis* L.—V. Rivera: Action of strong doses of γ-rays on *Bacillus tumefaciens* Smith and Townsend. Even extremely intense doses of γ-rays are unable to kill this pathogenic organism. So long as the exposure lasts, multiplication of the organism is prevented, and development subsequent to the irradiation is greatly retarded, but all the colonies retain their pathogenic properties.

Official Publications Received.

BRITISH.

Report for 1927 on the Lancashire Sea-Fisheries Laboratory at the University of Liverpool and the Sea-Fish Hatchery at Piel. Edited by Prof. James Johnstone. (No. 36.) Pp. 68. (Liverpool.)

Imperial Department of Agriculture for the West Indies. Report on the Agricultural Department, St. Lucia, 1927. Pp. iv+31. (Trinidad, B.W.I.) 6*d*.

Transactions of the Royal Society of Edinburgh. Vol. 16, Part 1, No. 4: *Calamoichthys calabaricus* J. A. Smith. Part 1: The Alimentary and Respiratory Systems—concluded. By G. Leslie Purser. Pp. 89-101+plates 2-4. (Edinburgh: Robert Grant and Son; London: Williams and Norgate, Ltd.) 2*s*. 6*d*.

Annual Report for the Year 1927 of the South African Institute for Medical Research, Johannesburg. Pp. 88. (Johannesburg.)

Air Ministry: Aeronautical Research Committee. Reports and Memoranda. No. 1150: Reports and Memoranda of the Aeronautical Research Committee published between 1st March 1927 and 30th June 1928. Pp. 8. 4*d*. net. No. 1162 (Ae. 326): A Summary of the Experimental and Theoretical Investigations of the Characteristics of an Autogyro. By H. Glauert and C. N. H. Lock. (T. 2597.) Pp. 5. 4*d*. net. (London: H.M. Stationery Office.)

The Salt Schools, Shipley. Prospectus for the Session 1928-1929, The High Schools, Technical School and School of Art, Shipley Evening Institutes. Pp. 154+12 plates. (Shipley.)

The Clothworkers' Departments of Textile Industries and Colour Chemistry and Dyeing in the University of Leeds. Souvenir Booklet, 1928. Pp. 27. (Leeds.)

Proceedings of the Royal Society of Edinburgh, Session 1927-1928. Vol. 48, Part 2, No. 12: An Analysis of Preferential Voting. By D. M. Y. Sommerville. Pp. 140-160. 2*s*. Vol. 48, Part 2, No. 13: Studies in Clocks and Time-Keeping. No. 4: The Present-day Performance of Clocks. By Prof. R. A. Sampson. Pp. 161-166. 6*d*. Vol. 48, Part 2, No. 14: The X-ray Examination of Coal Sections. (Preliminary Note.) By C. Norman Kemp. Pp. 167-179+8 plates. 3*s*. (Edinburgh: Robert Grant and Son; London: Williams and Norgate, Ltd.)

Canada. Department of Mines: Mines Branch. Investigations of Mineral Resources and the Mining Industry, 1926. (No. 687.) Pp. ii+80+7 plates. Investigations of Fuels and Fuel Testing (Testing and Research Laboratories), 1926. (No. 689.) Pp. vi+132+7 plates. (Ottawa: F. A. Acland.)

Memoirs of the Cotton Research Station, Trinidad. Series B: Physiology. No. 1: Studies on the Transport of Carbohydrates in the Cotton Plant; i. A Study of Diurnal Variations in the Carbohydrates of Leaf, Bark and Wood, and of the Effects of Ringing; ii. The Factors determining the Rate and the Directions of Movements of Sugars. By T. G. Mason and E. J. Maskell. Pp. 132. (London: Empire Cotton Growing Association.) 2*s*. 6*d*.

FOREIGN.

Smithsonian Miscellaneous Collections. Vol. 81, No. 4: Drawing by Jacques Lemoyne de Morgues of Saturioua, a Timucua Chief in Florida, 1564. By David I. Bushnell, Jr. (Publication 2972.) Pp. 9. (Washington, D.C.: Smithsonian Institution.)

International Hydrographic Bureau. Special Publication No. 23: Limits of Oceans and Seas. Pp. 24+1 map. (Monaco.) 35 cents.

Instituts scientifiques de Buitenzorg: "'s Lands Plantentuin." Treubia: Recueil de travaux zoologiques, hydrobiologiques et océanographiques, Vol. 10, Livraison 2-3, Août. Pp. 145-404. (Buitenzorg.) 5·00 f.

Proceedings of the Academy of Natural Sciences of Philadelphia, Vol. 80. A New Meteor Crater. By Daniel Moreau Barringer, Jr. Pp. 307-311. The Species of Campsomeris (Hymenoptera—Scoliidae) of the Plumipes Group inhabiting the United States, the Greater Antilles and the Bahama Islands. By J. Chester Bradley. Pp. 313-337+plate 26. (Philadelphia, Pa.)

Smithsonian Miscellaneous Collections. Vol. 81, No. 1: Mexican Mosses collected by Brother Arsène Brouard, II. By I. Thériot. (Publication 2966.) Pp. 26. Vol. 81, No. 5: The Relations between the Smithsonian Institution and the Wright Brothers. By Charles G. Abbot. (Publication 2977.) Pp. iii+27. (Washington, D.C.: Smithsonian Institution.)

The Memoirs of the Imperial Marine Observatory, Kobe, Japan. Vol. 3, No. 2, December 1927. Pp. 23-80. Vol. 3, No. 3, June 1928. Pp. 81-166. (Kobe.)

The Science Reports of the Tôhoku Imperial University, Sendai, Japan. Fourth Series: Biology. Pp. 481-677+plates 24-27. (Tokyo and Sendai: Maruzen Co., Ltd.)

Journal of the College of Agriculture, Hokkaido Imperial University, Sapporo, Japan. Vol. 19, Part 5: Notes on *Laspeyresia glycinivorella* Matsumura, the Soy Bean Pod Borer. By Satoru Kuwayama. Pp. 261-290+plate 11. (Tokyo: Maruzen Co., Ltd.)

Institut de la Science du Feu. Les extincteurs prétendus chimiques leur inefficacité, les dangers mortels de leur emploi. Par Félicien Michotte. Pp. 77. (Paris.) 3·50 francs.

Department of Commerce: Bureau of Standards. Bureau of Standards Journal of Research. Vol. 1, No. 2, August. Pp. 105-295. 25 cents. Research Paper 6: Some Measurements of the Transmission of Ultra-Violet Radiation through various kinds of Fabrics. By W. W. Coblenz, R. Stair and C. W. Schoffstall. Pp. 105-124. 5 cents. Research Paper 7: Tinting Strengths of Pigments. By H. D. Bruce. Pp. 125-150. 10 cents. Research Paper 8: Wave-Length Measurements in the Arc and Spark Spectra of Hafnium. By William F. Meggers. Pp. 151-187. 15 cents. Research Paper 9: Tests of the Effect of Brackets in Reinforced Concrete Rigid Frames. By Frank E. Richart. Pp. 189-253. 25 cents. (Washington, D.C.: Government Printing Office.)

Technical Books of 1927: a Selection Compiled by Donald Hendry. Pp. 28. (Brooklyn, N.Y.: Pratt Institute Free Library.)

U.S. Department of Agriculture. Farmers' Bulletin No. 1570: Mosquito Remedies and Preventives. By L. O. Howard and F. C. Bishopp. Pp. ii+13. (Washington, D.C.: Government Printing Office.) 5 cents.

Diary of Societies.

FRIDAY, OCTOBER 19.

MEDICAL OFFICERS OF SCHOOLS ASSOCIATION (at 11 Chandos Street, W.1), at 5.—Surg. Comdr. S. F. Dudley: Microbic Dissemination in Schools.

ROYAL COLLEGE OF SURGEONS OF ENGLAND, at 5.—Sir Arthur Keith: Demonstration of Problems in Human Anatomy which arise out of the Identification of a Skull attributed to Lord Darnley—Illustrated by Specimens.

SOCIETY OF CHEMICAL INDUSTRY (Liverpool Section) (in Muspratt Lecture Theatre, Liverpool University), at 6.—B. D. W. Luff: The Rubber Industry.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—R. W. Allen: Presidential Address.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS (Newcastle-upon-Tyne) (Annual General Meeting), at 6.—M. S. Gibb: Presidential Address.

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

SOCIETY OF CHEMICAL INDUSTRY (Glasgow Section) (jointly with the local Section of the Society of Dyers and Colourists) (at White's Restaurant, Glasgow), at 7.15.—Dr. H. H. Hodgson: Some Random Thoughts on Chemical Themes.

SOCIETY OF CHEMICAL INDUSTRY (South Wales Section) (jointly with the Institute of Chemistry) (at University College, Swansea), at 7.30.—L. King: In a Persian Oilfield (Illustrated by Cinematograph).

JUNIOR INSTITUTION OF ENGINEERS, at 7.30.—R. H. Sharp: Technical Advertising.

ROYAL SOCIETY OF MEDICINE (Electro-Therapeutics Section), at 8.30.—Dr. J. E. A. Lynham: Some Clinical Observations on Radiation Therapy (Presidential Address).

SOCIETY OF DYERS AND COLOURISTS (Manchester Section) (at Manchester).—G. E. Holden: The Fixation of Pigments on Texile Fabrics.

SATURDAY, OCTOBER 20.

NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS (Newcastle-upon-Tyne), at 2.30.—L. H. Forster: Notes on the Conversion of Main Pumping from Steam to Electricity, with Special Reference to the Plant installed at Messrs. The Stella Coal Company's Clara Vale Pit.—A. T. Adam: Tru-Lay Wire Ropes and Tru-Loc Fittings.—*Papers open for discussion*:—The Sinking of Londonderry Colliery, Seaham Harbour, Co. Durham, by the Freezing Process, J. L. Henrard and J. T. Whetton; Extracts and Recommendations from the Report of the Water Dangers Committee, T. G. Davies; The Physical Constitution of Coal and Coal-Seams, Dr. J. G. Kellett; The Distribution of Ash in Bituminous Coal-Seams, Dr. J. G. Kellett.

HULL ASSOCIATION OF ENGINEERS (at Technical College, Hull), at 7.15.—W. M. W. Brungate: The Ruston Airless Injection Heavy-Oil Engine.

MONDAY, OCTOBER 22.

ROYAL COLLEGE OF SURGEONS OF ENGLAND, at 5.—T. W. P. Lawrence: Demonstrations of Surgical Specimens.

NORTH STAFFORDSHIRE INSTITUTE OF MINING ENGINEERS (at North Staffordshire Technical College, Stoke-on-Trent), at 6.—J. R. L. Allott: Methods of Working Highly Inclined Seams Outlined, as a Basis for a Discussion on their Limitations and Possibilities.

INSTITUTION OF MECHANICAL ENGINEERS (Graduates' Section, London), at 6.30.—H. R. Steward: Compressed Air for Mining and Industrial Purposes.

ILLUMINATING ENGINEERING SOCIETY (Birmingham Centre) (at Chamber of Commerce, Birmingham), at 7.—J. L. H. Cooper: An Investigation of Electric Lighting in the Engineering Industry.

INSTITUTION OF AUTOMOBILE ENGINEERS (Glasgow Centre) (at Royal Technical College, Glasgow), at 7.30.—L. H. Hounsfield: The Integrity of the Technical Man.

INSTITUTE OF CHEMISTRY (Edinburgh and East of Scotland Section) (jointly with Society of Chemical Industry—Edinburgh and East of Scotland Section) (at 36 York Place, Edinburgh), at 7.30.—Major R. Bruce: Some Problems in Colloid Chemistry.

ROYAL SOCIETY OF MEDICINE (Odontology Section), at 8.—G. Northcroft: The Desirability of the Establishment of a Rationalised Standard for the Prevention of Dental Disease in Children (Presidential Address).

INSTITUTION OF CHEMICAL ENGINEERS (jointly with Chemical Engineering Group and London Section of Society of Chemical Industry).—Discussion on the Recent Visit to Canada.

ROYAL AERONAUTICAL SOCIETY (Yeovil Branch).—Brig.-Gen. P. R. C. Groves: Britain's Position in World Aviation.

TUESDAY, OCTOBER 23.

ROYAL SOCIETY OF MEDICINE (Medicine Section), at 5.—Dr. C. P. Symonds, Dr. W. R. Reynell, Dr. T. A. Ross, Dr. R. S. Allison, Dr. R. Hutchison: Discussion on Hypochondria.

ZOOLOGICAL SOCIETY OF LONDON, at 5.30.—The Secretary: Report on the Additions to the Society's Menagerie during the Months of May, June, July, August, and September 1928.—Miss Joan B. Procter: (*a*) Exhibition of Cinematograph Film of the Komodo Dragons at present living in the Society's Gardens; (*b*) On the Remarkable Gecko *Palmatogecko rangei* Andersson.—R. I. Pocock: (*a*) The External Characters of the Giant Panda (*Ailuropoda melanoleuca*); (*b*) Some External Characters of the Sea-Otter (*Enhydris lutris*); (*c*) The Structure of the Auditory Bulla in the Procyonidæ and the Ursidæ, with a Note on the Bulla of *Hyæna*.—Major S. S. Flower: Hints on the Transport of Animals.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN, at 7.—F. F. Renwick: Presidential Address.

WEDNESDAY, OCTOBER 24.

INSTITUTION OF MINING ENGINEERS (Annual General Meeting) (at Geological Society), at 11 A.M.—Dr. D. Penman: Atmospheric Conditions in Indian Coal-mines (Fifteenth Report of the Institution Committee on The Control of Atmospheric Conditions in Hot and Deep Mines).—C. C. Reid and A. V. Reis: The Light given by Various Types of Miners' Lamps.—J. R. Homer: The Sizing of Coal for Briquetting.—Further discussion, if time permits, on Extracts and Recommendations from the Report of the Water Dangers Committee, T. G. Davies; Mine-rescue Work in the United States, G. S. Rice.

INSTITUTION OF AUTOMOBILE ENGINEERS (Manchester Centre) (at Engineers' Club, Manchester), at 7.—L. H. Hounsfield: The Integrity of the Technical Man.

INSTITUTION OF PRODUCTION ENGINEERS (at 83 Pall Mall), at 7.30.—B. C. Jenkins: Time Study and Shop Demonstration Methods.

BRITISH PSYCHOLOGICAL SOCIETY (Medical Section) (at Medical Society of London, 11 Chandos Street, W.1), at 8.30.—Dr. R. D. Gillespie: Personality and Psychoneurosis.

THURSDAY, OCTOBER 25.

INSTITUTION OF MINING ENGINEERS (Annual General Meeting) (at Geological Society), at 10 A.M.

IRON AND STEEL INSTITUTE (at Engineers' Club, Birmingham), at 4.—J. G. Pearce: The Use and Interpretation of the Transverse Test for Cast Iron.—L. B. Pfeil: The Change in Tensile Strength due to Ageing of Cold-drawn Iron and Steel.—S. H. Rees: Some Properties of Cold-drawn and of Heat-treated Steel Wire.

CHILD-STUDY SOCIETY (at Royal Sanitary Institute), at 6.—Dr. C. J. Thomas: Child Study and the Health of the Child.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—Lt.-Col. K. Edgcumbe: Inaugural Presidential Address.

INSTITUTION OF CIVIL ENGINEERS (Yorkshire Association) (at Hotel Metropole, Leeds), at 7.30.—Prof. W. T. David: Address.

ROYAL SOCIETY OF MEDICINE (Urology Section), at 8.30.—J. S. Joly: The Cystoscope.

COKE OVEN MANAGERS' ASSOCIATION (at Hotel Great Central).—Annual General Meeting.

FRIDAY, OCTOBER 26.

ROYAL SOCIETY OF MEDICINE (Disease in Children Section), at 5.—Prof. Taillens: Dyspepsia in Children.

ROYAL COLLEGE OF SURGEONS OF ENGLAND, at 5.—Sir Arthur Keith: The Development of the Human Foot and its Bearing on Club-foot—illustrated by specimens.

INSTITUTION OF MECHANICAL ENGINEERS (Informal Meeting), at 7.—R. C. Macdonald: Mechanical Plant in Gas Works.

INSTITUTION OF ELECTRICAL ENGINEERS (North-Eastern Students' Section) (at Armstrong College, Newcastle-on-Tyne), at 7.15.—L. B. Harmer: Post Office Telephones and the Public.

JUNIOR INSTITUTION OF ENGINEERS, at 7.30.—G. W. Tookey: Legal Protection for Originality and Invention.

ROYAL SOCIETY OF MEDICINE (Epidemiology Section), at 8.—Dr. F. E. Fremantle: The Authority of Parliament in Relation to Epidemic Disease (Presidential Address).

INSTITUTION OF CHEMICAL ENGINEERS (at Institution of Civil Engineers).—Prof. A. L. Mellanby: Fluid Jets and their Practical Applications.

SATURDAY, OCTOBER 27.

SOUTH-EASTERN UNION OF SCIENTIFIC SOCIETIES (Autumn Meeting).—Visits to Croydon Aerodrome and Air-Port, and to Whitgift's Hospital, Croydon.

PUBLIC LECTURES.

SATURDAY, OCTOBER 20.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—Miss M. A. Murray: Sculpture in Ancient Egypt.

MONDAY, OCTOBER 22.

BEDFORD COLLEGE FOR WOMEN, at 5.15.—Miss Caton-Thompson: Excavations in the Fayum Oasis.

TUESDAY, OCTOBER 23.

ROYAL INSTITUTE OF PUBLIC HEALTH, at 4.—Dr. A. T. Henderson: Studies in Asthma and Related Diseases. (I.) Etiological Factors: Anaphylactic and Allergic Phenomena (Harben Lectures).

WEDNESDAY, OCTOBER 24.

ROYAL INSTITUTE OF PUBLIC HEALTH, at 4.—Dr. W. J. O'Donovan: Occupational Cancer of the Skin.

KING'S COLLEGE, at 5.30.—Prof. A. J. Allmand: The Rôle of Chemistry in the Life of the Nation.

THURSDAY, OCTOBER 25.

ROYAL INSTITUTE OF BRITISH ARCHITECTS, at 5.—T. Grut: Public Health Buildings and Recent Improvement in Town Development in Sweden (Chadwick Lecture).

BEDFORD COLLEGE FOR WOMEN, at 5.15.—Miss M. J. Tooley: The Sanctification of Travel (Earlier Middle Ages).

LEEDS UNIVERSITY, at 5.15.—P. L. Witherby: The Method of Producing the *Times*.

NORTHAMPTON POLYTECHNIC INSTITUTE, at 8.—Dr. L. Northcott: Engineering Steels and their Treatment. (Succeeding Lecture on Nov. 1.)

FRIDAY, OCTOBER 26.

ROYAL INSTITUTE OF PUBLIC HEALTH, at 4.—Dr. A. T. Henderson: Studies in Asthma and Related Diseases. (II.) Clinical Studies of the Asthmas: (*a*) Simple or Uncomplicated; (*b*) Infective and Reflex; (*c*) Asthmatic Bronchitis (Harben Lectures).

SATURDAY, OCTOBER 27.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—Miss M. Edith Durham: A Montenegrin Ballad of Old Tribal Life.

CONGRESS.

OCTOBER 19.

HOUSING AND HEALTH (at Town Hall, Windsor), at 8.—Dr. W. Butler: The New House.—Miss Joan Sunderland: The Old House.