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Scientific Achievement and Aptitude.

SCIENTIFIC literature in the United States has of late contained many references to that country's paucity of leading investigators in pure science, as distinct from its applications; and as we have already mentioned (NATURE, May 22, 1926, p. 731), the National Academy of Sciences has appointed a special board of trustees to administer a national fund to be raised for supporting research work in that domain. In the June issue of *Nation's Business*, published by the U.S. Bureau of Commerce, Dr. E. E. Slosson discusses this subject in the latter part of an article entitled "Pure Science Pays its Way." Examining the nationality of the Nobel prize-winners in physics, chemistry, physiology or medicine, he finds that out of a total of 72 prize-winners since 1900, Germany can claim 21, British Isles 11, France 10, Holland 6, the United States and Sweden 4 each, Denmark and Switzerland 3 each, Austria, Canada, Italy and Russia 2 each, Belgium and Spain 1 each. A Nobel prize has not yet been awarded outside of Europe and the North American continent. Further, by dividing the number of prize-winners into the number of millions of population, he obtains for each country a number which, he states, may be called "the national index of scientific research": Denmark, Holland and Switzerland 1, Sweden 1·5, Germany and Austria 3, France and the British Isles 4, Belgium 7, Spain and Italy 20, United States 28, and Russia 66.

As a check on this method of gauging national achievement in scientific research, Dr. Slosson selects the more objective plan of analysing the nationality of the discoverers of new chemical elements. Starting with the year 1894, prior to which the United States was not sufficiently developed to compete, he finds that seventeen elements have been discovered, of which seven were found in Great Britain, four in France, two in Germany, and one in each of the countries Austria, Czechoslovakia, Denmark, and the United States. With reference to sciences other than those for which Nobel prizes are rewarded, Dr. Slosson quotes the opinion of the editor of *Science* to the effect that the United States leads the world in biology, geology and astronomy and stands about even with Great Britain and Germany in mathematics and medicine.

The precise significance of Dr. Slosson's figures is not easy to deduce. The nationality of Nobel prize-winners, although a source of elation or depression, according to one's own nationality or proclivity, does not appear to have more than a remote connexion with general national ability or achievement in research; the winners are, in the main, men of genius, who are notoriously very rare, whose occurrence is exceedingly fitful, and the conditions of whose production are very obscure. In obtaining his national index figures, we

think that the author has unwittingly done his own country an injustice; we should omit the coloured population as well as much of the alien immigrant labour, just as we should omit the *moujik* population of Russia. In our opinion, a better index would be obtained by dividing the number of Nobel laureates in each country into the number of people who have enjoyed—or survived—a secondary school education.

The criterion afforded by success in discovery, whether of new elements or other things, appears to be too narrow; it ignores discovery of new methods and new generalisations, which are usually of much greater moment; and it neglects the factor of luck, which often plays an important part. As Galton observed: "When apples are ripe, a trifling event suffices to decide which of them shall first drop off its stick; so a small accident will often determine the scientific man who shall first make and publish a new discovery." It appears to us that a more accurate index would be obtained by analysing the literature-references in such impartial works as the "Progress Reports" published by the Chemical Society; and we commend this suggestion to Dr. Slosson, in case he wishes to pursue the subject. We are, however, not convinced of the general utility, or even of the desirability, of instituting international comparisons, particularly in regard to science, which should know no frontiers; but we recognise that Dr. Slosson, like all good "100 per cent." Americans, is anxious for his country's welfare, and that in diagnosing the ailment, he is also searching for its cause and cure.

The backwardness of the United States in producing leaders of research in pure science has doubtless a plurality of causes, among which *auri sacra fames* may well find a place, side by side with Dr. Slosson's reason that, in recent years, professors have been deprived of much valuable time to devote to research by the enormous influx of students into the universities. These causes, however, are not confined to the United States.

It may be, as E. Renan predicted, that the United States is expiating its original fault of creating a considerable popular instruction without any serious higher instruction; but it appears to be more profitable to think of the future than of the irretrievable past, and of our own shortcomings as well as those of a sister nation. Leaving genius aside, the really important issue is that every progressive nation must give thought to the conditions that favour the provision of efficient research workers. The number of such men is probably never great, but in the mass is not inconsiderable. They appear to come within the class of one in four thousand, which Galton selected as his second order of eminence (the first being men of genius, who represent about one in a million), and it is comforting to note that he was convinced that their ability is inheritable. The problem is how to produce more. Writing more than half a century ago, Huxley took a pessimistic view of the possibilities: "The great mass of mankind," he said, "have neither the liking, nor the aptitude, for either literary, or scientific, or artistic pursuits; nor, indeed, for excellence of any sort. Their ambition is to go through life with moderate exertion and a fair share of ease, doing common things in a common way."

This opinion is probably shared by most thinkers to-day; nevertheless, we believe that there is more latent interest for knowledge and attainments among the masses than is implied in Huxley's statement. Where Nature fails or stops, nurture may sometimes succeed. The great instrument of education could be used much more effectively than it has been as a winnowing process for sorting out the capables from the incapables; and, if we would be saved from the limbo of drab mediocrity, we must use it not only for developing latent aptitudes, but also for promoting that passion for excellence which is at the basis of all the best work in science, art, letters, and religion.

Judged by these criteria, our schools are sadly deficient; aptitude for learning, native curiosity and the pursuit of inquiries, are too often killed or suppressed by the pedantry of the pedagogue, if they have not already been throttled in the home; and the same educational diet is administered to all, irrespective of ability or inclination. As a result of this treatment, we find that very few adults have either the desire or the capacity for acquiring new knowledge; comparatively few have learned to take a pleasure in their work; and, what is far worse, few have acquired the habit of thought: of viewing things impartially, of comparing, evaluating, and of drawing correct inferences from trustworthy data.

The habit of sober, reflective, critical thought is one of the greatest needs of the time, and the lack of it is reflected almost daily in social and industrial misunderstandings. Whatever good compulsory education has done to the artisan classes, it has not been successful in making them think; and the same may be said of the majority in other classes: most men are as vulnerable as ever to the oratory of speakers of the persuasive, political type, and the authority of the printed word is still an almost universal article of belief.

The habit of independent thought and critical inquiry, the habit of work, and the desire to excel, appear to be the fundamental requirements of any country that aspires to remain in the vanguard. Given these, we have no doubt that a nation will find within its ranks all the ability that it may need for ensuring progress, including that important part of it which depends upon research work in science and its applications.

Judging Intelligence.

How we Judge Intelligence: an Investigation into the Value of an Interview as a Means of estimating General Intelligence. By Egbert H. Magson. (Thesis approved for the Degree of Doctor of Science in the University of London.) (*The British Journal of Psychology*, Monograph Supplements, 9.) Pp. ix+115. (Cambridge: At the University Press, 1926.) 8*s*. 6*d*. net.

EVALUATION of the character of his fellows plays an important part in the life of man. In harmony with this, the Consultative Committee of the Board of Education in its report on "Psychological Tests of Educable Capacity" expresses the opinion that "a careful and detailed study of the legitimate aims and inevitable limitations of viva-voce examinations" presents a promising line of advance in the attempt to discover reliable means of assessing ability. Dr. Magson's work, "published as a first contribution towards this complete and detailed study," is an excellent example of the painstaking industry with which psychologists, by the statistical treatment of adequate data obtained under carefully controlled experimental conditions, are unravelling the complexities of mental activity.

Following the method used by Webb in his work on character, several 'judges' were asked to distribute a number of individuals in seven grades of general ability so that the distribution in the grades was approximately 'normal.' The variability in such estimates emphasises the need of objective scales of reference; and in the search for such scales psychology has scored a first success in intelligence tests. These tests measure an inborn general mental ability concerned with analysing and co-ordinating the data of experience rather than with the reception or retention of the data. This general ability the judges were asked to estimate on the basis of five-minute interviews, and their ability to do so was judged by the correlation shown between their estimates and the results obtained from intelligence tests given to the 'subjects.'

Very few of the judges had any misgiving as to ability to perform the task, and most had a high degree of confidence in the trustworthiness of their own judgments. The judgments, however, revealed considerable differences of opinion. In one group of 25 subjects, 21 were placed in 3 or more grades, while the marks of one subject were scattered throughout the seven grades from +3 to −3. In stressing this disagreement the author appears to have overlooked the fact that, in 18 cases out of the 25, at least 3 of the 6 judges gave the same mark. In all probability, with an increased number of judges, the existence of a definite modal grade would have been clearly demonstrated.

The untrustworthiness of single judgments is a commonplace in psychology. A general tendency for a number of judgments to group about some mid value replaces the almost exact agreement in determinations of physical constants. That general tendency in this case is expressed by the fairly high mean consistency coefficient, $0{\cdot}52 \pm 0{\cdot}04$ for 87 pairs of sets of estimates. The judges have estimated some quality in their subjects with a fair degree of accuracy. This quality, however, is not the general ability measured by intelligence tests, for the average correlation of interview judgments and intelligence test scores has the insignificant value $0{\cdot}12 \pm 0{\cdot}13$. As estimates of the general ability that is measured by intelligence tests, the interview judgments are valueless.

What, then, is it that the judges have estimated? Introspective reports showed that, while the answers given by the subject were considered to be the chief determinant, his appearance, expression, and manner influenced the judgment considerably. Putting these results of introspection to the test of experiment, verbatim reports of the interviews were assessed, first by other judges and then, a year later, by the original interview judges. It was found very difficult to divide the subjects, on the basis of answers alone, into more than three groups, and the correlation between the judgments so secured and the original interview judgments was only $0{\cdot}37 \pm 0{\cdot}05$. On the other hand, when the subjects were graded for general appearance and manner, by judges who knew them well, this order was found to correlate so high as $0{\cdot}78 \pm 0{\cdot}04$ with the interview judgments. To a far greater extent than was recognised by the judges, their estimates are founded on hasty generalisation from first impressions of appearance, expression, and manner.

For comparison with the 'interview' judgments, 'mature' judgments of judges who had known the subjects intimately for at least a year were obtained. These judgments have a consistency of 0·83 and correlate with the intelligence test records $0{\cdot}54 \pm 0{\cdot}04$ and with the interview estimates $0{\cdot}22 \pm 0{\cdot}05$. Hence, while the bases of mature judgments differ very considerably from those of interview judgments, the mature judgment is a much better estimate of the general ability measured by intelligence tests.

Search for the reason why the agreement is not closer revealed the fact that, accepting the test score as reasonably correct, the badly underrated and overrated cases were almost always explained by strong personal likes and dislikes entertained by the judges for the particular subjects. This bias acts to a large extent unconsciously, and introduces a very serious

source of error into our judgments of those we know well.

Inquiry as to the possible influence of Maxwell Garnett's factor, 'cleverness,' involved the separate estimation of sense of humour, tendency to cheerfulness, quickness of apprehension and profoundness of apprehension. The estimates of 'profoundness' were found to correlate with the mature judgments so high as $0{\cdot}89 \pm 0{\cdot}01$. 'Profoundness' therefore plays a large part in the mature judgment, although its relation to interview judgment and intelligence test score yields coefficients too small to be considered significant.

The record of his own work, coupled with the excellent short summaries and bibliography of relevant work by other psychologists, is a valuable contribution to our knowledge of what the author, taking his cue from the Consultative Committee of the Board of Education, has described as "the inevitable limitations and defects of interviews as ordinarily conducted." To be of real value, an interview should be carried out by skilled interviewers, fully alive to the sources of error and working under rigidly controlled conditions; while the final decision should result from mean values obtained by pooling the entirely independent judgments of a number of such judges. The confident decision reached by the common practice of discussion over the table is far more likely to be wrong than right.

R. J. BARTLETT.

Melanesian Mythology.

Mythen und Erzählungen eines Melanesierstammes aus Paparatava, Neupommern, Südsee: Gesammelt und versehen mit Einleitungen und Erklärungen. Von P. August Kleintitschen. (*Anthropos* Ethnologische Bibliothek: Internationale Sammlung Ethnologischer Monographien, Band 2, Heft 4.) Pp. 509. (Mödling bei Wien: Verlag der Administration des *Anthropos*, St. Gabriel, 1924.) 15 gold marks.

THE very scant record of Melanesian mythology has been considerably augmented by the publication of myths and stories collected by the Rev. A. Kleintitschen of the Sacred Heart Mission from the natives of Paparatava, inland from Herbertshöhe in the Gazelle Peninsula of New Britain. With the similar collection made by Father Meier from the coastal people, the stories illustrate the beliefs of an important section of the Melanesian people.

There are one hundred and eighty tales, some of which, however, are variant relations of the same events. The native text is given, so that the work illustrates both language and folklore. Six of the seven groups into which the tales are divided are prefaced by summary accounts of the subjects to which they relate.

The first section describes the activities of the two legendary brothers To Kabinana and To Purgo in establishing the habitat, religion, and sociology of the Paparatava people. To Kabinana and To Purgo lived in a world already formed by a being vaguely named the *kaia* or spirit, who is called '*I*' (*i.e.* 'he,' the pronoun) on the coast. They had a mother, and were instructed in many things by the *kaia*. The exploits of these heroes recall those of Qat, Tagaro, Marawa, and other beings of southern Melanesia. They separated day and night. To Kabinana made level ground, but To Purgo furrowed it with valleys. Human figures were made, and sex bestowed by the insertion of a flying-fox and a young coconut. Another account says that To Purgo found a woman in a coconut. The sea was made, and triton shells, coral and clams placed in it. A black ant bit through the surrounding earth and the sea escaped and flowed round the land. The origin of death is ascribed to the neglect of To Kabinana and To Purgo to provide a fire of living wood for their mother after she had changed her skin. In another account, To Purgo becomes a kangaroo and tramples out the fire.

The next three series of tales relate to the ghosts. Death in the native view is not the separation of soul and body, for they may be parted before death, and the empty body from force of habit go on feeding and speaking; but the speech is foolish chatter, and there is no understanding. When activity ceases, death occurs, and a new life is begun as a ghost. The soul or shadow can be seen and not handled, and is sometimes endowed with a repulsive body. In one story a *tabaran* ate a soul, and a man broke up a *tabaran* all bones and roasted him. There are no rewards or punishments in the other world, but the shell money a man has distributed follows him and may possibly improve his sad condition.

The *tabaran* form the lowest order of ghosts. They lead a miserable life, and when they meet the living constantly complain. They are generally invisible, especially when engaged in evil-doing, but are sometimes seen as blow-flies and crows. They are intensely malevolent and plague mankind with ill-luck, sickness, and death.

The *tutanavurakit* form the second ghostly order. They dwell in a land where there is no pain or sorrow, but new joys and delight. They are beneficent towards men, and in all ways the opposite of the *tabaran*. The name *tutanavurakit* means 'everliving men,' that is, real men as distinguished from the *tabaran* who have nothing in common with mankind. In contrast to the *tabaran*, who share dark holes with the rats and bats, the *tutunavurakit* dwell in sunny places, where the ground is covered with moss, and shady trees and coco palms are plentiful.

The *kaia* are described as the greatest and most powerful ghosts. The name is connected with the verb *kaian* = to wonder at, and in spite of their many good qualities and benevolent acts, they are fearsome demoniac beings who inspire the natives with anxiety and terror. They have human bodies, but may take other shapes and especially favour the form of a *valvalir*, a snake about three metres long. Sometimes they are seen as giant stones, of which there are many (due to the now extinct volcano Varzin) in the Paparatava district. The stories about the *kaia* are of the same character as those told of the *tabaran* and the *tutana-vurakit*. The animal stories are few, and only the kangaroo, dog, parrot, and snakes appear in them.

Father Kleintitschen has provided a rich and valuable store of material for the comparison of Melanesian folklore. Though he finds in New Britain the remains of a lunar mythology which he connects on one side with Sumatra, and on the other with the Banks' Islands and New Hebrides, there is no indication of the genealogical evolution of the higher Polynesian mythology. We have here in New Britain, as in other parts of Melanesia, the simple wonder-tales of a primitive folk. SIDNEY H. RAY.

Photographic Photometry.

Photographic Photometry: a Study of Methods of Measuring Radiation by Photographic Means. By Dr. G. M. B. Dobson, I. O. Griffith, and Dr. D. N. Harrison. Pp. 121. (Oxford: Clarendon Press; London: Oxford University Press, 1926.) 7*s.* 6*d.* net.

PHOTOGRAPHIC methods of measuring the intensity of light have increased very much in importance in recent years: in some cases they are the only ones which can be used, and in others they are the most convenient. Investigators wishing to use the methods, among them being the authors of this book, have hitherto had to resort to the original literature on the subject in order to find out what has been done, no general summary being available.

Profiting by their experience, which has been gained at the expense of much time and research, the authors have written this review of the whole subject, discussing the principal methods employed, the sources of errors, how these errors can be minimised, and, generally, the best method of working. In making such measurements, everything depends on a proper knowledge of the properties of the photographic plate, its treatment during development, the measurement of densities, etc. Of this the authors have been fully cognisant; indeed, they embody the results of some of their own researches in the text. The outcome of the authors' experience is a book which should be of the greatest possible use to workers in the same field, indicating as it does the correct method of using the photographic plate in the measurement of radiation intensities. In the last chapter, examples of such measurements are given, together with a consideration of the accuracy obtainable.

There is very little to criticise, the treatment being generally clear and straightforward. Occasionally, however, what is clear to the authors may not be obvious at once to the reader. For example, in defining the characteristic curve (p. 21), it is stated correctly that the logarithm of the amount of light is plotted as abscissa, but in the curve given "log intensity" is plotted as abscissa, attention not being directed to the fact that the time factor is taken as constant, as would be the case in the experimental determination of such a curve. On p. 33 an obvious slip is made in stating that a sector wheel can be used to vary the intensity of the incident light. By their treatment of the subject the authors show that they are aware that this is not correct, but it is advisable to point out the slip, since the supposed variation of intensity by the use of sector wheels is a common error.

In the preface, Prof. Lindemann states that "if one atom in a grain [of the photographic emulsion] has absorbed a quantum and been ionised, the whole grain is rendered developable." It is unfortunate that Prof. Lindemann lends his authority to this statement. It is still a matter of dispute as to whether the Einstein law of photochemical equivalence has been proved to hold for the grain of a photographic emulsion; but even if it be assumed to hold, there is no experimental evidence to show that the presence of one atom of silver on a grain renders that grain developable. In all probability a large number of atoms is necessary to give a nucleus big enough to initiate development. T. S. P.

Intermediates.

Intermediates for Dyestuffs. By A. Davidson. Pp. xiii + 256. (London: Ernest Benn, Ltd., 1926.) 36*s.* net.

THERE can be no question that the whole problem of a national dyestuffs industry depends on the production of 'intermediates.' The allied industries of fine chemicals, explosives, artificial perfumes, and medicinal products also rely on the same source for the life-blood of their existence; in fact, many of the materials they produce are the 'intermediates' themselves. It is essential, therefore, that any nation which realises the necessity for a self-contained and efficient industry in this most vital department must see to it that not only the sources of its intermediates is secure, but also that the scientific knowledge by which the crude materials can be transposed into those capable of being used in the various industries is ready to hand.

So far as Great Britain is concerned, the raw material, coal-tar, from which the intermediates are produced is abundant, so that in respect of the source there is no need to anticipate trouble. Nevertheless, it is well known that prior to the War we relied mainly on Germany for the chemical knowledge and skill necessary to convert our raw material into finished intermediates. The eight years that have elapsed since the Armistice have seen a wonderful change, and at the present time only a very small percentage of the intermediates required for British dyestuffs industries and fine chemical industry is obtained from abroad. All honour, then, to those who have effected this wonderful transformation. We must not, however, rest content with this achievement. The chemistry of the intermediates is continually changing. New and improved processes for preparing old and familiar substances are always being discovered, and even the difference of a few pence in the cost of production may mean the loss or gain of a market. Moreover, the discovery of new intermediates often means the production of some new dye having, it may be, only a slight advantage over the old one but still enough to cause its replacement, owing to the appeal of the new dyed material to the fashion of the moment. There is also the possibility of the formation of new intermediates and their commercial utilisation. All these problems have to be met, and they can only be met, by keeping British research chemists, and those who intend to become research chemists, abreast of the times by imparting to them a thorough knowledge of this special branch of organic chemistry so that they may know not only what has been done already, but may also be in a position to advance knowledge on their own part.

It is therefore a pleasing picture to see a text-book of some 250 pages devoted entirely to a treatment of the chemistry of the intermediates. Mr. Davidson is to be congratulated on having produced a readable book on what must necessarily be a dull subject. In it an adequately full treatment is afforded to all the chief intermediates from the parent substances upwards. Especially noteworthy is the frequent use of tables to illustrate the manner in which the various derivatives are obtained from the parent substances, a treatment which the reader will find of the greatest assistance.

There can be no question that the book will be welcomed by all those who deal with the intermediates, and will also be of assistance to teachers who lecture in this branch of higher organic chemistry. As in all Messrs. Benn's chemical productions, the formulæ are clearly printed and the type free from errors. The absence of a bibliography is a detriment which might be removed in a future edition. J. F. THORPE.

Our Bookshelf.

Prof. Dr. phil. Dr. jur. h.c. Ludwig Darmstaedter. Ehrenmitglied des Staatsinstituts für experimentelle Therapie und des Georg Speyer Hauses in Frankfurt am Main zu seinem 80 Geburtstage am 9 August 1926. (Berlin: Albert Frisch, 1926.)

UNDER the title "Naturforscher und Erfinder. Biographische Miniaturen" Prof. Darmstaedter published recently a collection of fifty most fascinating, short biographical notices of pioneer workers in various branches of science. I received it privately from the author, as a token of friendship on the approach of his eightieth birthday. We were fellow students under Kolbe at Leipzig in 1868. He is the one German student friend with whom I have remained in communication. I always connect him with Butlerow, as I vividly remember his bringing the celebrated Russian chemist to visit us in the laboratory.

The volume now before me is a collection of short biographical sketches of his activities, presented to Prof. Darmstaedter on his eightieth birthday, by his friends and admirers, more particularly by the managers of the George Speyer Haus in Frankfurt, who have instituted a Ludwig Darmstaedter Prize, to be given triennially, together with a Paul Ehrlich medallion, for distinguished work in biology or chemical therapeutics. They have done this in recognition of the part he has played, together with his deceased sister-in-law, Frau Franziska Speyer, in the extablishment and management of the George Speyer Haus, in which Ehrlich's work was carried on from June 1902 onwards.

Trained as a chemist, Darmstaedter began his career as a member of the firm of Benno Jaffé and Darmstaedter, manufacturers of glycerin. In 1884, the firm acquired Oscar Liebreich's lanolin patent. He left this firm in 1906 to devote himself to his collections. He was long a noted collector of old china. He also built up a very valuable collection of autographs and letters of noted men from the Middle Ages upwards. These he presented to the Prussian State Library in 1907. The Dokumenten Sammlung Darmstaedter zur Geschichte der Wissenschaften und der Technik is now a distinct department of this library.

Darmstaedter's activity as an alpinist, as well as the part he has played in forwarding the creation of the first juvenile reformatory on the European continent, are both described, as well as his multiple other activities, in the monograph.

Darmstaedter has always been a man of remarkable vigour and an untiring worker throughout his life. A classical scholar and highly cultured, he is a typical, educated German. When the lanolin patent was in the Courts here, before Mr. Justice Romer, he made a remarkable impression by translating, in the witness-box, passages from the Greek bearing upon the use of wool-fat. The presence of such men in industry has had much to do with German success. He is probably best known to the world as author of his extraordinarily comprehensive "Handbuch zur Geschichte der Naturwissenschaften und der Technik," produced in co-operation with Prof. R. du Bois Reymond and Carl Schaefer. H. E. ARMSTRONG.

Handbuch der biologischen Arbeitsmethoden. Herausgegeben von Prof. Dr. Emil Abderhalden. Lieferung 184. Abt. 9: *Methoden zur Erforschung der Leistungen des tierischen Organismus,* Teil 2, 1 Hälfte, Heft 4. *Methoden der Süsswasserbiologie.* Pp. 653-852+xxiii. (Berlin und Wien: Urban und Schwarzenberg, 1926.) 10·20 gold marks.

THIS publication completes the first half of the volume in this handbook dealing with methods of research for the study of life in fresh water. It opens with a chapter, by August Thienemann, on life in inland waters, giving in broad outline the conditions to be considered in a study of this zone of life and the connexions between the animate and inanimate components of the environment. There follow articles by H. Thomasson on the study of the microphyta of the limnetic littoral and deep zones, and by H. Gams on the higher water-plants. Einar Naumann gives a long account of methods of demonstration for the purpose of teaching limnobiology, with special reference to the plankton and neuston. Finally, T. Freidenfelt contributes a chapter on the mathematics to be employed, especially by those working on plankton, for testing the accuracy of technique and finding the true significance of results obtained by sample methods.

For those taking up the study of fresh-water biology, the work should prove valuable as a guide to the methods that are now employed. At the same time, the papers, although not containing full bibliographies, give sufficient information and references to enable one, at once, to get on the track of the literature dealing with the results of research in any special branch of this huge subject in which interest may lie.

Electrical Technology: a Textbook for the following Examinations, National Certificate, City and Guilds, A.M.I.E.E., B.Sc. Engineering. By H. Cotton. In 8 weekly parts. Part 1. Pp. xv+48. (London: Sir Isaac Pitman and Sons, Ltd., 1926.) 1*s.* net each part.

THE student will find this a very convenient form in which to acquire Mr. Cotton's book on "Electrical Technology." Besides the advantage of paying for the book by eight instalments, there is a decided benefit in not having a bulky volume to carry about.

Part 1, which has just been published, includes the necessary elementary work in the form of a short introduction. This work should, of course, have been done previously, but the student will find the introduction convenient for reference. The whole volume is divided into two parts, the first being devoted to direct current and the second to alternating current. Chaps. 1, 2, 3, and the beginning of Chap. 4, appear in the part just published.

A clear exposition of the magnetic circuit forms the first chapter, and the second chapter gives an account of electromotive force. Then follows the direct current technology. In the direct current part is to be included a chapter on illumination and one on electrolysis and cells. The alternating current part is to include chapters on furnaces and welding, electric oscillations, and measuring instruments. The descriptions are adequate and the diagrams good, so that the student should find it a useful work.

Le problème de chimie: recueil de problèmes inédits avec leurs solutions à l'usage de la Classe de mathématiques spéciales des candidats au S.P.C.N., au M.P.C., au Baccalauréat (M.E.), aux Grandes Écoles et à divers concours. Lois générales, métalloïdes, chimie organique. Par Jean Duval. Pp. 116. (Paris: Albert Blanchard, 1926.) 10 francs.

MANY years ago, the plan of teaching chemistry, or rather, of exercising the mind in chemical matters, by means of problems and answers, was very fashionable. Nowadays it seems to have fallen into disuse, except perhaps in schools, although the method was a good one which enabled the student to fix reactions and principles on his mind without making undue calls on his memory. Of course, much depends on the kind of problem selected and the manner in which it is treated, but if too much chemical arithmetic is avoided, and the problem chosen involves some theoretical principle which appeals to the mind, a great deal of useful knowledge can be imparted, often from an unusual viewpoint. M. Jean Duval has applied the method to a number of cases and has produced a book which should appeal to students generally. Both inorganic and organic problems are chosen, many of them being of surprising ingenuity. The French is so easy to understand and is so clearly expressed that many English students would do well to add this book to their library.

Il Naturalista viaggiatore. Per Gestro e Vinciguerra. (Manuali Hoepli.) Seconda edizione. Pp. xv+204. (Milano: Ulrico Hoepli, 1926.) 14 lire.

THE first edition of this work, published in 1881, was a pioneer amongst collectors' handbooks, and its successor, extended, illustrated, and brought up-to-date, gives concise instructions for the collection and preservation of animals, vertebrate and invertebrate, so that they may be afterwards available for detailed scientific examination. Much study has been given to the fluids which best kill and retain in preservation the characteristics of the tissues and structures of different types of animals, and accordingly a chapter is devoted to each group, from mammals to protozoa, while additional chapters deal with general instructions for marine research, and the collection of plants and of mineralogical specimens. The work resembles in character the "Handbook of Instructions for Collectors," issued by the British Museum, but the paper binding is quite insufficient for a volume which is likely to see much and rough service in many climes.

Chambers's Encyclopædia: a Dictionary of Universal Knowledge. New edition. Edited by Dr. David Patrick and William Geddie. Vol. 8: *Penobscot to Saco.* Pp. iii+871. (London and Edinburgh: W. and R. Chambers, Ltd.; Philadelphia: J. B. Lippincott Co., 1926.) 20*s.* net.

THE newest volume of this encyclopædia again bears evidence of careful revision and the addition of new articles. Events that have occurred within the last few months are mentioned. Many of the longer articles are admirable summaries and should prove invaluable for quick and easy reference. There are eight new coloured maps as well as many text illustrations and diagrams.

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.*]

River Terraces of the Euphrates.

IN NATURE (vol. 111, p. 332, 1923) attention was directed to the remarkable uniformity in height of the successive terraces bordering the rivers which open into the Mediterranean Sea and the Atlantic Ocean. We now learn from Dr. E. Passemard (*C.R.*, t. 183, p. 365, 1926) that this uniformity extends beyond these regions into the valley of the Euphrates, which opens through the Persian Gulf into the Indian Ocean.

Five well-marked terraces are well displayed one above the other on the right bank of the river along the great curve which it makes in passing from Rakka to Deir-el-Zor. Their heights above the river, as measured by M. Darrous, Topographer to the "Mission hydrographique Héraud," are given in metres in column 1 below:

	1.	2.
5th Terrace	77·13	93-95
4th ,,	56·14	55-57
3rd ,,	30·52	28-30
2nd ,,	15·36	15-16
1st ,,	3·60	...

A comparison of these with those of the terraces of the Isser, Algeria, measured by General Lamothe (col. 2), reveals a remarkable correspondence between the 2nd, 3rd, and 4th terraces of the two rivers: but this agreement does not extend to the 5th terrace. The 1st terrace was not observed on the Isser, but it exists at about the same height elsewhere in the Atlantic region.

The interest of these observations is increased by the discovery in the 3rd terrace of an implement which is assigned by Dr. Passemard to the upper Chellean industry.

W. J. SOLLAS.

University Museum,
Oxford.

The Transmission of Cutaneous Leishmaniasis to Man from Artificially Infected *Phlebotomus papatasii*.

THREE examples of the transmission of cutaneous Leishmaniasis to man from naturally infected sandflies, *P. papatasii* ♀♀, have been recorded by us (*Ann. Trop. Med. and Parasitol.*, vol. 20, No. 2). It was also shown that the causative organism in each of the three lesions was biologically and morphologically identical with *Leishmania tropica*. There could therefore remain no doubt as to *P. papatasii* being a transmitter of *Leishmania tropica*.

Nevertheless, inoculation experiments performed in 1925 on seven volunteers, with flagellates from sandflies artificially infected by feeding on oriental sores, all proved negative. In these experiments flagellates were obtained from sandflies 2, 4, 5, 6, and 7 days after the infecting feed. Since *P. papatasii* is a proved carrier of *L. tropica*, it was possible to account for these negative results only on the theory that *L. tropica* undergoes a complete biological cycle of development in the sandfly, and until the cycle is completed all the flagellates (and Leishmania forms) in the sandfly are non-infective.

In order to determine at what stage *L. tropica* in the sandfly becomes infective, a further series of experiments was performed with flagellates from artificially infected, laboratory-bred sandflies 8, 9, 10, 11, 12, 13, 14, 15, and 21 days after the infecting feed. All the sandflies were kept at laboratory temperature, 19°-23° C. The infecting feeds were made on a lesion which was the result of an artificial infection with flagellates from a natural infected sandfly. Up to the present two experiments have given positive results.

(1) *P. papatasii* ♀ hatched in laboratory, Sept. 8, 1926; fed on experimental lesion same date; died on Sept. 16, and dissected soon after death. (No further feed was allowed after the infecting feed.) Numerous flagellates were found in the pharynx, œsophagus, and mid-gut of the sandfly, but none in the hind-gut. Two inoculations were made into the left forearm of a volunteer shortly after the dissection.

Oct. 14, 1926. A papule noted on the site of one of the inoculated points was found to contain numerous Leishman-Donovan bodies.

(2) *P. papatasii* ♀ hatched in laboratory, Sept. 7, 1926; fed on experimental lesion, Sept. 9; died Sept. 17, and dissected shortly after death. (No further feed was allowed after the infecting feed.) Numerous flagellates were found in the whole alimentary tract from pharynx to rectum. Two inoculations were made into the left forearm of a volunteer shortly after the dissection.

Oct. 14, 1926. A papule on the site of one of the inoculated points was found to contain Leishman-Donovan bodies.

Thus a strain of *L. tropica* has been observed between June 26, 1925, and Oct. 14, 1926, through four successive generations of hosts.

(1) A sandfly (naturally infected).
(2) A human being experimentally infected from (1).
(3) Laboratory-bred sandflies infected from (2).
(4) Human beings infected from (3).

The proof that *Phlebotomus papatasii* is a transmitter of cutaneous Leishmaniasis is therefore complete.

S. ADLER.
O. THEODOR.

Microbiological Institute,
Hebrew University,
Jerusalem, October 15.

Science and Psychical Research.

IN reply to Dr. Tillyard's letter in NATURE of October 23, I cannot see that 'catalytic agent' is in any way a better simile for a medium than is the word 'instrument,' for catalysts, equally with instruments, are not possessed of any form of consciousness or of motives. Moreover, how can we be sure, as Dr. Tillyard states, that a medium is not actively a participant in the experiment? Trances can be simulated, and anyway, what is to prevent the subconscious mind being affected by motives, just as may be the case in the fully conscious mind?

The occasional failure of experiments in chemistry classes, as also, let me add, in the case of physics demonstrations, have no analogy to the uncertainty that seems to exist in all psychic affairs. As Dr. Tillyard must well know, no new fact in chemical or physical science is ever finally accepted until the experiments that establish it have been repeated by numerous observers, and further, until observers are satisfied that the experiments can be repeated with certainty at will, and give identical results under the same conditions every time.

Where do we get such exactness in psychical re-

search? Mr. W. H. Massey, the well-known engineer, tells me that he once offered a reward of 1000*l.*, which he advertised in the papers, to any one who could give a single conclusive demonstration of telepathy. In reply he did not get one single offer, and was told by an eminent authority on the subject that it was absurd to expect that telepathy could be done to order, and that it only occurred apparently spontaneously and on rare occasions. What sane scientific man would believe in any physical phenomenon which, once experimentally obtained, could not be reproduced at will and with certainty; and why should we treat psychical phenomena upon any different basis?

Dr. Tillyard objects to my strictures on the word 'national' as applied to a psychical research laboratory, which is so new that it has not yet even got into the London Directory. No doubt there are hundreds of concerns calling themselves 'national.' Some are really national institutions, and others assume this position. Most are merely commercial concerns, in many cases insignificant ones, wishing to advertise their commodities and give themselves a name by which they hope to magnify their small importance. Thus, I find that 'national' is even adopted by a firm of funeral undertakers. It is the same spirit that leads caravanserais that by no means deserve the appellation to call themselves 'Grand' or even 'Majestic.' When we come, however, to a new scientific institution the object of which is, I assume, the serious elucidation of truth, then I cannot think that it was a happy idea to begin this comparatively minor institution's career by calling it by a pretentious name to which it has no real claim, and may easily be confused by the ignorant with another really national laboratory of vast importance.

I have, however, no wish to labour this point, in regard to which Dr. Tillyard has attacked me. It was only a minor issue in my letter in NATURE of September 25, where the principal reason I gave for declining Dr. Tillyard's kind invitation was that, in my opinion, thermographic phenomena in connexion with mediums are more a matter for a physiologist than for a physicist.

Dr. Tillyard, however, broadly accuses me of "an unscientific attitude to the subject of psychical research." This he bases on his belief that I have never been to a spiritualistic—or shall we say psychical—séance, and never intend to go to one. I must defend myself against this charge; but here I must first differentiate between what, on one hand, I would call spiritualistic séances, where professional mediums are employed, and where spirits, either directly visible or through mediumistic agency are vocal or mechanically active, are supposed to be conjured up, and secondly, séances or meetings at which such things as telepathy are experimented with, where no mediums are requisite. Let me say at once that I have taken part in numerous serious meetings of the latter kind, where telepathy without contact was attempted, but have never met with even the slightest evidence of what could be called success. This, I may add, has been always to my exceeding disappointment, as was also the case when I tried most strenuously to repeat Blondlot's *N*-ray experiments. In both cases at first I fully expected to succeed, just as I did succeed when I repeated Röntgen's X-ray experiments when these were first announced, and before they had been confirmed by any one else in England.

As regards the other type of spiritualistic séances, I think I can honestly say that if I have in the past never attended such, this is for the reason that I have never been invited to attend one, as I am sure, in the days when I delighted in Maskeleyne and Cook's Egyptian Hall of Mysteries, and also enjoyed wonderful thought-reading exhibitions by Stuart Cumberland and others, I should have jumped at such an invitation. As regards the present and the future, however, perhaps increasing age and experience have given me a greater sense of responsibility, and my present attitude is that I do not think it right to give any countenance to proceedings where I should fully expect to be misled, and afterwards told that, anyway, I could not explain the phenomena I had been shown, and that therefore there must be something supernormal in them.

My firm conviction is that, as in the past, so at present, there is overwhelming evidence that at all spiritualistic séances where there are ghostly apparitions, spirit voices, and any kind of communication with what is supposed to be another world, the phenomena are invariably due to fraud—not necessarily conscious, perhaps in some cases subconscious, but absolute fraud all the same. I have already been taken to task for the use of this ugly word 'fraud' in this particular connexion, but I get it from no less a master in science than Lord Kelvin, who used frequently to say that all the phenomena of what he called that 'wretched superstition of spiritualism,' when not to be explained by 'defective observation,' were due to 'fraud.' If it is considered an unscientific attitude to refuse to have any dealings with fraud, then I prefer to be thought unscientific, for I agree with the book of Ecclesiasticus that "He that toucheth pitch shall be defiled therewith."

In conclusion, let it not be supposed that I impute anything worse than undue credulity to our very few really eminent scientific spiritualistic believers, past and present, who I am sure were or are quite honest in what they thought or think to be their pursuit of truth. Of these I would only repeat the words of my countryman, David Hume, who, speaking of miracles more than one hundred years ago, asked the simple question as to whether it was more probable that these very extraordinary and unprecedented things did actually happen, or whether the observers or narrators of them were mistaken.

A. A. CAMPBELL SWINTON.

40 Chester Square, S.W.1,
October 27.

ONE wonders who are the onlookers who would be so 'unwise' as to elevate any of the three 'hypotheses' mentioned by Sir Oliver Lodge (NATURE, October 30, p. 622) to the "high status required of a scientific theory." Few would dignify even by the term hypothesis what are simply observations. Granted genuine phenomena, how much further are we scientifically? Granted 'ectoplasm,' can science justify repetitions of the human vivisection necessary to produce it when there is no purpose, except curiosity, in view? Granted an 'intelligence' behind the phenomena, can science say to which order amongst the myriad intelligences of Nature such belongs? Granted a 'spirit' hypothesis, can science describe or define spirit?

If the function of science be to discover the *rationale* of all facts of human experience, it follows that it can serve and protect mankind only in so far as it discharges this function. None of the many eminent men of science in European countries and the U.S.A. who, during the last seventy-five years, have attested the reality of psychic phenomena, have advanced a scientific theory of the cause. If present-day investigators would make themselves acquainted with what has been done by their predecessors (who were equally competent and disinterested), they would

find that there are no grounds for believing that we know any more about the phenomena than men of science did fifty years ago; and truth to say, the 'hypotheses' advanced then were much more philosophically phrased and discussed. I should also like to ask on what authority Sir William Crookes is labelled a 'spiritist.' He, with the majority of men of science who have been interested, dropped the investigations when convinced of the facts, because it was found that the phenomena were mainly repetitions of what had been already widely recorded in a large body of literature in various ages and countries, and that no new scientific facts could be deduced from recurrent sporadic phenomena, unconnected with existing scientific knowledge, and beyond the control of men of science.

More recently another type of 'researcher' has persisted in certain investigations without either the justification of a 'spiritist' belief or the sanction of scientific prevision. What is the motive? What can be the motive when, after fifty years of psychical research, the problem is exactly where it was in the Dark Ages, during which the Church, at least, discouraged human vivisection and also necromancy? These are strong words; but are investigators unaware of the fate of the majority of mediums, many of whom in the beginning are simple, honest, but sensitive human types? Do they not know how frequently degeneracy gradually ensues from the use of the mediumistic faculty? In the lives of mediums are many strange and terrible tales of immorality, sensuality, obsession, insanity, and crime. Those who have studied the history of this subject know, too, how often investigators have completely lost and never recovered their own reason once they have resigned their self-control to follow the dictates of an unknown 'guide.' Zöllner was not the first or the last to suffer this penalty.

It would be dangerous, therefore, to accept blindly Sir Oliver Lodge's counsel to "follow our leaders." He is a great man of science. We accept his authority in matters of physics, as we accept facts of astronomy, etc., from other men of science, and are glad to do so, as we know they have undergone the necessary training and discipline to become specialists in their subjects. They speak with the authority of knowledge and do not ask us to follow other unknown leaders of whose *bona fides* they or we know nothing.

On what authority, however, can any of the modern 'scientific investigators' of psychic phenomena ask us to accept their fancies about a *spiritual* world? Have they attained knowledge by self-discipline, self-sacrifice, and the experience of trials overcome? Have they shown any signs of the power reputed to be possessed by religious teachers and Wise Men, 'mediators,' of old, who could themselves control the energies of the lower 'psychic' world, cast out 'evil spirits' from the insane and obsessed unfortunates, and deliver clear and inspiring teaching from a serene, spiritual level so far above the commonplace 'communications' that issue via mediums as science is (or ought to be) above vanity?

The younger 'psychical researchers' would be better engaged in compiling a history of the lives of mediums and collecting statistics of the periodic epidemics of psychism, which latter should be plotted with waves of crime. An inquiry might be made also as to why the mediumistic practices encouraged amongst us to-day were forbidden by the Hindus and all Eastern religions before their decline. Neither the religion nor the science of our times understands what was evidently part of the knowledge of ancient scientific religion. Hence the danger. W. W. L.

THERE cannot be much doubt that Sir Oliver Lodge (NATURE, October 30, 1926, p. 623) wishes to compare the attitude of an hypothetical race of "secluded, but intelligent aborigines," towards rumours of X-rays, telephones, radio telegraphy, and the existence of a hitherto unsuspected race of white men—with that of present-day opponents of what is called 'spiritualism.' This comparison, in my opinion, is unsound. In the first place, it would be possible for any one of the aborigines mentioned to insist that the believers in X-rays, and other things of a like nature, conduct him to the part of the world where these phenomena were alleged to be produced, in order that he might examine them. Further, upon arrival, he would be met by actual individuals of the race of white men, as to whose existence he had harboured doubt, and these people, of flesh and blood like himself, would proceed to show him the phenomena in actual operation, and, I take it, explain to him, in a perfectly rational and detailed manner, how they were brought about. Such a demonstration, which could be repeated, under ideal conditions for seeing and understanding, as many times as the aborigine wished, would, without question, convince him that the rumours he had heard in his own country were based upon fact, as it would any other reasonable person.

In the case of the disbeliever of the claims of modern spiritualists, no such rational and clear demonstration is vouchsafed. He is unable to converse in a normal manner with the 'intelligences' who, it is asserted, are responsible for the production of the 'occult' phenomena, and no spiritualist is able to give him the slightest real inkling as to how these phenomena are produced. In fact, to use Sir Oliver Lodge's words, he finds himself in the hands of "gropers in a tangled region off the obvious track," and cannot be blamed if his disbelief is merely increased by such an unsatisfactory experience.

Not only is the comparison under discussion unsound: it is also unfortunate. Aborigines, like certain people of the present day, though intelligent in some things, are nevertheless found to be willing believers in even the most preposterous of 'ghosts,' and would thus be most unlikely to doubt the statements (regarding X-rays and other similar phenomena) of those of their companions whose observations they had been in the habit of treating with respect. J. REID MOIR.

Patent Law and Unemployment.

IN a leading article in NATURE of September 18, it is argued that the increase in the percentage of patents kept alive to the end of the fourteenth year since 1905 is due to official examination for novelty introduced in that year. I submit that this reasoning does not hold good. The rise preceded the year 1905, as the following figures will show:

Year.	Sealed.	Paid 14th year's Tax.	Percentage.
1897	14,465	442	3·0
1901	13,995	594	4·2
1902	15,242	596	3·9
1903	15,105	653	4·3
1904	16,124	804	4·9

Prior to the Act of 1883 the percentage was much higher—nearly 10 per cent. for 1876. Probably many factors unite in determining the variation of the percentage. The market value of patents depends upon their industrial value in a given period, and this value will depend upon their property of being used for the promotion or obstruction of home industries. Hitherto

no attempt has been made to analyse the result of the British patent system with the view of determining how far it tends to the introduction of new industries. I agree with the writer that this should be done, and that the system should be subjected to a searching investigation by economists with the view of ascertaining the influence of the Law of Novelty upon industrial progress. E. WYNDHAM HULME.

Old House, East Street,
Littlehampton, October 4.

WITH regard to Mr. Hulme's first point, the accompanying graph, Fig. 1, which shows the number of patents surviving fourteen years from each of a large number of years, indicates that his selection of figures is not representative. The effect of the Acts of 1883 and 1902 is very clearly seen. It is true, however, that the figures for 1903, 1904 show the effect of the Act of 1902 (the figure for 1903 is differently given in different reports), while the slight increase for 1901, 1902 may or may not be a normal fluctuation. The rise in 1903, 1904 may be attributed to two causes: (*a*) The Act of 1902 probably owes its effect not so

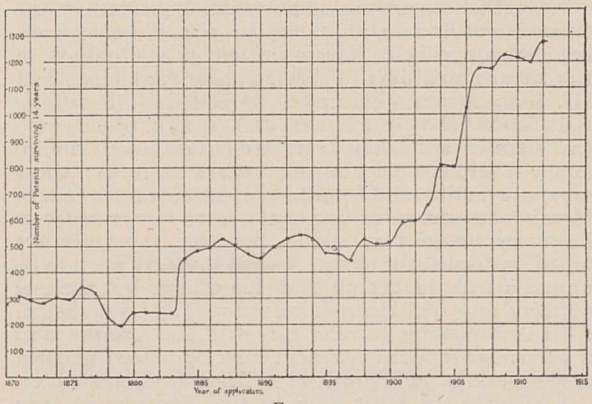

FIG. 1.

much to its direct action as to the enhanced prestige which it conferred on patents generally. It is not unnatural, although it is not strictly logical, that patents which escaped the official examination (first made in 1905) should nevertheless benefit by this general rise in the prestige of patents. (*b*) A number of specifications which would normally have been filed in 1905 or 1906 was rushed into the Patent Office in 1903 and 1904 in order to escape the examination: this is clearly indicated by the number of patents granted to foreigners, which were as follows:

1900	6424	1905	6255
1901	6573	1906	6503
1902	6509	1907	7373
1903	7455	1908	7522
1904	7019	1909	6485

These rushed-in patents would, on the whole, belong to the more serious class, for the academic type of patent is filed promptly, without waiting for experimental development, and cannot, therefore, be "rushed." Inventions coming from abroad are certainly selected inventions.

As regards Mr. Hulme's second point: the *percentage* figure for 1876 is not significant for the present issue, for the absolute figure for that year was only 341, as compared with 1200 or more in recent times. The fact is that the peculiar incidence of application and renewal fees in the early days favoured a high percentage of survival.

THE WRITER OF THE ARTICLE.

Explanation of the Spectra of Metals of the Second Group.

THE explanation of the complicated spectra of elements is now making rapid strides, thanks to the more complete and accurate knowledge of the structure of the atom which we owe to Stoner, and the development of the quantum principles of combination which we owe to Russell, Pauli, Heisenberg, and Hund. The latter authors have so far confined their attention to the explanation of the fundamental terms of the spectra. But the principles can be extended for finding out the higher members as well. The following is a brief sketch:

If we write out the different sub-levels according to Stoner (K_{11}, L_{11}, L_{21}, L_{22}, etc. . . .), and begin with the alkalies, the fundamental orbit is some X_{11}-orbit. But if we allow the electron to run through the successive sub-levels we get $2p_{12}$, $3d_{23}$ . . . $2s$ . . . terms. In the case of alkaline earths we keep one electron in any X_{11}-orbit, and allow the second to run through the successive sub-levels. The resultant orbit is calculated by applying the rules of quantum-addition for r (multiplicity-quantum number), and k (azimuthal-quantum number), but discarding Pauli's rule for the inner quantum number. This is quite justified, because Pauli's rule ought to hold only when the electrons close a sub-level. Thus, taking calcium, if both electrons are taken in the N_{11}-level the sub-group is closed, Pauli's rule holds, we get $^1S_0$ only and not $^3S_1$. But when one electron is in N_{11}-level, the second or vibrating one is in the O_{11}-level, Pauli's rule should not hold, we get the second Rydberg member of 2^1S_0, and 2^3S_1. Combination of the N_{11}-electron with the orbits just following or just preceding gives large prime terms; thus N_{11}, N_{21}, or N_{22} gives us the large $^3P_{012}$, $^1P_1$ terms; N_{11}, M_{21}, or M_{22} give us the large $^3D_{123}$, $^1D_2$, which are observed in calcium as well as in strontium and barium, but not in magnesium, because in magnesium there is no vacant D-level preceding the fundamental M_{11}-level. The theory thus explains the details of the normal spectrum of magnesium, calcium, barium, strontium, zinc, cadmium, mercury in a very simple and convincing way.

The success, however, applies not only to the regular terms, but also to the dashed terms which, according to Russell and Saunders, arise from the metastable ^2D-levels of Ca^+, Sr^+, or Ba^+. Taking calcium, we put the first electron in the M_3-levels, and then add the second electron either to these levels, or to any one of the higher levels in the Stoner-sequence. In this way we get not only $\bar{S}_0$, $\bar{P}$, $\bar{D}$, $\bar{F}$-levels of both singlets and triplets and their higher Rydberg sequences fixed up by Russell, but also the $^3\bar{P}''$, $^3D''$, $^3\bar{F}''$ terms. The latter terms are regular terms, and ought to be designated as b^3P, b^3D, b^3F. Thus Russell and Saunders' contention that these terms arise from the metastable D-level is completely justified. In short, the procedure accounts in a most convincing way for all the details in the spectra of elements of the second group, including the probable values of these terms.

A detailed paper will be published in the *Philosophical Magazine*.

The ideas in this communication are contained implicitly in the writings of Hund and others, but they have not been worked out in detail, nor has it been shown that they are capable of explaining in such details the structure of the spectrum.

MEGHNAD SAHA.

Physical Laboratory,
Allahabad, India,
September 6.

Absorption Bands in Nitrogen.

SOME time ago the critical potentials in nitrogen were determined by the present writer (*Zeit. f. Phys.*, 34, 622, 1925) by measuring the excitation potentials of the 0-0 band of the second positive group and of the negative bands. The results were 13·0 and 19·6 volts respectively. Having the absolute value of 13·0 volts, and using the term scheme of N_2 given by R. T. Birge (*Phys. Rev.*, 23, 294, 1924), the excitation potentials of the first and fourth positive groups of nitrogen could be calculated, and a value of 8 volts was obtained for the resonance potential, as was predicted by R. T. Birge (NATURE, 114, 642, 1924). The band system belonging to the transition between the first excited and the normal state was, however, not known. In order to settle the question about the normal state of the nitrogen molecule, absorption plates have been taken. It is extremely difficult to get the right conditions for this experiment. The final pictures were taken with the vacuum spectrograph of Prof. J. J. Hopfield, which he kindly offered to me for that purpose.

We filled the whole spectrograph with carefully prepared nitrogen to about 20 cm. pressure and used Lyman's capillary method (*Astrophys. J.*, 60, 1, 1924, and NATURE, 118, 156, 1926) for the continuous light source. The plates show a band system with frequency differences which have the same values as those of the final state of the first positive group, proving definitely that the first positive group is going out from the first excited state of the molecule. The 0-0 band of the new system corresponds to an excitation potential of 8 volts, confirming the prediction of R. T. Birge and my critical potential measurements. In the detailed paper which will be given soon, these and other bands appearing on the plate will be discussed.

H. SPONER.

Department of Physics,
University of California, September 13.

The Reaction to Flea Bites: Anaphylaxis and Louse Infestation.

I WAS much interested in Prof. Boycott's letter (NATURE, October 23, p. 591) dealing with anaphylaxis consequent upon the bites of fleas, as I have in mind an interesting case illustrating the same phenomenon after infestation by lice. The case came under my notice in 1918 whilst I was serving as entomologist with the American Red Cross Trench Fever Commission in France under Prof. (then Major) Richard P. Strong, of Harvard University, U.S.A. During the experimentation a number of volunteer subjects were injected intravenously with filtered extract of louse excrement from insects which had fed upon trench fever cases. One such volunteer was inoculated at 3.25 P.M., and, to quote, "Z. showed very marked anaphylactic phenomena at 3.40 P.M., severe œdema of the face, and very marked general urticaria and much discomfort. The symptoms slowly subsided. Z. had previously been used for the feeding of normal lice from May 31 to June 10. During this period over one hundred lice were fed upon him twice daily. His case illustrates a very unusual form of anaphylaxis" ("Trench Fever," Oxford University Press, 1918, p. 278).

Again, from the case report (p. 430, *ibid.*), Z. showed "marked generalised œdema, beginning half an hour afterwards and temperature of 99·8° F., gradually decreasing, and lasting two days, except around previous bites of normal lice, where it lasted five days." It remains to mention that the man had been used as a 'foster nurse' for uninfected lice used in other experiments, and that the injection work and clinical observations were carried on by Prof. Strong and Prof. (then Major) Homer F. Swift.

A. D. PEACOCK.

Zoological Department,
University College, Dundee,
October 26.

The Antiquity of the Labiatæ or Mint Family.

IN Knowlton's recent catalogue of the Mesozoic and Cenozoic plants of North America, there is not a single species of Labiatæ. Schenk, in Zittel, refers only to interglacial *Lycopus europæus* and *Stachys palustris*. More recently Reid has recorded preglacial Labiatæ, such as Lycopus, Stachys (two species), and Mentha from England. The fruits and calyces are distinctive, and should be easily recognisable; but owing to the specialised character of the family, and the prevalent opinion concerning the late evolution of herbaceous plants, it has seemed unreasonable to expect very ancient fossils of this type.

Nevertheless, among some fossils collected in the Green River Eocene of Colorado in 1923 is a characteristic labiate calyx. The specimen was obtained in the Roan Mountains by Prof. Junius Henderson and Mr. John Byram, high up on the plateau. The calyx is dark, the tube 3·3 mm. long and 1·3 mm. broad, with five slender, spreading teeth which are about 2 mm. long. There are twice as many striæ as teeth; these are quite distinct. The general aspect is nearly that of Mentha, but the spreading of the teeth rather suggests *Leonurus cardiaca*, in which, however, the teeth are much broader at the base. Two of the teeth seem to be united a trifle higher up than the others, but there is scarcely any departure from strict radial symmetry. As it is impossible to refer this with any assurance to a particular modern genus, it may be placed under a new generic term Menthites, as *Menthites eocenicus*.

Evidently we must look in the Mesozoic for the origin of the Labiatæ. T. D. A. COCKERELL.

University of Colorado,
October 14.

Early Egypt and the Fayum.

THE statements about the Fayum question in NATURE of October 30, pp. 624-5, were already familiar to me, but they do not appear to invalidate the six reasons which are as I have stated (p. 514) for the received view of the Nile-fed lake. For example, the sandy island flagged over with stones for a quay is exactly what fishermen need for drying fish away from the jackals. A discussion of details would much exceed a journal correspondence. But the appeal to "hard geological facts" involves, to begin with, a solution of the problem of interpretation. There must first be some common understanding about the traces of a Nile-fed lake level, which would appear from (1) a lake rising and falling 8 or 10 feet every year, with margins varying over about a furlong of sands; (2) with a general rise of level 4 or 5 feet every 1000 years; and (3) the ground being later dried up and subjected to 2000 years of high-wind denudation without any vegetation covering it, and some hundreds of rain storms. At least it is certain that the traces of it would be quite different from those of the old permanent estuarine lake of pre-human date, both physically and biologically. When we know what to expect, we may then know how to interpret the present appearances. FLINDERS PETRIE.

Chlorine Gas Filters in Relation to Reaction Velocity.

DURING the course of some work which I have been carrying out recently on the photo-synthesis of hydrogen chloride from its elements, rather curious results have been obtained. The light used to activate the chlorine-hydrogen mixture was filtered through varying quantities of chlorine gas with the object of studying the corresponding variations in the reaction velocity. It was found that a very small pressure of chlorine in the filter was able to reduce the actinic power of the light very greatly, but increases of the chlorine pressure produced less and less effect. The curve obtained by plotting actinic power against density of filtering medium was not, however, an exponential function, but more the shape of a rectangular hyperbola which for high densities tended to a definite 'residual' value for the actinic power. A tube of 45 cm. of chlorine at atmospheric pressure reduced the reaction velocity to 10 per cent. of its initial value.

In conjunction with Mr. A. Elliott, further experiments were carried out using a tube one metre and a half in length, and the curve extended in the direction of still greater concentrations. The residual velocity was then reduced to 5 per cent., and a very similar curve was obtained when a solution of chlorine in carbon tetrachloride was used as the filtering medium instead of chlorine in the gaseous state.

WILFRID TAYLOR.
(Earl Grey Fellow.)
University of Durham, Armstrong College,
Newcastle-upon-Tyne, September 24.

The Structure of the Continents.

IN the investigation of the structure of the continental masses there are two important considerations which must not be overlooked.

The first is the inadequate data available for the calculation of the velocity of transmission of vibrations in the earth's crust. Dr. Jeffreys has made excellent use of what little there is, but, as I pointed out at the meeting of the British Association at Bournemouth in 1919, and as he himself has contended, there is urgent need of systematic *experimental* work on the times of transmission of such vibrations.

In the second place, experiments on the elasticity and physical characters of hand specimens of rocks is of little value for the determination of those of deep-seated magmas of similar composition, not only on account of the enormous pressure that prevails even at moderate depths, but also because of the presence of volatile constituents, consisting largely of the elements of water and (especially in basic rocks) of sulphur compounds, far in excess of those contained in hand specimens of even glassy rocks such as tachylyte.

JOHN W. EVANS.
Imperial College of Science,
South Kensington, S.W. 7,
October 25.

Sterility in the Vegetable Marrow.

SEEING that a letter on the above subject has recently appeared in NATURE (October 23, p. 592), it may be of interest to place on record my experience this summer regarding pumpkins. Besides growing vegetable marrows, which, as it happens, have behaved quite normally this season, bearing an abundant crop, we usually put out a single pumpkin plant and manage, as a rule, to obtain from it one large fruit. For the first time, two plants were put out this year—a piece of good fortune, for one of these declined to produce a single female flower. I had it under strict observation the whole season. The other behaved normally, forming plenty of female flowers and ripening one fruit. The two plants grew side by side under identical conditions of soil and light. Pumpkins have been grown by me for the last six or seven years, and this is the first time a plant has been seen to behave in this way. I have never yet come across a completely male marrow plant.

I fear I can offer no adequate explanation as to the reason for the lack of female flowers in the marrow plants mentioned by Miss Armitage. If the past summer had been cold and sunless, low temperature might have been suggested as the cause; but, as she writes, the season has been favourable for half-hardy plants, and the abundance of marrows formed and matured here point to this. It looks as if the maleness had been innate in the seeds and not induced by external conditions.

JOHN PARKIN.
Blaithwaite,
Wigton, Cumberland,
October 25.

Optics and Poetry.

"Iam clarum mane fenestras
Intrat, et angustas extendit lumine rimas."
PERSIUS (A.D. 34-62), *Sat.* iii. 1-2.

"Here is full morning coming through the window shutters, and making the narrow crevices look larger with the light"—(Conington's translation).

THAT a narrow slit seems to grow wider as the intensity of the light coming through it increases is of itself a dry and not very important matter of common observation; but the very charming use of this fact by the Latin poet, as an indication to the sluggard within that he has long overslept the proper hour of rising, gives it a new attraction and interest, and is worth noting. "We go on snoring, enough to carry off the fumes of the unmanageable Falernian, while the shadow is crossing the fifth line of the dial," that is, at eleven o'clock.

This apparent widening of a narrow slit is perhaps due to a kind of dazzle or halation affecting the surface of the retina, comparable to the irradiation or spreading of the light on a photographic plate. After a night in bed the eyes would naturally be more alert to effects of this kind. M. Gustave Le Bon found by experiment that it requires at least fifteen minutes spent in darkness to bring the eyes to their maximum sensitiveness to faint illumination. No doubt the poet had often observed the phenomenon himself as he lay, 'twixt sleep and waking, watching the slits in the shutters, first in the grey dawn and then lit by the sun.

H. C. BROWNE.
Dublin, October 21.

'Red Rain' at Bordighera, Italy.

'RED rain' fell at Bordighera on the morning of October 31, coating the pavements and vegetation with a dense red-brown deposit which turned to salmon colour when dry. The shower, which terminated about noon (English summer time), was accompanied by a current of hot moist air from the east. The previous day was wet and overcast, and the evening after the shower there was a thunderstorm with long flashes of lightning from east to west at an estimated altitude never touching below 2500 feet. Samples of the deposit (doubtless sand from the Sahara) are being preserved for microscopical examination.

G. H. BRYAN.
Le Lucciole, Bordighera,
Italy, November 1.

Cretaceous Mammal Skulls from Mongolia.

By Dr. WILLIAM K. GREGORY and G. G. SIMPSON.

THE discovery of Cretaceous mammal skulls in Mongolia by the Central Asiatic Expedition of the American Museum of Natural History is an event of exceptional importance in vertebrate palæontology. The Cretaceous forerunners of the varied placental mammals of the Palæocene and Eocene have hitherto been known only by inference. The studies of Cope, Osborn, Wortman, Matthew, and others upon the dentition and skeleton of Eocene mammals led to the view that the earliest insectivores and creodonts, taken collectively, were descendants of the most primitive group of placentals, for which the name Thericteoidea was proposed by Gregory in 1910.[1] It was further inferred that the stem placentals of the Cretaceous would be more or less intermediate in character between the Jurassic "Amphitherium" and such early Eocene forms as Palæoryctes, Didelphodus, and the Oxyclænidæ.[2]

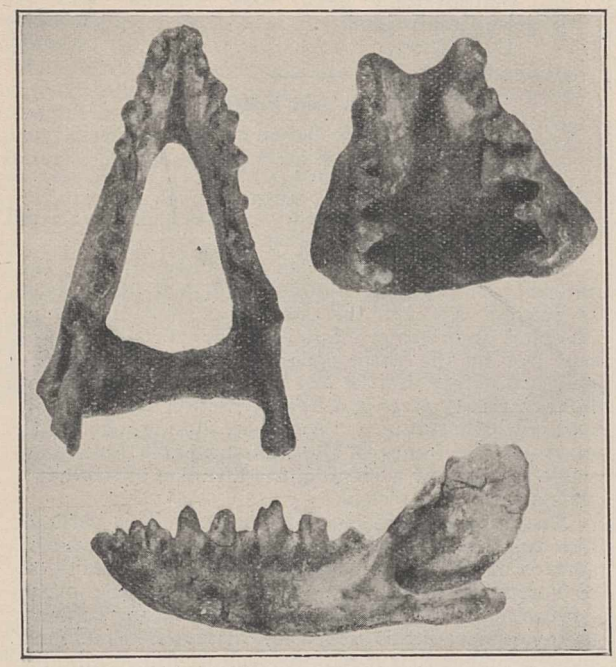

FIG. 1.—*Deltatheridium pretrituberculare*. Type palate and mandible. Djadockta formation, Mongolia. Twice natural size.

In 1924 and 1925 the third Asiatic Expedition, under the leadership of Roy C. Andrews, explored the Djadockta formation of Mongolia, which yielded the famous dinosaur eggs and the superb series of Protoceratops skulls and skeletons. Here Mr. Walter Granger and his associates, after prolonged search, finally discovered no fewer than seven skulls or parts of skulls, some with associated lower jaws, of Cretaceous mammals. Of these the first specimen discovered in 1924 proved to be an allotherian or multituberculate, and has been described as the type of a new genus and family of allotherians in the *American Museum Novitates*.[3]

The remaining specimens discovered in 1925 have been very skilfully extricated from the matrix by Mr. Albert Thomson and generously entrusted to us for description by Prof. Osborn and Dr. Matthew. Upon examination the new specimens appear to be quite distinct from all of the hitherto described jaws and teeth of Cretaceous mammals, including those in the Marsh collection of the Peabody Museum, Yale University, in the American Museum of Natural History, in the United States National Museum, and elsewhere.

All the known American Cretaceous mammals, except the allotherians, are marsupials, related rather closely to the existing opossums, so that as the evidence now stands the placental mammals did not invade north-western America until the Palæocene. All the Mongolian Cretaceous mammals, on the contrary, again excepting the allotherians, so far appear to be placental.

So far back as Morrison (basal Cretaceous) times the pantotherian or tritubercular mammals were differentiated into several families. We are therefore not surprised to find that the Mongolian Cretaceous placentals show considerable diversity among themselves, so that even in the half-dozen specimens now available there are representatives of not less than four genera and two families, all apparently new to science.

The largest of these animals was somewhat bigger than a large house rat. Its skull and dentition were distinctly carnivorous in type, with enlarged laniary canines and sharp-bladed, narrow, triangular molars, approaching in these features the most primitive Eocene creodonts. Three genera are referred to this family, which is named by us the Deltatheridiidæ.[4] The upper molar teeth are in what may be called a pre-tritubercular stage of evolution, since the para- and meta-cones are connate or not separated from each other and are median in position, in line with the primitive tips of the premolars, while the so-called 'protocones' are internal spurs from the base of the crown. The lower molars are tritubercular, with shearing paraconid-protoconid blades and narrow heels.

In the second family, called Zalambdalestidæ, the very elongate snout suggests that of Solenodon, except that the lateral, not the median, incisors are enlarged. The cheek teeth, much worn in the type, strongly suggest those of zalambdadont insectivores, but a referred specimen indicates that the para- and meta-cones were partly separated and more buccal in position than in modern zalambdodonts, thus supporting Matthew's view[5] that the peculiar zalambdodont molars have been derived from a more normal tritubercular type. The lower molars are tuberculo-sectorial, with fairly broad heels. One pair of the anterior teeth, probably the median incisors, were much enlarged and procumbent, working between the enlarged upper incisors. The canines were small or absent, and

[1] The Orders of Mammals, *Bull. A.M.N.H.*, **27**, p. 464; see also pp. 304-307, 467, 468.

[2] "The Origin and Evolution of the Human Dentition." Baltimore, 1922, pp. 99-107, 512.

[3] Simpson, G. G., 1925. A Mesozoic Mammal Skull from Mongolia. *American Museum Novitates*, No. 210, Nov. 24, 1925.

[4] *American Museum Novitates*, October 1926. Cretaceous Mammal Skulls from Mongolia, by William K. Gregory and G. G. Simpson.

[5] Matthew, W. D., 1913. A Zalambdodont Insectivore from the Basal Eocene, *Bull. A.M.N.H.*, **32**, Art. 27, pp. 307-314.

there were long spaces behind the enlarged front teeth. The skull avoids the specialisations of modern zalambdodonts, the nasals being separate, the zygomatic

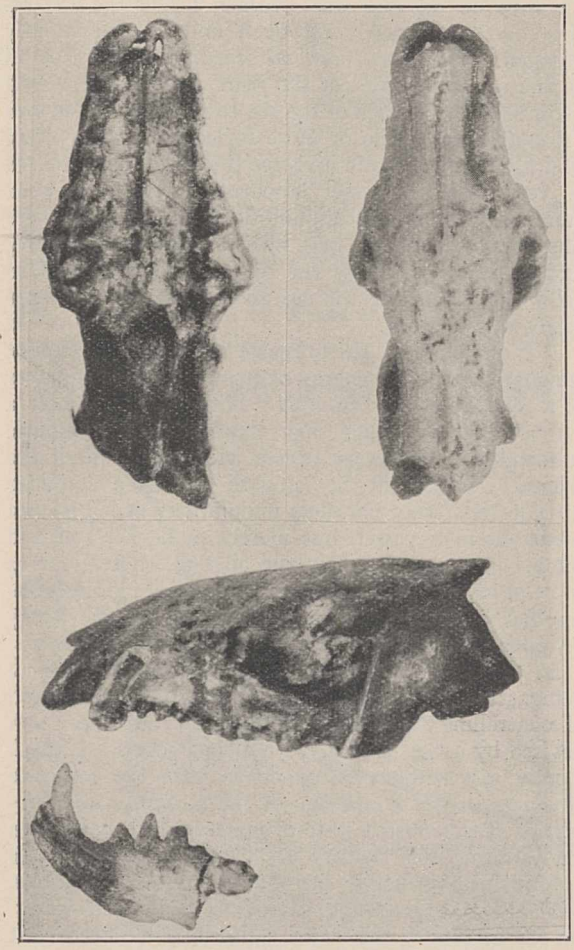

FIG. 2.—*Deltatheridium pretrituberculare*. Referred specimen. Twice natural size.

arches complete and the glenoids not displaced medially; orbital region less reduced, with prominent lacrymal rims; brain-case moderately expanded, not tubular. In these and other important details the Zalambdalestidæ agreed with the Deltatheridiidæ, and the characters of one of the new genera named Hyotheridium indicate that at that time the two families were still closely related, however much their presumed descendants, the placental carnivores and insectivores, diverged in later times.

Accordingly these specimens afford additional support for the following conclusions, based on much other evidence.

(1) The Palæocene and Eocene insectivores and oxyclænid creodonts, taken collectively, represent survivors of an earlier insectivore-creodont stock, examples of which have now been discovered in Mongolia.

(2) The discovery of these earliest of definite placentals in Mongolia furnishes some support to the hypothesis that Central Asia was the homeland of the placental radiation.

(3) The Mongolian Cretaceous mammals stand between the Jurassic pantotherians and the Palæocene placentals, both in time and in dental structure, but are somewhat nearer to the latter.

(4) The Mongolian Cretaceous mammals favour the view of Wortman and others that the para- and metacones collectively of the mammalian tritubercular molar are in line with, and homologous with, the 'reptilian' tip of the premolar crowns, and that the so-called protocones represent internal basal spurs, correlated functionally with the differentiation of a heel or talonid, on the lower molars.

The following is a list of the mammalian fauna now known from the Djadockta formation:

MULTITUBERCULATA.
Philodontidæ.
Djadochtatherium matthewi Simpson.

INSECTIVORA.
Deltatheridiidæ.
Deltatheridium pretrituberculare G. and S.
Deltatheroides cretacicus G. and S.
Hyotheridium dobsoni G. and S.
Zalambdalestidæ.
Zalambdalestes lechei G. and S.

Of these all are known from at least part of the skull, including the palate, and all but Deltatheroides also

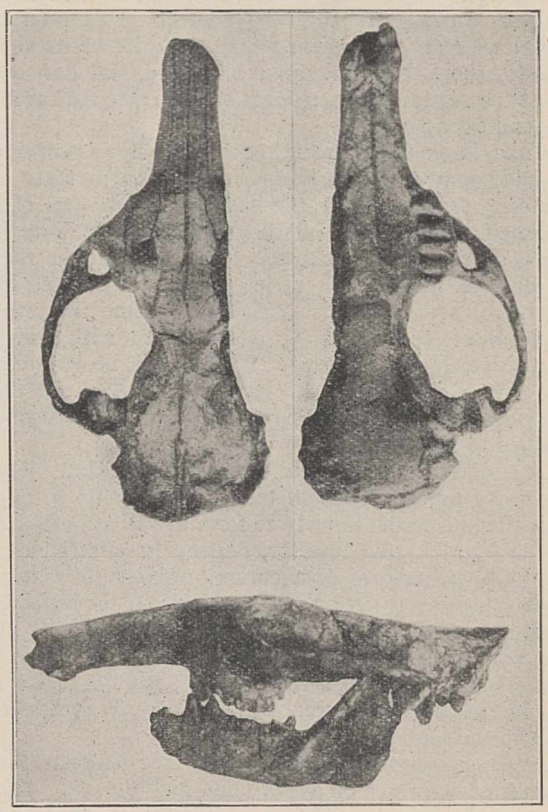

FIG. 3.—*Zalambdalestes lechei*. Type. Twice natural size.

from associated lower jaws. Zalambdalestes is incomparably the best known of all Mesozoic mammals, every main part of the skull and jaws being known, although some features are still rather obscure.

Properties of Thin Films.[1]

By Sir WILLIAM B. HARDY, F.R.S.

EVERY one knows of the three states in which matter can exist—solid, fluid, and gas or vapour. Thin films of matter, familiar to all in the form of soap bubbles or lubricating films of oil, are no less than a fourth state, because, choose what physical constant we may, it will have a different value for any particular kind of matter in this state from what it has in any of those other states which are more easily apprehended by the senses.

Life itself depends upon this fourth state of matter. There is a film spread over the surface of each living cell which seems to control the passage of substances into or out of the cell. This film is actively maintained by the expenditure of energy on the part of the cell. The new technique of microdissection, by which living cells so small as to be almost or quite invisible can be dissected, has increased our knowledge of this surface film. If it be punctured at one place the living matter in the neighbourhood of the puncture becomes curdled in appearance and dies, but the membrane grows in at the back of this dead substance, cutting it off from the rest of the cell. This is the fundamental surgery of living matter.

I cannot hope to do more now than deal in haphazard fashion with this vast subject. I propose to begin with an experiment which, in spite of its simplicity, shows how ubiquitous films are, and how our most elementary impressions of the external world depend upon them.

Take, for example, smoothness. It is not a property of solid matter in mass, but of this fourth state of matter. A tea-cup has the delicate velvety feel of a polished surface; but neither porcelain nor ware is really smooth in that sense. Their surface, like that of all other naturally occurring surfaces, is covered by a film of greasy matter, which may come from the atmosphere or from the 'clean' cloth with which the object has been dried. If that film be removed the surface feels harsh and rough because, to use the engineer's phrase, one's finger-tips, if they are freshly washed, seize to it.

It is not possible quickly to remove the film. The necessary procedure would take too long, and in any case the film would quickly re-form in the atmosphere of a room. I can, however, destroy its effectiveness by taking advantage of a curious property of water. That substance is not only not a lubricant for vitreous surfaces, but it is also an anti-lubricant in that it destroys the effect of the natural lubricating film. All I have to do, therefore, is thoroughly to wet the surfaces of the tea-cup and saucer, and the tea-cup ceases to slide in the saucer.

A tea-cup suggests a storm, and that suggests the curious power which oil has of smoothing the sea. The oil spreads over the surface of the water until the layer is only about the five-millionth of a millimetre in thickness. A figure of that kind is apt to mean little; I will therefore try to give an impression of the minute quantity of oil needed in another way. In 1919 an oil ship was wrecked inside the Lizard. The oil-tanks were burst open and the oil rapidly escaped. There has been no sensible quantity of oil in the wreck for the last six years, yet sufficient still escapes to the surface of the sea to produce an obvious 'smooth' for a mile or more to leeward. The effect of a film of oil of quite invisible thickness upon the sea is very real. A vessel labouring in a sea-way or running before a gale can, and does, find some measure of safety by streaming bags filled with oil to windward, and Pliny records how the oyster-fishers used oil to calm the surface of the sea so that they were more easily able to work.

It is obvious that the presence of this oil film cannot seriously modify the energy of great seas, say, a quarter of a mile from crest to crest; but when seas enter a 'smooth' they change their character with dramatic suddenness. They lose their viciousness, and the moment they are in the 'smooth' take the character of those relatively harmless undulations which do not break on to a vessel, but merely make her roll and pitch. The question how the oil film, so tenuous as to be of invisible thickness, curbs the sea is an interesting one, and the attempt to answer it will inevitably introduce us to the chief properties of films on water.

In the late 'nineties a most ingenious method of demonstrating the existence of films on water, and of controlling them for experimental purposes, was devised by a German lady, Fräulein Pockels. I think I may say without exaggeration that the immense advances in the knowledge of the structure and properties of this fourth state of matter which have been made during this century are based upon the simple experimental principle introduced by Miss Pockels. Take an oblong trough of metal filled with water. On the surface of the water, quite invisible because it is even thinner than the invisible dead black portion of a soap film, there is a layer of greasy contamination. If I lay upon the trough a strip of glass or metal so that it touches and is wetted by the water, and move it along, I can compress the superficial film in front and expand it behind. Both processes are easily rendered visible by scattering lycopodium dust on the surface.

The capacity which these films have of expansion is easily shown by sweeping the natural film to one end, thus leaving a tolerably clean surface of water behind. Some lycopodium dust is now placed at one end and the surface touched with a platinum wire, the extreme tip of which has just been dipped into an oil. The dust particles are swept away swiftly in front of the advancing film of oil, although the film itself is absolutely invisible.

The film tends to spread, but the surface of the water in virtue of its surface tension tends to contract. It is this same surface tension which rounds up drops of fluid to spheres, or as near an approach to the spherical shape as other forces which may be operating, such as gravity, permit. There are therefore opposing influences: the tendency of the water to contract, opposed by the tendency of the film to expand, with

[1] Discourse entitled "Films," delivered at the Royal Institution on January 29.

the result that composite surfaces of oil and water have a surface tension less than that of pure water. Composite fluid surfaces have also an enhanced mechanical stability. When a ring of wire a few centimetres in diameter is withdrawn from clean water no film is formed across it, but when the surface of the water is coated with oil it acquires the property of forming free films, which may have an endurance comparable even with that of a soap bubble. In Fig. 1 the curve E F G H gives the surface tension plotted against the quantity of oleic acid per unit area of surface, and the curve A B C D gives the duration of bubbles which have been formed on the surface by allowing air to escape slowly and regularly from an orifice within the trough. It will be noticed that the bubbles are most stable when the film of contamination is just dense enough to begin to alter the surface tension, and that

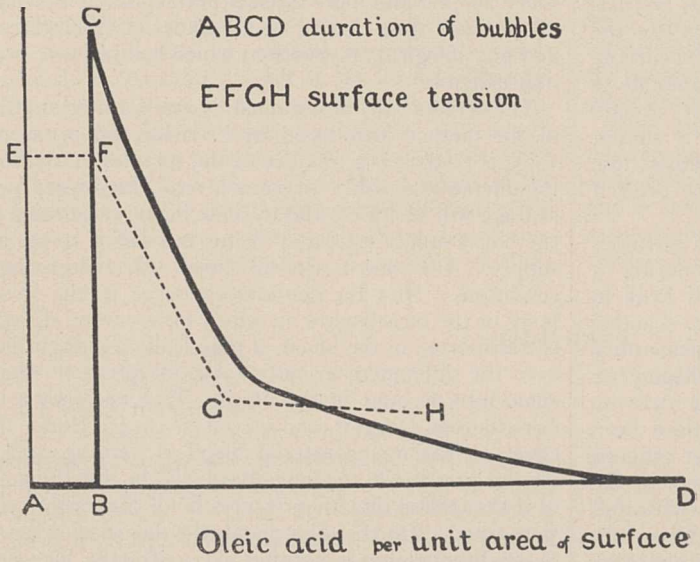

FIG. 1.

the bubbles have no stability when contamination is either vanishingly small or very great.

Do these properties of composite surfaces, namely, the lowered surface tension and the increased mechanical stability, explain the calming of the sea? In my opinion the answer is 'No,' but current doctrine would perhaps say 'Yes.' It has been pointed out that the special capacity of composite surfaces to resist extension and their mechanical stability, which is only another special aspect of the same thing, tends to prevent the inevitable expansion of the surface which occurs when a wave is formed. This has been held to be a sufficient explanation. I do not think it is, and for two reasons. The first is that the surface of the sea is always contaminated by something which lowers its surface tension and gives to it a remarkable measure of mechanical stability. One of the most striking aspects of a heavy gale is the 'windrows,' which are due to the foam formed when a sea breaks being blown by the wind in long lines over the surface. Foam after all is no more than a collection of bubbles; obviously therefore these naturally formed bubbles have great stability.

The nature of the film which covers the surface of the sea must remain uncertain. Sometimes it is composed of substances like saponin, of vegetable origin, derived from the masses of seaweed flung upon the coast. Foam of this kind is remarkably stable. I have seen it on the day following an on-shore gale knee-deep in the hollows above Flamborough Head. The bruising and shattering of seaweed is, however, a coastal happening and 'windrows' are deep-sea phenomena.

The true explanation of the 'smooth' produced by a film of oil was, I think, furnished by Benjamin Franklin in 1773. His discussion is worth reading. It has the spacious dignity and charm which the hurry and specialisation of to-day have of necessity banished from scientific papers. He tells how he was at sea in 1757 with a convoy of ninety-six sail, the wind being very fresh, and how he noticed a 'smooth' in the wake of two of the vessels. He inquired the cause of one of the officers and was told with some degree of contempt, it being a thing which every fool should know, that the 'smooth' was due to the fact that the cook had just thrown greasy water over the side. In those days tallow was used to coat the bottoms of vessels to keep them clear of growth, and Franklin also notes the 'smoothness' in the wake of vessels which had been freshly tallowed.

Franklin's explanation is based entirely upon friction. The oil makes the sea so very smooth that the wind cannot 'catch upon it.' I confess Franklin's explanation did not appeal to me at first, but I believe he is right. The comparative safety of a 'smooth' is due, not to the fact that the seas in it are sensibly smaller than those outside of it, but to the fact that they have been deprived of their viciousness. Now the viciousness of a sea, the degree of danger it carries to the mariner, is measured by its instability. It is when the head of the sea topples over and becomes a mass of water moving with a high velocity that it is dangerous. Within the limits of a 'smooth' produced by oil the seas cease to break, or to 'crack,' as Cornish fishermen say. The wind not only drives a sea forward by its horizontal pressure, but also draws the crest upwards by friction against the surface of the wave.

If the friction between the air and the water be greatly reduced, the wind fails to lift the crest of a wave to the point at which it is blown bodily over by the horizontal pressure. The wave then sinks down to a relatively harmless 'swell.'

The 'catch' of the wind upon the waves is not, however, confined simply to a direct frictional pull, and here it is that the surface tension perhaps comes in. It is easy to convince oneself that an oil film prevents the formation of ripples—that is, of the very smallest kind of wave. When there is no oil film, a great wave carries countless ripples and wavelets each of which gives the wind a direct thrust on the surface. It is to the suppression of ripples and wavelets that the characteristic smooth appearance is due, and when they cease to be formed, the chief 'catch' of the wind upon the sea is lost.

Acclimatisation to High Altitudes.[1]

By Dr. J. S. HALDANE, F.R.S.

THERE is now general agreement among physiologists that, as was originally concluded by Paul Bert, the formidable group of symptoms known as 'mountain sickness' is due essentially to the lowered partial pressure of oxygen owing to the diminished barometric pressure of high altitudes; also that the symptoms depend upon the lowered oxygen pressure being insufficient to saturate with oxygen to a normal extent the hæmoglobin of the arterial blood, so that a normal pressure of oxygen is not maintained in the central nervous system. The defective saturation of the arterial blood shows itself by blueness, often extreme, of the lips and face. Persons who ascend by gradual stages to high altitudes are commonly found to be immune to mountain sickness; and this fact has been brought into extraordinary prominence by the experiences of the last Mount Everest expedition. Members of the expedition were completely immune to mountain sickness at a height of 27,000 feet, though persons going without acclimatisation to a similar barometric pressure in balloons or steel chambers lose consciousness rapidly, and would shortly be dead if they remained in the rarefied atmosphere.

Two expeditions have been made to high altitudes with the special object of investigating the nature of the acclimatisation. The first was to Pike's Peak in the Rocky Mountains in 1911 by Douglas, Yandell Henderson, Schneider, and myself, with supplementary investigations by Miss FitzGerald at mining villages, etc. The second was to Cerro de Pasco, Peru, in 1922 by Prof. Barcroft and associates. There have also been various observations in steel chambers under reduced barometric pressure, and in air-tight chambers in the air of which the oxygen percentage was allowed to fall without accumulation of carbon dioxide. These observations have shown that (1) for a given consumption of oxygen or production of carbon dioxide in acclimatised persons the volume of air breathed is increased in proportion to the fall in barometric pressure; (2) the percentage of hæmoglobin in the blood is similarly increased. Both of these changes will evidently act in the direction of diminishing the fall in oxygen pressure in the central nervous system. If the breathing were increased without compensatory changes in the body, the latter would be very abnormally alkaline, owing to excessive washing out of carbon dioxide. This extra alkalinity is, however, almost entirely compensated owing to the fact that as soon as the breathing begins to be increased owing to the stimulus of want of oxygen, the kidneys begin to excrete an increased amount of alkali, as was shown by Kellas, Kennaway, and myself. Hence in an acclimatised person the alkalinity of the body is scarcely increased at all.

So far, there appears to be agreement on the subject of acclimatisation; but on further points there is marked difference in opinion. The very careful, and apparently conclusive, experiments of Fredericq and of A. and M. Krogh had shown that, as measured with the aerotonometer, the oxygen pressure of the arterial blood is, under normal resting conditions, always lower than that of the alveolar air in the lungs. On the other hand, the experiments of Douglas and myself by the carbon monoxide method had shown that the mean oxygen pressure of the blood leaving the lung alveoli is, under normal resting conditions, exactly the same as that of the alveolar air, so that diffusion equilibrium for oxygen between alveolar air and blood is complete. At the time we attributed the difference in results to there being a loss, during the conveyance of the arterial blood from the lungs, of a slight amount of oxygen owing to the presence in the blood of reducing substances which had not had time to be oxidised completely in the lungs. A later investigation by Meakins, Priestley, and myself in 1918 furnished, however, a much simpler and more satisfactory explanation, which at the same time cleared up a number of other clinical and physiological observations which had hitherto been unintelligible.

The alveolar air, as obtained by one form or another of the method introduced by Priestley and myself in 1905, is evidently a mixture of the samples of air from innumerable alveoli. In some alveoli the oxygen percentage will be lower, and in some higher, according as the blood supply is greater or less in relation to the air supply. The mixed arterial blood will reflect these conditions. Now the dissociation curve in the living body of the bicarbonate, in which form carbon dioxide is transported in the blood, is practically a straight line over the differences in carbon dioxide pressure which come into account in the lungs. This was shown by Christiansen, Douglas, and myself in 1914. Hence the effect on the mixed arterial blood of varying carbon dioxide pressure in the lung alveoli will be just the same as if the carbon dioxide pressures in all the lung alveoli were equal. On the other hand, the dissociation curve of oxyhæmoglobin is nothing like a straight line, and has the characteristic doubly inflected form discovered by Christian Bohr. The effect of the varying oxygen pressure in different alveoli will therefore be that the mixed arterial blood will have a lower oxygen pressure than that of the mixed alveolar air. This effect will, moreover, be exaggerated if the oxygen pressure of the alveolar air is abnormally low, as at high altitudes.

We have thus a complete explanation of the difference between the results by the aerotonometer and carbon monoxide methods, since the latter method gives the average of the oxygen pressures of the various streams of blood leaving different alveoli, and not the oxygen pressure of the mixed arterial blood. We have also the explanation of why, in unacclimatised persons, a quite moderate lowering of barometric pressure—for example to the pressure at 11,000 feet—may produce extreme symptoms of mountain sickness, with great blueness of the lips.

In the Pike's Peak expedition we used the carbon monoxide method, and found, in every subject investigated, that after acclimatisation, the average oxygen pressure of the blood leaving the alveoli was much higher than that of the alveolar air. But this was not the case in an unacclimatised control, who was still blue when examined, and shortly afterwards became mountain-sick, though after he was acclimatised, and

[1] From a lecture delivered to Section I (Physiology) of the British Association at Oxford, on August 10.

his lips were again normal in colour, he reacted just like the other acclimatised subjects. We therefore concluded that active secretion of oxygen is an essential part of acclimatisation. Later experiments by Kellas, Kennaway, and myself in 1918 on acclimatisation in a steel chamber gave strong confirmation to this conclusion.

In the Peru expedition no experiments were made by the carbon monoxide method, but Prof. Barcroft and his associates made determinations of the percentage oxygen saturation of the arterial hæmoglobin. From the results of these analyses they drew the conclusion that the oxygen pressure of the arterial blood is never higher than that of the alveolar air. This conclusion, however, depended on a further conclusion that in all the subjects investigated the dissociation curve of the oxyhæmoglobin in the blood was greatly altered in such a way that the blood passing through the lungs would take up more oxygen than at sea-level. This result is in direct contradiction of careful experiments made previously by Barcroft himself on the Peak of Teneriffe and on Monte Rosa, and of particularly careful confirmatory experiments made by Douglas and myself on Pike's Peak, at practically the same height as in the Peru expedition. No explanation is given of the contradiction, and it seems quite incredible that a real difference could have existed. Until, at least, confirmatory evidence is forthcoming, I can only conclude that there was some error of experiment in the Peru determinations. The analyses of the arterial blood gave just such results as we should have expected from the Pike's Peak experiments; and if, as I must still believe, the dissociation curves were practically the same as at sea-level, these blood-gas analyses prove, by themselves, our conclusion that oxygen secretion is an essential element in acclimatisation.

Prof. Barcroft unfortunately failed to understand the nature of our conclusions as to oxygen secretion, or the significance of previous work as to the relation between the mean alveolar oxygen pressure and the oxygen pressure of the mixed arterial blood. He has thus been unwittingly led, particularly in his recently published book on "The Respiratory Functions of the Blood," into a complete misrepresentation of my own views on the subject. On reviewing the whole of the existing evidence, including the very important data from the Everest expeditions, I can see no way of interpreting the phenomena of acclimatisation without the assumption of oxygen secretion in addition to the other known factors.

(The lecture contained a review of the evidence bearing on oxygen secretion by the lungs, since the time when its occurrence was first suggested by Ludwig; and at the end there was a discussion of the reason, now evident enough, why so little benefit was obtained in the last Everest expedition from the use of oxygen.)

Obituary.

PROF. EDOUARD NAVILLE.

THE late Prof. Edouard Naville, who died recently at Geneva in his eighty-third year, was a typical representative of the older generation of Egyptologists. The son of a distinguished Genevese family, of strong Evangelical tenets, he came to England when young to study at King's College, London, and here imbibed the liking for England and all things English that was characteristic of him through life. He went on to Bonn, and later studied Egyptology under Lepsius. He and Maspero both began their scientific work at the same time, round about the year 1870. In spite of great differences of temperament and style, their work shows resemblances characteristic of their time, especially in purely archæological matters; neither was able quite to enter into the spirit of the newer science of archæology or to understand its insistence on the importance of small things equally with great. The men of that generation thought only of great, beautiful, and fine things, and could see nothing of importance in a bead or a scarab. They were scholars and connoisseurs, not anthropologists.

Naville began to excavate in the early 'eighties for the Egypt Exploration Fund, shortly after its foundation (as also did Prof. Sir Flinders Petrie), and his work at Bubastis and at Deir el-bahri for the Fund will always be notable; that at Deir el-bahri being indeed among the most important excavations carried on by the Society. His work on the supposed site of Pithom and on the route of the Exodus was the most important, and in its time certainly interested a large body of subscribers. But his views on this subject are not now so generally accepted as they were then. The placing of the Exodus in the reign of Meneptah is no longer regarded as a *chose jugée*, and Naville's views on the actual route of the Exodus have undergone some modification at the hands of younger scholars. For their time, however, his theories were very advanced, and of great importance. At Deir el-bahri he uncovered the great temple of Hatshepsut, and in later years (1903–7) that of Mentuhotep IV., this time assisted by the present writer, Mr. E. R. Ayrton, Mr. C. T. Currelly, and others. His earlier work had been done almost entirely alone, except that for one season at the Hatshepsut temple he had had the assistance of Mr. D. G. Hogarth. His plans and architectural descriptions were made for him chiefly by the late Mr. Somers Clarke, though in the Mentuhotep temple Mr. C. R. Peers and one of Naville's relations, M. Edmond Fatio, also helped.

Later on, Naville began the excavation of the Osireion, the great subterranean building behind the temple of Abydos, thought by him to be of the time of the Old Kingdom, but proved by his successor in the work, Mr. H. Frankfort, to be the funerary temple and cenotaph of Seti I. (XIXth Dynasty), thus confirming a surmise of Borchardt's published in *Klio* several years ago. This building was discovered by Sir Flinders Petrie and Miss M. A. Murray so long ago as 1902, but on account of the enormous labour and expense required for its excavation had been abandoned until Naville and the Exploration Fund took it up. Naville's work, in which he was assisted by Mr. T. E. (now Prof.) Peet and Mr. G. A. Wainwright, resulted in the clearance of practically the whole of this extraordinary building. Then the War came and closed down operations. Naville, after it, was too old to resume the work, which could not in any case be

begun until last year, when Mr. Frankfort carried it to its conclusion.

Naville's other scientific work related chiefly to the "Book of the Dead," of which he published the first critical edition. He was always specially interested in the religious side of Egyptian culture, and published a short work on "Egyptian Religion."

Naville was always proud of his knowledge of England, in the fortunes of which he took steady interest. In fact he was politically almost an Englishman, and showed his partiality by his impassioned defence of our action in the Boer War, when he published many pamphlets in all tongues in our favour, gaining rather an unenviable notoriety thereby on the Continent. He was a man of the courage of his opinions, and a keen polemist, as his attacks on "the Higher Criticism" of the Old Testament and his long disputes with the German Egyptologists on the question of the Semitic origin of the Egyptian language or the succession of the Thutmosids show; and in polemic he by no means always came off second-best.

Naville possessed many British and foreign degrees, was an Hon. F.S.A. and foreign associate of the Institute of France. During the War he was a prominent member of the Central Red Cross Committee at Geneva, over which he presided. No notice of him would be complete without a word regarding his devoted wife. Mme. Naville (*née* de Pourtalés) assisted him enormously in his work by copying descriptions, piecing together fragments of monuments, and so forth; her knowledge of Egyptology was considerable, and he always emphasised the value of her assistance to him in his scientific work.

H. R. HALL.

DR. FRANCIS WARNER.

THE passing of Francis Warner has removed one of the last of the group of physicians and physiologists who studied movements and gaits, attitudes and postures in the 'seventies of the last century. Much of the study was conducted by means of pneumatic tubes connected with Marey's recording tambours. This phase of Warner's work was set out in his well-known work, "Physical Expression," and in his Hunterian lectures to the Royal College of Surgeons. Modern electrical methods and kinematography have modified and extended the conclusions then reached. Warner's clinical observations on the postures and movements of nervous and defective children made at the East London Hospital for Children, and later supplemented at the London Hospital, still remain standards for all observers.

In the early days of compulsory elementary education, it was soon found that many children were unable to profit by the facilities offered; in some instances, such as those who were blind or deaf, the need for special schools was obvious and was soon supplied in gradually increasing measure, but in the case of others with mental or physical defects, public opinion was more slowly influenced. It is largely to Dr. Warner's efforts in investigating the conditions of some 10,000 children in the London elementary schools and to his labours on a series of commissions that the present provision in London, unequalled anywhere in the world, came into being. Warner made a great point of observing the child at rest and while performing certain very simple movements, such as looking at an object or holding the hands straight in front of the body with the palms down. He directed attention to slack or convulsive postures of the hand which indicated nervous instability, to the knitting of the eyebrows, which might indicate nervous strain or hypermetropia, to muscular overaction of various kinds.

For some years Warner's tests formed a large part of the examination of children suspected of needing special education, and though they have been supplemented and in part replaced by tests of the Binet-Simon pattern, and other tests of power of performance and of adapting thought and movement to new requirements, they are still an essential item of a complete examination. Above all things, Warner stressed the point that an examination should be dynamic rather than static, that evidences of defect as shown by stigmata, then popular as supposed indices of mental status, were as nothing compared to that derived from actual movements and performances.

Dr. Warner was one of the first of a series of school hygienists and child students, who did much himself and, by his example and ready help and advice, laid the foundations of the present system of care for the health of scholars and the comfort and sanitation in the broadest sense of our schools.

PROF. CARLOS SPEGAZZINI died on July 1 of this year. He was born on April 20, 1858, at Bairo, Italy, and was a pupil of the late P. A. Saccardo at Padua. In 1878 he contributed his first paper on mycology, a study of coprophilous fungi, to the short-lived periodical *Michelia*, which Saccardo edited. He published a series of notes on the diseases of the vine and began to issue fascicles of dried specimens ("Decades mycologicæ Italicæ"). In 1880 he went to the Argentine as professor of natural history at Buenos Aires. The number of fungi recorded for the Argentine was then thirty-nine. Spegazzini worked this virgin soil to the full, and until his death made continuous contributions to the mycological flora, extending his investigations to most countries of South America. His work was that of a general systematist, and in the thousand or so new species he described, practically all groups are represented. His work appears to be much more carefully done than is usual in such mass production, and is illustrated by clear and attractive drawings. Spegazzini not only accomplished an enormous amount of mycological work but also published numerous papers on Phanerogams, specialising during the last few years more particularly on Leguminosæ. Odd papers on all sorts of subjects testify to his great interest in general natural history and science.

WE regret to announce the following deaths:

Sir Edward Busk, sometime Vice-Chancellor and Chairman of Convocation of the University of London, and a member of the governing bodies of the Imperial College of Science and Technology and of several well-known schools, on October 29, aged eighty-two years

Mr. R. N. Lennox, formerly assistant to the late Sir James Dewar at the Royal Institution, on November 1.

News and Views.

THE King has approved of the following awards this year by the president and council of the Royal Society: A Royal medal to Sir William Hardy for his pioneer work on colloidal chemistry and the theory of lubrication. A Royal medal to Prof. A. V. Hill for his distinguished work on the physical and chemical aspects of muscular contraction. The following awards have also been made by the president and council: The Copley medal to Sir Frederick Hopkins for his distinguished and fruitful work in biochemistry. The Rumford medal to Sir Arthur Schuster for his services to physical science, especially in the subjects of optics and terrestrial magnetism. The Davy medal to Sir James Walker for his work on the theory of ionisation and ionic equilibria in solution. The Darwin medal to Dr. D. H. Scott for his contributions to palæophytology, particularly in relation to the period of coal. The Hughes medal to Admiral Sir Henry Jackson for his pioneer work in the scientific investigation of radio-telegraphy, and its application to navigation.

THE following is a list of those recommended by the president and council of the Royal Society for election to the council at the anniversary meeting on November 30:—*President*—Sir Ernest Rutherford; *Treasurer*—Sir David Prain; *Secretaries*—Mr. J. H. Jeans and Dr. H. H. Dale; *Foreign Secretary*—Sir Richard Glazebrook. *Other Members of Council*—Sir Hugh Anderson, Dr. F. W. Aston, Prof. L. Bairstow, Prof. F. O. Bower, Sir Archibald Garrod, Prof. E. J. Garwood, Sir Thomas Heath, Prof. J. P. Hill, Dr. P. C. Mitchell, Prof. R. Muir, Sir John Parsons, Sir Robert Robertson, Mr. A. A. C. Swinton, Sir Gilbert Walker, Sir James Walker, Mr. W. C. D. Whetham.

THE announcement that Sir Alfred Yarrow has made a donation of 10,000*l.* to the funds of the British Association is of particular significance, as showing the appreciation of scientific study and research by a great leader of industry. A few years ago another pioneer of engineering science—Sir Charles Parsons—made a like gift to the Association; and it may be hoped that the generous lead thus given will be followed by other representatives of progressive industry which benefit directly or indirectly by the advancement of scientific knowledge. Sir Alfred Yarrow, feeling that the present urgent needs of the British Association, in its work for science, should receive precedence over provision for the distant future, has made it a condition that his gift should be expended, as to both capital and interest, within a period of twenty years. Sir Charles Parsons has expressed himself similarly with regard to his gift. Through these gifts, and by the provision for their use in a single generation, the Association will be able to strengthen its powers of obtaining general attention for the objects of science, and of affording more steady assistance to scientific research in directions indicated as desirable during the deliberations of its various sections at the annual meetings.

WE learn with great pleasure that no less an artist than Sir William Orpen has consented to paint the portrait of Prof. J. A. Fleming, whose many friends and admirers, as we have already announced, are raising a fund for this purpose. The portrait is to hang in University College, London, with which Prof. Fleming has been so long and honourably connected, and no doubt Sir William Orpen's willingness to paint the picture is in part due to the fact that Sir William Orpen himself received his early artistic training at the Slade School, which is part of University College. A replica of the portrait is also to be presented to the Institution of Electrical Engineers, as representing the great scientific profession and industry for the advancement of which Prof. Fleming has done so much. In the popular view no doubt Prof. Fleming is chiefly known as the inventor of the famous 'valve', which, adapted as it has been in many forms to radio telegraphy and telephony, has made broadcasting possible. His other great activities as a teacher, and especially as a writer, must not, however, be forgotten. His many works, on alternating electric currents, on electric lamps, on electrical testing, and on electric wave telegraphy, are standard volumes, while his reminiscent account, "Fifty Years of Electricity," makes the most delightful and inspiring reading. It is an open secret that many years ago Prof. Fleming would, but for his unfortunate deafness, have been elected president of the Institution of Electrical Engineers, and to add to his many other qualifications for honour, he is well known as one of the most skilled and popular experimental lecturers on electrical subjects in the world. The subscription list for the portrait is still open, and intending contributors are asked to send their donations as early as possible to the honorary secretary of the Fund, Prof. W. C. Clinton, University College, Gower Street, London, W.C.1.

THE new science laboratories of the University College of North Wales, Bangor, were declared open on Tuesday, November 2, by Sir Joseph Thomson. A tour of inspection of the laboratories was made in the morning, and in the afternoon Sir Joseph addressed a gathering of about eighteen hundred people in the Pritchard-Jones Hall of the College. The science laboratories form part of the North Wales Heroes' Memorial, and consist of five separate buildings, which house the six Departments of Physics, Chemistry, Botany, Zoology, Agriculture, and Forestry. When completed, the whole memorial, which includes a memorial arch and a bursary fund in addition to the laboratories, will have cost a sum approaching 150,000*l.* Of this amount about 120,000*l.* has already been subscribed. The afternoon meeting was presided over by Lord Kenyon, president of the College. He read and presented to Sir Joseph Thomson an address in album form, and the laboratories were then thrown open to the public. The buildings are of one storey, with the exception of the agricultural block, which has two storeys. Each block covers a floor space of about

10,000 square feet. All the heating, gas, water hydrant, and electric mains which serve the different rooms are run in brick trenches under and between the buildings. By this means all the pipes and cables are readily accessible. Special mains have been laid by the Corporation. The physics block is furnished with a liquid air plant, and accommodation is provided for about 100 students and a dozen research men. Each research room is furnished with electric power supplies of 400 volts D.C.: 200 volts D.C., 150 volts from a battery (any voltage from 2 to 150 volts in steps of 2 volts can be obtained), and alternating current at about 220 volts and 50 cycles. The main laboratories, of which there are three, and the lecture rooms are provided with the same electric power supplies. The floors are of concrete, which is covered with cork lino for insulation purposes. The cable carrying the electric power and the battery leads run along shallow ducts in the floor. The department is furnished with a well-equipped workshop. A small hut has been erected a few yards away from the main physics building in which measurements in radio-activity will be conducted. The general lay-out and equipment of the other blocks are similar to those of the Physics Department.

THERE has recently appeared in the *Daily Express* a series of articles by leading men of science under the general title of "The Mystery of the Universe." The contributors are the Astronomer Royal (Sir Frank Dyson), Profs. Plummer, Eddington, and Andrade, Sir Oliver Lodge, and the Bishop of Birmingham (Dr. Barnes). The first four writers confine themselves in the main to an exposition of the leading facts and generalisations of modern physics and astronomy; Sir Oliver Lodge attempts "to weave together the four preceding articles and draw scientific conclusions"; and the Bishop of Birmingham considers the same material in relation to the much-discussed question of the connexion between religion and science. It is a matter for satisfaction that one of the principal London newspapers should publish such articles as these, and we hope the example will be followed by other daily papers from time to time. The influence of science on the life of the community is far greater than is commonly realised, and it is in every way desirable that at least the general outline of current research should be given as wide a publicity as possible. Nor can it be too strongly emphasised that this should be done by experts, and not by the ordinary reporter who, however well instructed he may be, has in practice often failed lamentably to give even an intelligible, much less an accurate, account of scientific matters. We offer our congratulations to the *Daily Express* on the excellent lead it has given in this direction.

A NOTEWORTHY feature of the series is that it deals exclusively with the physical sciences. Of the six contributors (considering only their scientific qualifications), three are astronomers, two physicists, and one a mathematician. This would perhaps seem fitting if the utilitarian aspects of science were in question, but they are scarcely mentioned; the emphasis, as the title indicates, is laid on the unknown and the unapplied, and the fundamental relationships between science, religion, and philosophy form the background, concealed or expressed, of the whole. The exclusion of biology is to be regretted, for a symposium on the mystery of the universe which includes no discussion of life from the scientific view-point, must necessarily be unbalanced. The expressed conclusion that physical discovery brings us no nearer to a solution of the problem of the nature of life and mind makes the omission even more striking. If, however, we may take the subjects dealt with, and the manner of their treatment, as indicative of the trend of public thought in these matters, the change from the bitter squabbles of the last century between would-be advocates of religion and science is as welcome as it is complete. There is no longer a *conflict* between religion and science; there is a *relationship*, perhaps not yet discovered completely, which we seem to be able to approach with greater chance of success along the road of cosmic physics than along that of biology. This is, perhaps, the greatest advance which scientific philosophy has yet made.

THE authorities of the Science Museum at South Kensington have instituted a series of exhibitions of apparatus used in, and results obtained by, recent research, and the first of the series is now open to the public free. It deals with work which has been carried out at the National Physical Laboratory in the Departments of Physics, Metallurgy, and Engineering. The new hygrometers for cold stores, new thermal insulators, protectors against X-rays, new high vacuum pumps, apparatus for predetermination of the acoustical properties of halls, the composition of steels and other alloys, and the detection of defects in their interior by X-rays, furnaces for metallurgical investigations, and methods of testing the lubricating properties of oils under pressure are all shown, and later in the month it is proposed to show some of the results which have been obtained by the Adhesives Research Committee of the Department of Scientific and Industrial Research. These exhibitions will enable the general public to understand readily the advances which are now being made by research workers in science and how they may be applied in industry.

FOR some time past many students and others interested in Africa have felt that a special organisation, framed on an international basis, is urgently needed for the study of African linguistics and culture. Such an institution was desirable not only to continue work such as that carried on by the Hamburg Colonial Institute before the War, but also to collate, supplement, and extend the work of existing organisations such as, in England, the African and Geographical Societies and the Royal Anthropological Institute. The aim of the projected organisation was practical as well as scientific: it was intended not merely to promote African studies in the widest possible sense; it was proposed that it should, as the result of such studies, lay down lines for, and participate in, educating and training the African

native, by stages suited to his mentality and culture, for the inevitable clash of cultures when he has to meet conditions arising out of the European occupation and exploitation of his country. As a result of invitations issued after a conference held in London in September 1925, a considerable body of influential support has been obtained. The International Institute of African Languages and Cultures, as the new organisation has been named, will include among its members accredited representatives of the African Society, the Advisory Committee on African Education of the Colonial Office, of which the Secretary, Major Hans Vischer, has accepted the vice-directorship of the Institute, the Royal Anthropological Institute, the School of Oriental Studies, the Advisory Committee on Bantu Studies in South Africa, the National Research Council of the United States, the principal universities and learned societies interested in African studies of France, Belgium, Italy, Germany, Austria, and Sweden, and the missionary societies, both Roman Catholic and Protestant. Sir Frederick Lugard will act as chairman of the executive council. M. Delafosse, the well-known authority on Africa, and Dr. D. Westermann, equally well known as an authority on African linguistics, will be joint directors. An extensive programme of work, to a great extent but not entirely, linguistic, has already been mapped out. Further particulars of the Institute and terms of membership may be obtained from the temporary offices, Lever House, Blackfriars, London, E.C. 4.

THE *Rand Daily Mail* for September 20 contains a notice of a conference to be held at Potchefstroom which will endeavour to prove scientifically "that no reconciliation is possible between Scripture and evolutionary science, and that evolution is a false dogma of pagan origin and anti-Christian character." Among the points to be proved are the following: That the Bible alone explains the origin, essence, and final purpose of things. That there is a generally accepted theory of evolution, but there are no experimental proofs. That the facts of palæontology do not point to the gradual development of forms, but are explicable on the hypothesis of catastrophic change. That the fabulous age of the earth ascribed to it by geologists is an uncalled-for speculation. That the intimate connexion between man and the apes has not yet been proved. With regard to man and the apes, that descent is not the relationship between them has already been pointed out to the Fundamentalists of America by Prof. Osborn; but as for the other points raised, it is not our business to refute, but to direct attention to them. If they were raised seriously in the interests of scientific truth, there would be no cause for uneasiness; but as this is evidently a definite effort on the part of a theological faction to influence and organise ill-informed public opinion, we must regard it in a very serious light. Those who suppose that the cause of religion is helped by this sort of thing are deceiving themselves; there is nothing that can possibly damage it more than this ill-advised propaganda. It is especially dangerous in countries where democratic institutions are combined with a not very high standard of general education. Sinister possibilities lurk behind this agitation, obscure as it may seem to those in England. Democracy, when it takes to persecution, can rival Torquemada, for from its verdict and sentence there is no appeal.

IN the *Nineteenth Century* for October Sir Frank Beaman has an article on "Psychology and Crime." He seems to be annoyed at the suggestion that psychology can have anything to offer towards the understanding of the criminal. With the actual administration of the law as it stands the psychologists would be quite in agreement with the writer. If the facts prove incontestably that A killed B, and if it is the law that any person who kills another is to be hanged, there is no more to be said. In law, though, as in other branches of knowledge, difficulties soon arise as to the exact connotation of the words and the exact sphere of application. It should be noted, too, that insanity is always "legal insanity"; insanity has a purely legal significance and has no place in medicine. Nearly half the article is by way of introduction, and we are given Sir Frank Beaman's views, expressed with dogmatic fervour, on the human factor in various sciences, political economy, the statistical method (which is very fallacious), the ignorance of medical practitioners (they do not know why some otherwise quite normal people are literally poisoned by eggs or by gooseberries), the variety of the human body, Mendelism (greatly over-vaunted), evolution (a question-begging term), psychology (the least trustworthy of the sciences), psycho-analysis (morbid and sensational), spiritualism (pretentious), the morbid taste of the general public, etc. The actual problem seems a little lost against this background. The general method is not unlike the Bellman's "What I tell you three times is true." There is something to be said for the more usual form of the statistical method.

THE Greenland expedition of the University of Michigan returned to America in September under the leadership of Prof. W. H. Hobbs, who gives, in *Science* of October 8, a short account of the work done during the summer. The base of the expedition was on Maligiak Fjord, fifty miles east of Holsteinsborg, where a meteorological station was set up. Pilot balloons were sent up to test the direction of the upper air currents. Some ninety balloons were traced to an average height of 7000 metres, several to 10,000 and one to 14,000 metres. Three meteorographs, with records intact, were recovered from *ballons-sondes* which had reached considerable elevations, in one case more than 1500 metres. An exploring party under Prof. Hobbs ascended the ice-sheet 100 miles east of Holsteinborg. Pilot balloons were traced to a maximum height of 5500 metres and wind observations were made at three-hour intervals at the surface. Self-registering meteorological instruments have been left at Holsteinborg to be used throughout the winter. Tidal observations were also undertaken. Prof. Hobbs plans to return to Greenland next summer with a larger expedition and to continue his studies of Greenland winds both on the margin and in the interior of the ice-sheet.

AN interesting correspondence in recent issues of the *Times* shows that the sound of the 'concentration shoot' at Portland on Saturday afternoon, October 30, was heard at great distances in the midland counties. There are records from Long Wittenham, near Abingdon (98 miles from Portland), Shipton-under-Wychwood and Shotover in Oxfordshire (103 miles), Bourton-on-the-Water in Gloucestershire (104 miles), Eton and Chertsey (108 miles), Bosbury in Herefordshire (112 miles), and Dunchurch near Rugby (141 miles). The wind at three of these places was roughly in the direction opposite to that of Portland. Moreover, the sounds were very distinct. At Eton and Bosbury the observers were working in their gardens. At Shotover, according to the president of Trinity College, Oxford, "the noise was so loud that we thought that it might proceed from some explosion at the Morris Motor Works, which lie to the south of the hill." The remarkable point about these observations is not so much the great distances of the places, but the unusual loudness of the sounds, which suggests that the places mentioned lie in an outer sound-area separated from the source by a silent zone.

THE paper read by Messrs. J. Beard and T. Haldane to the Institution of Electrical Engineers on November 4 was a very timely one, as they discuss the possibility of standardisation in the design of the systems used for distributing electric light. It seems certain that in ten years' time the supply of electricity to consumers in Great Britain will be at least doubled. It is very advisable, therefore, that piecemeal extensions of the various supply networks such as have sufficed in the past should no longer be made. The present time is most suitable for getting all the benefits of standardisation. The suggestions made are very helpful. Engineers have just adopted 230 volts as the standard pressure. One of the reasons for adopting this somewhat odd number is that when a three-phase system is used and 230 volts is used for lighting, 400 volts is available for power. As one of the pressures is equal to the other multiplied by the square root of three, it is impossible to make them both decimal. In the system of distribution proposed by the authors, the distributing pressure from the substation would be at 11,000 volts. It would then be transformed down to 400 volts and 230 volts by a four-wire three-phase distributing system. Continuity of supply is secured by having a duplicate high voltage supply. The low voltage cables are very convenient, having four equal cores inside a lead covering. The costs, however, which are independent of the load, are very large, the main item being the high cost of excavation for the distributor cables. This accounts for the rapid rate at which the total costs per unit delivered decrease with the load. If the load is doubled they are reduced by about one quarter. In our opinion, the adoption of a standard system such as that suggested by the authors would be in the interest both of the industry and of the country.

A PROPOSAL for a meteorological cruise in the Atlantic in 1927 is suggested in the *Meteorological Magazine* for September. The cruise is to honour the memory of Colonel Chaves, the founder of the Meteorological Service of the Azores. The meteorological observations from the Azores were transmitted free by the Portuguese Government and have in the past added much to the possibility of successful forecasting of the weather in the British Isles. There is an eclipse of the sun on June 29 next year, of which the line of totality crosses the Irish Sea, and this is suggested as a starting-point. It is proposed that the cruise should occupy about 25 days, beginning with June 28. Readers of the *Meteorological Magazine* and others disposed to join in such a cruise are asked to communicate with Mr. C. J. P. Cave, vice-president of the Royal Meteorological Society, or with Sir Napier Shaw, lately Director of the Meteorological Office.

To the four series of picture postcards devoted to precious stones, and the two series representing decorative stones, the British Museum (Natural History) has now added two further series (D9 and D10) of cards illustrating crystals (London: British Museum (Natural History). 1s. each set). As before, each set consists of six attractively printed cards, accompanied by an explanatory leaflet. The leaflet includes a masterly little essay on crystallography, ranging in its scope from Steno's fundamental law of angles, announced in 1669, to the work of Laue and the Braggs on X-ray analysis. The first set of cards gives examples of cubic, tetragonal, hexagonal, and rhombohedral crystals; and the second of the remaining systems and of twin-crystals. Both in accuracy and attractiveness of reproduction, and in educational value, these new series fully maintain the high standard achieved by previous issues.

SENATORE G. MARCONI has been elected an honorary member of the Institution of Electrical Engineers.

DR. W. H. STEAVENSON, who contributed the article on Mars to our issue of November 6, has been elected president of the British Astronomical Association in succession to the Rev. C. D. Percy Davies.

IT is gratifying to note that Mr. Mackay, who for several seasons past has been engaged in excavation at Kish in Mesopotamia, has been engaged by the Archæological Survey of India to work on the sites in the Indus Valley on which remains of the earliest culture yet known in India, including the famous pictographs of Sumerian type, were discovered. Mr. Mackay's knowledge of Mesopotamia will be invaluable in these excavations should further material bearing any resemblance to Sumerian antiquities be brought to light.

THE Trustees of the Beit Fellowships for Scientific Research announce that Sir Otto Beit has promised to hand over to them a further sum of 15,000*l*. This will enable the Trustees to make all their appointments to fellowships for two years, instead of one year as has happened in the past. The fellowships are tenable at the Imperial College of Science and Technology, South Kensington, and since the foundation of the fund in 1913 there have been eighteen appointments. The extension of tenure will add considerably to the value of the fellowships from the point of view of the promotion of fundamental research.

SIR FLINDERS and Lady Petrie and other members of the British School of Archæology will leave in the course of a few days for Palestine, where the winter will be spent on excavating Egyptian remains in the southern area of that country. As announced since last season, the School, for the present at any rate, will discontinue work in Egypt itself owing to the difficult conditions in which archæological research has now to be carried on. While it is not possible at this moment to mention any specific object in view, there are many problems requiring investigation. The work of the expedition will depend upon circumstances; but no doubt Sir Flinders Petrie hopes to secure further evidence bearing upon the Badarian culture, which, on his view, reached Egypt through Palestine.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A professor of physiology in Presidency College, Calcutta—The Secretary to the High Commissioner for India, 42 Grosvenor Gardens, S.W.1 (November 20). A Principal of the Municipal Technical College, Dewsbury—The Secretary for Education, Town Hall, Dewsbury (November 20). A Warden of the Farm Institute and Experimental Station at Askham Bryan, near York—The Joint Clerks, Yorkshire Council for Agricultural Education, County Hall, Beverley (November 30). An assistant horticultural instructor under the Kent Education Committee—The Director of Education, Springfield, Maidstone (November 24). An assistant lecturer in chemistry at University College, Swansea—The Registrar, Singleton Park, Swansea (November 27). A Vice-Warden for Ashburne Hall of Residence for Women Students of Manchester University—The Honorary Secretary, Ashburne Hall, Fallowfield, Manchester (November 29). An assistant lecturer in agricultural chemistry in the University of Leeds—The Registrar (November 30). A radiologist in the medical department of the Federated Malay States—The Private Secretary (Appointments), Colonial Office, 38 Old Queen Street, S.W.1 (December 4). An assistant in the department of zoology of the National Museum of Wales—The Director, National Museum of Wales, Cardiff (December 4). A professor of physical chemistry in the University of Bristol—The Registrar (December 10). A teacher of geography and mathematics at the Borough Polytechnic Institute—The Principal, Borough Road, S.E.1.

Our Astronomical Column.

COMETS.—Neujmin's periodic comet, 1916 II., has been detected by its original discoverer, Mr. Neujmin (presumably at the Simeis Observatory, Crimea), on Nov. 5 at $1^h\ 37{\cdot}9^m$ U.T. in R.A. $10^h\ 10^m\ 56^s$, N. Decl. 18° 29′, magnitude 14·5. The date of perihelion deduced from the R.A. is Jan. 15·93, 1927, from the Decl. Jan. 15·80, 1927. The evidence is, on the whole, against the identity of the doubtful object photographed in 1920 with the comet, but is not yet decisive. The comet is approaching both sun and earth, so should become considerably brighter. The following corrected ephemeris is for 0^h U.T.:

	R.A.	N. Decl.	log r.	log Δ.
Nov. 16	$10^h\ 43{\cdot}1^m$	14° 36′	0·1689	0·1411
20	10 54·9	13 1		
24	11 6·7	11 22		
28	11 18·5	9 38		
Dec. 2	11 30·2	7 50	0·1546	0·0922

A doubtful object (comet or minor planet) of the twelfth magnitude was discovered by Prof. J. Comas Sola, of Barcelona, Nov. $5^d\ 0^h$, R.A. $2^h\ 56^m\ 36^s$; N. Decl. 6° 31′; daily motion—1^m, south 3′. Later: Mr. B. M. Peek and Mr. G. Merton confirm the cometary character of the observations on the morning of November 10.

GIACOBINI'S COMET AND THE METEORIC DISPLAY OF OCTOBER 9.—Mr. W. F. Denning writes: "It appears certain that on October 9 the earth intersected a point in the orbit of Giacobini's comet, but that this point was about two months in front of the comet. The latter is due at perihelion on about December 10 next, so that taking the rate of velocity of the meteors at 14½ miles per second, as computed by the Rev. M. Davidson, the comet's place on October 9 was about 77 millions of miles distant along the orbit from the point of intersection with the earth on the above date. In 1900 the nearest approach of the two orbits was about 5½ millions of miles, but perturbations since that date have sufficiently disturbed the orbit of the comet to make it intersect that of the earth at this return. Had the comet arrived at perihelion two months earlier this year, the conditions would then have favoured a meteoric display of exceptional grandeur. Dr. A. C. D. Crommelin's position for the cometary radiant is 265° + 54°, Mr. Prentice's radiant for the meteor shower was 263° + 54°, and the radiant of the fireball of October 9, as deduced by Mr. King and myself from a number of observations, is 262° + 55°, so the agreement is very good and near β Draconis."

MARS.—*Popular Astronomy*, Nos. 7 and 8, contain Report No. 37 of Prof. W. H. Pickering on the 1924 apparition of Mars. He commences with a discussion of the rotation period, and concludes that when allowance is made for Marth's change in the adopted position of Mars' axis in 1896, the period now generally employed, $24^h\ 37^m\ 22^s{\cdot}65$, represents the observations of the last fifty years. The research is complicated by the considerable changes of size and shape to which some of the dusky markings are liable.

In discussing various drawings of 1924, Prof. Pickering notes that there is considerable agreement among observers as to the position of the canals, but there is much personality as to the width assigned to them. An objection frequently brought by M. Antoniadi against the objective reality of the canals, based on their being drawn straight when far from the centre of the disc, is answered by a careful observation of the canal Amenthes-Thoth on October 19 and 20, 1924; it was respectively 16° east and 16° west of the centre of the disc. The curvature was clearly reversed in the two drawings, which corroborates the objective reality of the marking, and its close adherence to a great circle.

Proceeding to the question of the nature of the canals, Prof. Pickering notes his own opinion that the supposition of their being artificial explains more facts than any other, and that the regular patterns, such as pentagons and stars which were seen in 1892, 1907, and 1924, point in the same direction. He does not claim it as more than an hypothesis, but he considers that it is rendered more probable by his own observations of Martian clouds in 1922, and Dr. Wright's photographs in infra-red light in 1924, which indicated a considerable amount of atmosphere.

Research Items.

AN EARLY ESKIMO CULTURE IN ALASKA.—In a communication issued by the Victoria Memorial Museum, Ottawa, Mr. Diamond Jenness, Chief of the Division of Anthropology, reports on the results of four months' field-work in Alaska, where he excavated ancient ruins and studied local dialects with the object of determining the origin and antiquity of an Eskimo civilisation which has left traces in Canada extending from the Mackenzie River Delta to Hudson Bay. At Wales, the point of Alaska nearest to Asia, ruins were discovered belonging to four distinct periods, all preceding the discovery of Alaska by Europeans. The remains of the second period resembled very closely those of the oldest known ruins of Arctic Canada. Excavations on the Diomede Islands confirmed those at Wales, and revealed a still earlier culture, of which there is no trace in Canada. The most characteristic feature of this culture was a style of curvilinear engraving unlike anything known of Eskimo art elsewhere, ancient or modern. Its source must be sought either among neighbouring Indian tribes or in north-east Asia. In regard to the former suggestion, it is to be noted that local Eskimo folklore and traditions show strong Indian influence, to be seen also in the masked dances, the use of body armour of bone or ivory, and certain sounds in the language. An antiquity of some 1000 to 1500 years is tentatively assigned to the earliest culture.

DIDINGA WITCHCRAFT.—In *Sudan Notes and Records*, vol. 8, Mr. J. H. Driberg, in the course of notes on Didinga customary law, refers to the penalties imposed on witches and wizards, and gives some indications of the character of the belief among these people. The practice is very prevalent and is usually associated with the use of poison. The influence of the evil eye is greatly feared, but does not belong to witchcraft proper, to which, however, the habit of bestiality, presumably a sexual abnormality, is attributed as a practice intended to injure live-stock. The wizard attains his object by dances. To secure the death of a man, a dance is performed at night at his door; to injure his crops, the dance takes place in the crops, but not necessarily at night. The dead are disinterred by wizards, who are fond of dancing by new graves. A wizard caught performing his dances invariably begs for compassionate treatment and proffers a spear, an axe, or a bracelet, which, if accepted, is carefully hidden away. Notwithstanding promises of amendment, the wizard continues his dances, the evidence in the form of the objects accepted as ransom accumulating until the wizard is seized and arraigned before a council, by which he is sentenced to death and hanged. A goat is sacrificed at his funeral. The wizard's powers are transmitted to another, with or without his knowledge, by a certain drug served in a pot of beer. Involuntary witchcraft so induced is an adequate plea at trial provided the principal wizard who was responsible is denounced. The wizards are all highly strung and hysterical, and are capable of self-delusion to such an extent that they believe themselves invisible when dancing on cultivated ground.

FISH PASSES. — In a very interesting paper (*Fisheries, Scotland, Salmon Fish.*, 1926, II. Edinburgh and London: H.M. Stationery Office, 4*s.* 6*d.* net), Mr. W. L. Calderwood gives accounts of different salmon passes that have been constructed from time to time. These descriptions, together with photographic illustrations, show the gradual evolution of the modern type of pool pass from the original ladder pass, through such forms as the Bracket pass and many others fitted with baffle arrangements. There are many factors to be borne in mind in building a pass, and it is largely from the comparative failure of previous types that the most modern forms have been evolved. Of special importance in the British Isles is the fact that spring-running salmon are not jumpers, and will not face a strong rush of white superaerated water when that water is cold (below 40° F.). For such fish, then, the gradient of the pass must be easy, with no falls necessitating jumps; the velocity also must be sufficiently slow and regular to allow plenty of black water. Of paramount importance is the position of the outflow of the pass; this should be near to the obstruction to be avoided and close to the usual lie of running fish; it should also discharge a sufficient flow of water to be attractive. The protection of the inflow from flood water and the carrying of stones and gravel into the pass is necessary. The most modern pass consists of a series of pools with only slight drops between, a protected entrance for the water and an arrangement of movable sills, worked by floats, ensuring the passage of the same flow of water through the pass at all levels of the river, whether in flood or drought. Plans of two new passes designed by Mr. Rook for the river Tummel are given.

FUNGAL SYMBIOSIS.—In a communication to the Reale Accademia delle Scienze dell'Istituto di Bologna (*Rendiconti*, Vol. 29), Prof. Fausto Morini describes three examples of the parasitic existence of one fungus on another. In the case of a spermogonial form of *Phyllosticta parassitica* growing on the perithecia of *Uncinula salicis*, the injurious effect of the parasitic organism on the development of the host is apparent from the diminished number and size of the ascospores. In the second case, the host consists of a species of mucor resembling, in the ramification of the sporangiophore hyphæ, a reduced and modified form of *M. racemosus*, although it appears to be allied also to *M. corymbosus*. The parasite, a species of Piptocephalis, differing slightly from *P. Freseniana*, especially in the characters of the haustorial hyphæ, penetrates the mycelial hyphæ of the mucor and branches freely therein. The third example is that of *Piptocephalis microcephala* on *Pilobolus crystallinus*. A scheme of classification of the principal fungal symbioses is appended to the paper.

ABNORMAL FERN PROTHALLI.—Miss E. Schindler has found that the spores of *Asplenium septentrionale*, *A. trichomanes*, *Dryopteris filix mas*, and *Polypodium vulgare* will germinate when submerged beneath a liquid nutrient medium. Under these conditions they give rise to long filamentous structures, the cells dividing generally only by walls in one plane. These filamentous prothalli branch fairly freely. Neither the normal meristematic growth of the prothallus nor the formation of archegonia, follows in these prothalli unless they succeed in raising themselves out of the liquid medium into the damp air above it; antheridia occur sometimes on the submerged prothalli when growing in nitrogen-free culture media. This work was carried out by Miss Schindler at Cracow, under the guidance of Prof. Rouppert, and is published in the *Bulletin International de l'Académie polonaise des Sciences et des Lettres*, No. 5-6 B, June 1925.

POTATO MOSAIC AND TEMPERATURE.—The so-called 'virus' diseases are occupying considerable attention at present, and although 'leaf-roll' of potato is the form to which is attributed the greatest

potency in inducing degeneration in English potato crops, those forms of mottled or puckered foliage connected with 'mosaic' are not infrequently reported. Considerable interest therefore attaches to the American experience recorded by C. M. Tompkins (*Phytopathology* 16, 581-610, September 1926) as the result of his work at the Department of Plant Pathology, University of Wisconsin. Tompkins reports that air temperatures of 23° to 24° C., even though only occasionally prevailing, are sufficient to mask completely the existence of mosaic in diseased stock when judged by the ordinary diagnostic symptoms. If the plants are afterwards kept at lower temperatures, characteristic mosaic symptoms are again developed. On the other hand, under histological examination the leaves of the diseased plants in which the disease is masked are said to show marked deviation in structure from healthy leaves, both palisade and spongy parenchyma of the mesophyll being very regularly arranged so that air spaces are almost completely eliminated.

FOSSIL LEAF-BEDS IN VICTORIA.—In Miocene times in Victoria, the country adjacent to the shoreline, then 40 to 70 miles inland from the present coast, was in places marked by a lacustrine phase. It was then that large lake deposits were formed consisting of ferruginous mud or slime, fine pipe-clay or silty material. Into these lakes were swept large quantities of leaves of the Miocene forest and brush. The leaves are well preserved and are now found in the ironstones and pipe-clay deposits in seven localities in Victoria. These fossil leaf-beds have been found at Pitfield, Bacchus Marsh, Berwick, Bogong, Cobungra and Dargo. Through some recent studies of the Tertiary flora of the sandstone and quartzite of Narracan in Gippsland (*Proc. Roy. Soc. Vict.* Vol. 38, 1926, pp. 183-191), Frederick Chapman has added several new forms to the known list of fossil plants from the earlier localities mentioned. The Narracan flora comprises a eucalyptus of a modern coastal type, the myrtle beech (Nothofagus), the flame tree (Sterculia), the kanooka (Tristania), the cinnamon, and other Australian genera. Although of Miocene age, these deposits contain several types of leaves still existing in Victoria, mingled with others now belonging to areas situated in lower latitudes, as New South Wales and Queensland. Another point clearly established in this paper is the relatively older age of the Narracan leaf-beds as compared with the leaf-beds in the brown coal of Morwell and Yallourn.

MESOZOIC GEOLOGY OF ALASKA.—*Bulletin* 776 of the U.S. Geological Survey, by G. C. Martin, 1926, contains a valuable record of the advances made in Alaskan geology during the present century. Mesozoic history provides by far the most important clues to the present structure of the Peninsula, and has a direct bearing on the mineral resources. At the end of the Palæozoic there was a widespread emergence of the land accompanied by intense and long-continued vulcanism. Profound marine submergence followed in Upper Triassic times, but the sea withdrew from the entire area during the late Triassic and early Jurassic, and the rocks already deposited were folded. Marine transgression began afresh in the Lower Jurassic, and widespread vulcanism again broke out, culminating in great granitic intrusions with accompanying formation of ore deposits. The Jurassic was brought to an end with vigorous uplift and erosion. The sea again swept over Alaska in Lower Cretaceous times, receded at the beginning of the Upper Cretaceous, and then advanced again. Finally, the submergence of the Upper Cretaceous slackened, marshes were formed and coal-beds deposited. The end of the Mesozoic and the beginning of the Eocene were marked by the complete withdrawal of the sea, a renewal of folding movements and intense vulcanism, intrusion, and mineralisation. A geological map of Alaska is now in preparation and will shortly be available.

ECONOMIC GEOLOGY OF CANADA.—The Geological Survey of Canada has published on this subject an extremely valuable and well-illustrated memoir by G. A. Young (No. 1 of the *Economic Geology Series*). Having regard to its physical features and geological structure, Canada is naturally divisible into six major regions. The Arctic archipelago and the Hudson Bay lowland contain extensive deposits of coal. The Canadian Shield is a U-shaped area bordering Hudson Bay, made up of ancient rocks, in which have been developed the Sudbury nickel-copper mines which are the world's chief source of nickel, the spectacular gold mines of Porcupine and Kirkland Lake, and the rich silver deposits of the Cobalt district. In the Appalachian and Acadian region are the asbestos deposits of south-eastern Quebec and the coal-fields of Nova Scotia. In the St. Lawrence region to the south occur the salt beds and petroleum fields of Ontario. The Interior Plains lie between the Canadian shield and the mountains to the west, and are underlain by vast reserves of coal. The Cordilleran region borders the Pacific, and in addition to extensive coal-fields it is noteworthy for the wealth of its placer gold-fields, copper-gold ores, and silver-lead-zinc ores. It is noteworthy on the negative side that Canada does not rank as a producer of aluminium, tin ores, or of precious stones. An excellent geological map accompanies the memoir, and a mineral map in which every important occurrence is numbered; an annotated list gives details of each.

TWILIGHT PHENOMENA.—In the *Denkschriften der Schweizerischen Naturforschenden Gesellschaft*, 62, 1926, there are two memoirs only, of which the first, of 190 pages, is by P. Gruner. It is the second of a series by this author, under the general title of "Contributions to the knowledge of twilight phenomena and of the Alpine glow"; the former paper (of 154 pages) gave a historical-chronological review of Swiss observations and publications on twilight colours and the Alpine glow. The present paper is a similar review of non-Swiss observations and publications on twilights, atmospheric-optical disturbances, and related phenomena. As the extent of the memoir indicates, the author has cast his net widely and summarises an immense mass of literature, which he also indexes under the names of authors, with references, forming a bibliography. The subject is so large when the term "related phenomena" is interpreted generously, as in this case, that completeness is neither attained nor to be expected. But the memoir should be of real value to investigators whose work bears on these fields.

THE LAW OF SPEED RECORDS.—In 1906, Prof. A. E. Kennelly published a paper on "An Approximate Law of Fatigue in the Speeds of Racing Animals," noticed at length in NATURE, vol. 75, p. 463. In this he showed that if L is the length of the race in metres, T the time occupied by the winner in seconds, and V the mean speed in metres per second, we have approximately

$$T = \frac{1}{c} L^{9/8} = \frac{c^8}{V^9},$$

whatever the type of race. If $\log L$ is plotted against $\log T$, for example, different types of race give parallel straight lines. Prof. Kennelly has now published a second paper, "Changes during the Last Twenty Years in the World's Speed Records of Racing Animals"

(*Proc. Amer. Acad. Arts. Sci.* vol. 61, No. 11, 1926), in which the records created since the first paper was written have been included. Only two classes of events show an appreciable general increase in speed: men swimming by about 10 per cent., and horses running by about 2 per cent. In all other cases the new records fit reasonably well to the lines previously given. The records for horses, running or pacing, show as before far the best fit to the straight-line law, and bicycling records still form an apparent exception to the rule. The conclusion deduced that speed should be maintained at a uniform level throughout the race is in accord with the work of A. V. Hill.

DIAMAGNETIC GASES.—Recently, E. Zehrer (*Zeit. für Phys.* vol. 37, p. 155, 1926), using an independent method, failed to confirm the experimental results obtained by Glaser, namely, that the specific susceptibilities of the diamagnetic gases hydrogen, nitrogen, and carbon dioxide were dependent on the pressure. It is therefore interesting to note that G. W. Hammar (*Proc. Nat. Acad. Sci.*, Oct. 1926), who employed the same method as Glaser, has found these susceptibilities to be independent of the pressure over a range from zero to one atmosphere. In searching for a possible source of error which might explain Glaser's results, Hammar found that a slight trace of moisture produced the effects described by Glaser, and he suggests that the difference between the two sets of results may be due to an adsorbed layer of water vapour on the surface of the test body. Hammar also directs attention to the need of greater reliability in the determination of the susceptibility of gases, since two of the latest and most careful determinations of the susceptibility of oxygen differ by 4·5 per cent., although each observer claims an accuracy of 0·1 per cent.

HEAT TREATMENT OF GAS CYLINDERS.—The second Report of the Gas Cylinders Research Committee, which has recently been issued, is concerned with the periodical annealing of cylinders. It was a recommendation of the Home Office Committee of 1895 that all cylinders of wrought iron or mild steel should be annealed every four years. On the other hand, the present Committee, in its first Report of 1921, considered that cylinders of 0·45 per cent. carbon steel should not require re-annealing during their life of fifteen to twenty years. The later experiments show that annealing, which is usually conducted at 650° C., and may be continued for many hours, is harmful. If the steel be overstrained and then annealed, the structure is altered, the ferrite and lamellar pearlite being replaced by ferrite with globular cementite, the size of the particles increasing with the time of annealing. This change is accompanied by a fall in the tensile strength and by an increase in brittleness, as shown by the Izod test. On the other hand, normalising, or heating to a temperature 50° above the critical point and then cooling in air without exposing to draughts, has no evil effects, and the injury done by overstraining followed by annealing may be almost completely corrected by such a treatment. The proper temperature is 900° for a 0·25 per cent. carbon steel and 850° when the carbon is 0·45 per cent. With properly made cylinders, a single normalising treatment after manufacture is all that is necessary. As it has been supposed that rough handling, involving jarring, may induce brittleness, experiments on the effect of repeated hammering have been made, with the result that the steel is not found to be rendered brittle by such treatment.

THE SUPPOSED REGENERATION OF ENZYME ACTIVITY.—During the past few years, various investigators have published experimental results which appear to indicate that certain enzyme solutions are able, after being boiled for some minutes, to recover partially their lost enzymic activity. Experiments made by Prof. Ivo Novi, and described in the *Rendiconti della R. Accademia delle Scienze dell' Istituto di Bologna* (Vol. 29), help to prove, as was shown by Pasteur more than sixty years ago, that such phenomena are not observed when care is taken to prevent access of air-borne micro-organisms to the solutions.

HEATS OF CRYSTALLISATION.—The heats of crystallisation, Q, of seven more members of the homologous series of normal monobasic fatty acids, obtained by W. E. Garner, F. C. Madden, and J. E. Rushbrooke, are to be found in the September issue of the *Journal of the Chemical Society*. With the exception of stearic acid, the data for all the even acids up to C_{20}, and all the odd acids except three, are now available. As the series of acids is ascended, marked alternation in the values of Q is shown, and this is ascribed to an alternation in the arrangement of the terminal groups in passing from one acid to the next. An alternation in the melting-points of both odd and even members exists, and the two melting-point curves converge and approach a maximum at 115°. No evidence of alternation was obtained for the specific heats of the acids in the liquid state.

RADIATION THEORY OF CHEMICAL ACTION.—In a memoir published in the *Rendiconto dell' Accademia delle Scienze Fisiche e Mathematiche della Società Reale di Napoli*, Fascicoli 4-8, April-August 1926, Prof. Francesco Giordani proposes a modification of the formula connecting reaction velocity, k, with radiation density, u_ν, proposed by Lewis :

$$k = \frac{\pi c^2}{3mh\nu} u_\nu N.$$

He supposes that it is necessary to take into account the number of vibrations in the molecule r, which he puts equal to the number of ordinary chemical valencies concerned in the reaction, and instead of u_ν he uses $u_\nu^{1/r}$. When the modified Planck expression for u_ν is substituted in the equation, raised to the power $1/r$, it is shown that the results are in fair agreement with experiments on the decomposition by heat of phosphine, nitrogen pentoxide, and ozone (bimolecular). The great deviations between calculation and experiment which have previously appeared are then avoided.

THE DETERMINATION OF γ BY THE METHOD OF CLEMENT AND DESORMES.—The determination of the ratio of the specific heats of a gas by Clement and Desormes' method may be made to depend on measurements of temperature and pressure differences resulting from an adiabatic expansion or contraction (Lummer and Pringsheim, Partington, etc.) The adiabatic change is obtained by momentarily connecting the gas, contained in a vessel under a slightly different pressure, with the atmosphere. It has been known to all previous workers that equilibrium is not established instantaneously, but in a time which depends on the shape and size of the orifice, the volume of the vessel and the pressure difference. In the *Proceedings of the Indian Association for the Cultivation of Science*, for August 15, 1926, G. Subrahmaniam and G. Gunnayia show how to calculate approximately the time necessary for the pressures to equalise, in terms of quantities found in the experiments. Their results indicate that the size of the aperture does not have any great effect when the temperature measurements are employed to calculate γ, but when the pressures are measured, overshooting takes place if the opening is too large. In fixing the lower limit for the size of the aperture the effect of radiation has to be considered.

The Nutrition of Cattle.

IN a previous article in our columns (NATURE, 1925, vol. 116, p. 175) an account was given of some aspects of the feeding of cattle, including the method of indirect calorimetry, by means of which the value of different foodstuffs for maintenance and production can be determined, opportunity being taken at the same time to consider the relationship between the protein of the diet and the milk. The values assigned to different foodstuffs in nutrition depend not only on the accuracy of the experimental data from which they are estimated, but also on the correctness of the principles of the method of calculation used; that finality has not been reached in either case appears from a number of papers which have recently been published dealing with the various methods and their difficulties, both of technique and of interpretation. Probably the most important general figure for a foodstuff is its net energy value, that is, the amount of energy contained in it which is available for maintenance and production after deducting the non-utilisable energy and that necessarily expended in the actual processes of utilisation of the remainder.

The net energy value can be determined *directly* by means of the animal calorimeter. The heat given off by the animal is deducted from the energy value of the food as determined in the bomb calorimeter, the difference giving that available for the maintenance or increase of body weight, and for the production of milk. The method requires the use of complicated apparatus and a great attention to detail: to ensure accuracy, a number of corrections must be applied to the experimental results (M. Kriss, *Jour. Agric. Res.*, 1925, vol. 30, p. 404), but with proper precautions the heat production can be satisfactorily estimated to within 1 per cent.

On the other hand, this estimation can be made *indirectly*, either by the use of the animal calorimeter again, but determining the oxygen consumption and the carbon dioxide production (instead of the heat emission) and calculating the latter from the amounts of protein, fat, and carbohydrate oxidised in the body, as determined from the respiratory exchange and the respiratory quotient, or, more simply, by deducting from the energy of the food the energy of the excreta plus that of the body tissue gained as determined from the nitrogen and carbon balances. This latter method is the one more generally used and gives results which compare well with the direct method (M. Kriss, *loc. cit.*, p. 393): its most serious source of error appears to be the loss of material, from the urine and fæces, presumably through fermentation, during drying, preliminary to the determination of the energy value of the excreta in the bomb calorimeter: this loss can be minimised by drying at a low temperature.

In using the second of the two indirect methods described above, the 'balance' method, a source of error may be introduced by irregularity of excretion; thus the fæces of a given period may not correspond accurately to that period, and this is especially the case when the diet is varied. R. W. Swift (*Journ. Dairy Science*, 1925, vol. 8, p. 270) has made a study of the weights of fæces in metabolism experiments of varying length with cows and bullocks, and has found that the chances are 31 to 1 that, with an eight-day collection period, the errors of the averages will not exceed 7 per cent. and 5 per cent. respectively: it is probably better to ignore the first few days on a new ration: hence the entire period should last about a week.

If an animal neither loses nor gains weight over an experimental period, the heat production will equal the available energy of the food: but only rarely does this occur; usually the calculated energy of the flesh and fat formed or lost from the body must be subtracted from or added to the energy of the ration, to give the maintenance requirement. It is possible to avoid the calculation of the energy of the body tissue gained or lost by feeding the animal on two differing sub-maintenance rations, and calculating from the lessened loss of energy from the body on the higher ration, the increased amount of energy which must still be added to the latter to prevent any loss from the body; at the same time an estimation can be made for the heat production of the body when no food whatever is given. By increasing the diet above a maintenance value it is possible to obtain a figure for the amount of food which must be added for each pound of body fat laid on, an extremely important calculation for the fattening of animals.

Two assumptions are made in these calculations, which have been used chiefly by Armsby and Kellner respectively, as is pointed out by J. Wilson (*Scient. Proc. Roy. Dublin Soc.*, 1925, vol. 18, pp. 77 and 117): first, that the maintenance requirement is the same whether food is being taken or not, or whether the ration is large or small, and secondly, that the maintenance requirement found with one type of food applies equally if the nature of the ration be changed, provided it has an equal calorific value. Wilson has made a critical examination of some of Kellner's and Armsby's results, from which he concludes that straw, for example, is less efficient than hay, as a ration, and that the food required by the bullock, whether idle or fattening, rises with the amount and kind of long fodder in the ration and also with the rate at which fat is being put on. Thus the maintenance requirement rises with an increase in the ration; in part this is due to the ensuing stimulation of metabolism which always occurs after food, so that the body lives less economically and a proportion of the energy of the food is wasted as useless heat. The increased heat production after a meal, especially one containing protein, is a well-known phenomenon. It is thus difficult to apply results obtained with one kind of food to an experiment in which another ration is given, or to assume that the energy value of a food will be the same at whatever level it is fed. Accurate results will be obtained only when the ration given is just sufficient for maintenance.

The force of these criticisms, however, is somewhat reduced by improvements in the methods of calculating results, including the adjustment of the daily heat production to a figure representing a standard day of twelve hours lying and twelve hours standing, as well as by improvements in technique. The latest method of calculation of the net energy values of feeding stuffs and some of the results obtained are given in a series of papers from the Institute of Animal Nutrition, Pennsylvania State College (M. Kriss, *Jour. Agric. Res.*, 1925, vol. 31, p. 469; E. B. Forbes and M. Kriss, *ibid.*, p. 1083; E. B. Forbes, J. A. Fries, and W. W. Braman, *ibid.*, p. 987; D. C. Cochrane, J. A. Fries, and W. W. Braman, *ibid.*, p. 1055; E. B. Forbes, *Proc. Am. Soc. Animal Production*, 1924, p. 23, and *Science*, 1926, vol. 63, p. 311; and E. B. Forbes, J. A. Fries, and M. Kriss, *Jour. Dairy Science*, 1926, vol. 9, p. 15). The animal is given different rations during a series of experimental periods: by subtracting the heat production of a period on a lower diet from that of one on a higher ration, the increased heat production due to the increase in the food is obtained. The net energy required for maintenance is the total heat production

in the period minus the total increase in this value due to the food, calculated from the average of the figures previously obtained. The total net energy of the ration is the *average* net energy for maintenance as found in the different experimental periods in which the particular food under consideration was used, plus the energy gained by the animal, which is determined by subtracting the total heat production from the metabolisable energy of the food.

By this method it is found that the results obtained in the different experimental periods usually agree fairly well, and it is easy to see and discard any abnormal set of figures. The authors are inclined to consider differences in maintenance requirements in different periods as due to experimental errors rather than to differences in the rations or in the plane of nutrition of the animal. On the other hand, from experiments on fasting animals it appears that energy is more efficiently utilised in sub-maintenance periods, so that consistent figures for net energy values of rations are more likely to be obtained when the plane of nutrition in the different periods does not vary too greatly, and thus that the results should be considered as applying accurately in other cases only when the animals are kept at a somewhat similar level of nutrition. A further point to which attention may be directed is the applicability of results obtained with a particular breed to animals of another breed or in a different country where the rations are almost certain to be different. F. J. Warth, L. Singh, and S. M. Husain (*Memoirs Dep. Agric. India*, 1926, vol. 8, p. 153) have established certain differences between their animals and those used in America in considering the requirements for milk production with Indian foodstuffs. These differences affect primarily the digestibility of the rations, due in part to their actual nature, but at the same time individual animals have their own characteristics.

In conclusion, it may be stated with confidence that there appears to be sufficient accurate knowledge of the efficiency of different rations for maintenance and production to enable the practical farmer to select from those available to him the most economical in meeting his requirements.

Marine Biology at Plymouth.

THE latest number of the *Journal of the Marine Biological Association* (N.S., vol. 14, No. 2, August 1926, 10*s*. net) is full of good things. Dr. Orton resumes the interrupted publication of his studies on the rate of growth of marine organisms with a paper on the cockle. The investigations were carried out mainly in an experimental box laid down in the estuary of the river Yealm, in which the growing cockles were exposed to practically natural conditions, and the results have been checked by observations on near-by cockle beds. Apart from the definite determination of growth-rate—a matter of some economic importance, though it may be expected that the growth-rate will vary in different localities—the main interest of the paper lies in the study of the growth rings on the shell. It appears that, in the main, the deeply marked rings do indicate the winter checks in growth, and may be used—with caution—to determine the age of the cockle. Dr. Orton has, however, made the interesting observation that the mere removal of the cockles from the box for an hour or so for the purpose of examination suffices to cause the appearance of a " disturbance ring " on the shell. Specially well-defined rings are induced by the technique adopted of marking the shells for identification purposes with a file. Such disturbance rings can also be induced in the mussel. Further, in mild winters the winter-ring may become extended and spread out into several rings, so that accurate determination of the age by means of winter-rings is a matter of some difficulty, especially in the larger individuals. The paper would have been improved by the addition of a summary.

A second paper by Dr. Orton deals with the comparative effect of dilute but lethal solutions of T.N.T. on native and Portuguese oysters (*Ostrea edulis* and *Gryphea angulata*), and was carried out at the request of the Fisheries Department to clear up a point left undetermined in the course of Dr. Orton's elaborate study of the abnormal mortality among native oysters in 1920–21. It is said that the mortality did not affect the Portuguese oysters. Dr. Orton shows, however, that both species are about equally susceptible to T.N.T.

The next paper—a valuable study, by Dr. C. M. Yonge, of feeding and digestion in the oyster—also arises out of Dr. Orton's oyster-mortality investigations, and its genesis illustrates in a striking way how important it is that ' fundamental ' or purely scientific studies should accompany, or better still precede, any investigations directed towards a practical or economic end. It became apparent from Dr. Orton's own work on the mortality of oysters that not nearly enough was known about the normal physiology of the oyster for any one to say what conditions were normal and what were indicative of disease or pathological disturbance. Dr. Orton wisely pointed the moral by recommending a special research into the anatomy and physiology of the oyster, and of this Dr. Yonge's paper gives us the first fruits.

The paper seems to us wholly admirable. Dr. Yonge is of the modern school in combining anatomy with physiology, in studying form and function together. Considerable space is given to a clear and well-illustrated account of the anatomy and histology of the digestive apparatus both in the adult and in the larval oyster, and to a description of the amazingly complex system of ciliary currents by which the oyster collects and sifts out the tiny planktonic organisms on which it feeds, rejecting all such as are too large for it to deal with, and leading the rest over the palps into the mouth, down into the stomach and the digestive diverticula (commonly known as the ' liver '). Other sections treat of assimilation, the digestive enzymes, the function of the crystalline style, and the storing of reserve products. Dr. Yonge finds that digestion is mainly intracellular—soluble matter and fine particles being ingested by the cells of the digestive diverticula, larger particles by the phagocytes present in all parts. This is demonstrated by ingenious feeding experiments with iron saccharate, with blood corpuscles of the dog-fish, with olive oil, and with the diatom Nitzschia. He rejects the theory of the Danish workers that the oyster is primarily a detritus feeder, and emphasises the importance of the smaller diatoms, peridinians, algal spores, and other microscopic vegetable matter.

It comes out clearly from Dr. Yonge's work, especially that on the enzymes present, that the oyster, like other lamellibranchs, is specially adapted for the digestion, assimilation and storage of carbohydrates. The rationale of fattening the oyster for market is, then, to supply it with plenty of microscopic vegetable food, as already indicated by Savage in a recent paper, and as realised empirically in some fattening ponds, particularly in France. It has been known for some time that the oyster stores its surplus nourishment mainly in the form of glycogen, which is no doubt

chiefly derived from the carbohydrates richly present in the diatoms and peridinians of its food. Dr. Yonge's elaborate paper represents a distinct advance in our knowledge of lamellibranch physiology, and cannot fail to be of great service both theoretically and practically.

The three papers so far considered take up about half the present number of the *Journal*, and the remaining papers can be only lightly touched upon. Mr. F. S. Russell continues his interesting studies on the vertical distribution of the macro-plankton, with papers on the diurnal changes in distribution of pelagic young fish and on the importance of light as a factor in determining the vertical distribution of plankton forms. From Dr. Atkins comes a third contribution to our knowledge of the phosphate content of sea-water in relation to the growth of algal plankton. Samples obtained from the English Channel, North Sea, the open Atlantic and Pacific confirm the author's views on the importance of phosphate as a limiting condition for production in the sea. Mr. C. F. Hickling gives some further details regarding the remarkable kind of luminescence discovered by him in the fish *Malacocephalus laevis*. Among two or three faunistic papers one may perhaps specially note one by Dr. Lebour giving a general survey of larval euphausiids, with a scheme for their identification. Such work is of very great service to plankton investigators, and it is to be hoped that Dr. Lebour will continue the good work and deal with other groups in the same way.

In conclusion, mention must be made of the ingenious 'vacuum grab' invented by Mr. O. D. Hunt, with the assistance of Dr. Bidder, and here described in detail. By means of this instrument samples of the bottom can be taken which retain the finest particles together with the micro-fauna and micro-flora therein contained. E. S. R.

University and Educational Intelligence.

BIRMINGHAM.—At the meeting of the Council of the University held on November 3 the following appointments were made: Dr. T. L. Hardy, assistant physician to the General Hospital, to be assistant to the chair of medicine; Dr. C. C. W. Maguire, physician for out-patients at Queen's Hospital, to be honorary demonstrator in the Department of Anatomy.

It was decided that the Court be asked to confer the title of emeritus professor upon Prof. O. J. Kauffmann, joint professor of medicine in the University from 1913 to 1926.

CAMBRIDGE.—Mr. T. W. Wormell, St. John's College, has been appointed observer in meteorological physics at the Solar Physics Observatory. Mr. J. T. MacCurdy, University lecturer in psycho-pathology, and Mr. H. C. B. Mynors, have been elected to fellowships at Corpus Christi College. The Adam Smith Prize has been awarded to G. T. Jones, Emmanuel College. The Engineering Department has been presented with portraits of Sir Alfred Ewing, the late Prof. Bertram Hopkinson and Prof. Inglis. The Henry Sidgwick Memorial lecture will be given at Newnham College on Nov. 13 at 5 P.M., by Sir William Bragg, who will take as his subject "The New Crystallography."

LONDON.—The following doctorates have been conferred: *D.Sc.* (*Economics*) on Mr. S. G. Panandikar (London School of Economics) for a thesis entitled "The Wealth and Welfare of the Bengal Delta"; *D.Sc.* (*Chemistry*) on Mr. G. W. Ellis for a thesis entitled "A Contribution to the Chemistry of Drying Oils, Parts i-iii. (containing a Study of the Autoxidation of Linseed Oil and a Theory on the Nature of the Autoxidation of Unsaturated Compounds)"; *D.Sc.* (*Veterinary Science*) on Mr. J. T. Edwards for a thesis entitled "The Chemotherapy of Surra (*Trypanosoma evansi* infections) of Horses and Cattle in India."

ST. ANDREWS.—On November 3 Dr. Fridtjof Nansen was installed as Rector of the University, after having been admitted to the honorary degree of Doctor of Laws. He delivered an inspiring address on the spirit of adventure, in the course of which he referred to his own experiences as an explorer and as a supporter of the League of Nations. The honorary degree of LL.D. was then conferred upon His Excellency Mons. P. B. Vogt, Norwegian Minister; Prof. Vilhelm F. K. Bjerknes, of the University of Oslo; Prof. Bjorn Helland-Hansen, of Bergen; Capt. Otto Neumann Sverdrup (Captain of the *Fram*); Prof. J. Norman Collie; Brig.-General the Hon. Charles Granville Bruce; Sir T. W. Edgeworth David; and (*in absentia*) the Right Hon. Viscount Cecil of Chelwood.

IT is stated in the *Chemiker Zeitung* that Dr. G. von Hevesy, professor of physical chemistry at the University of Freiburg in Baden, has been invited to succeed Prof. Bodenstein in the chair of physical chemistry at the Technische Hochschule at Hannover.

THE British Institute of Adult Education issued in September the first number of a half-yearly review entitled the *Journal of Adult Education*, published by Messrs. Constable and Co., Ltd., at 2*s*. 6*d*. The editors, Prof. J. Dover Wilson and Prof. A. E. Heath, are assisted by an advisory panel of thirty-one, whose names, well known in educational circles, appear on the cover. This first number is remarkable for the prominence given to the questions of what are and what should be the purposes of adult education. The questions are raised both explicitly in the more important articles, and indirectly by incompatibility of the ideals of some of the writers. They are dealt with most comprehensively by Prof. Robert Peers, the director of the important department of extra-mural education of University College, Nottingham, who classifies the various views concerning the aims of adult education under the three heads—development of the individual person, social service, and social change. A certain ambiguity is observable in the arguments owing to confusion between the aims of the students, the aims of the teachers, and the aims of those who organise and administer and finance the work. Education that aims primarily—not at the student's emancipation from the shackles of ignorance, but at the emancipation of 'workers' from the restraints incidental to a social system under which 'the means of life' are subjects of private ownership, the education on a Marxian basis, as given in the 'Labour' colleges, is described in one of the articles as 'independent' working-class education. This article, beginning with this curious use of the word 'independent' and ending with an appeal to class hatred by describing resistance to the subsidising of the mining industry as "the whole power of capitalism turned to defeating one particular section [of 'the workers'] by the use of the starvation weapon against women and children," shows that a wide circulation of the Journal is anticipated.

A PROJECT for founding a British Institute in Paris was launched at a meeting at the Mansion House,

London, on November 1. The scheme has been warmly commended by the Prince of Wales, by whom a Canadian hostel was opened in Paris but two days before, in the Cité Universitaire near the Parc de Montsouris. The erection of a similar residential college is not, however, a central feature of the British Institute project, which aims primarily at providing a centre for serious study and exchange of ideas for French students of English and for British students in France. It is proposed to work in co-operation with, if not to absorb, the existing Collége de la Guilde, founded thirty years ago by Miss Edith Williams and now carried on as a tutorial agency with the full approbation of the University of Paris authorities. At the Mansion House meeting Lord Crewe, the French Ambassador (M. de Fleurian), Lord Burnham, M. Desclos (on behalf of the Rector of the University of Paris), Sir Theodore Morison (representing the Standing Committee of the Vice-Chancellors of the Universities of the United Kingdom), Sir William Beveridge, Lord Meath, and Lord Derby all strongly supported the scheme, and an influential committee was appointed as a provisional council of the Institute. In the *University of London Gazette* of November 3 appears a notice of a Resolution of the Senate warmly approving the project and of the appointment of a committee to report how the University can co-operate. The minimum amount required for financing it is 100,000*l.*, towards which Sir Daniel Stevenson and others have promised some 15,000*l.* Sir William Beveridge stressed the need of an institution capable of representing British Universities in Paris as the American University Union represents the Universities of the United States in London and Paris. This need, which has long been felt, has become acute since the establishment of the International Institute for Intellectual Co-operation in Paris.

THE universities' duty of self-adjustment to contemporary social changes is discussed in a suggestive article by Hubert Phillips in the October number of the *University Bulletin*, the organ of the Association of University Teachers. In an age in which in the secular conflict of Man *versus* the State the honours seem to be with the latter, whilst the spiritual ascendancy of the syndicated press, the B.B.C., and the 'movies' seems to be assured, how, it is asked, are the will to criticise, and the will to determine, and the will to progress to be nourished and kept alive? It is suggested that it is 'up to' the universities to find ways and means. The newer universities are commended for not being ashamed to call themselves provincial and are exhorted to go further and "*be* provincial—to fight for people and places against syndicates and machinery." Lastly, reference is made to the fact that, unlike the churches (or certain of them), the universities have not made their voice heard as mediators in the disastrous struggle in the coal industry, notwithstanding that they are the custodians of accumulated wisdom in regard alike to mining technology, economics, social ethics, and industrial organisation and finance. We are reverting, in the view of the writer, to a society in which all significant institutions must exercise—somehow—political functions, or must perish: the professional politician is ceasing to matter. In these circumstances, it behoves the universities not to be obsessed by the fear of "interfering in politics," always provided they can keep their interference clear of any party complexion. The article is entitled "Some Academic Horizons": it is interesting as an addendum to Dr. Earle's paper, read at the Universities' Congress last July, on "An Imperial Policy in Education."

Contemporary Birthdays.

November 6, 1861. Principal Arthur P. Laurie.
November 8, 1872. Dr. Martin Onslow Forster, F.R.S.
November 8, 1864. Prof. Benjamin L. Robinson.
November 10, 1861. Mr. Robert T. A. Innes.
November 10, 1851. Prof. Waldemar C. Brøgger, For. Mem. R.S.
November 10, 1847. Earl of Iveagh, K.T., G.C.V.O., F.R.S.
November 12, 1863. Prof. Alfred W. Porter, F.R.S.
November 14, 1891. Prof. Frederick G. Banting.
November 14, 1869. Prof. Harry Yandell Benedict.
November 17, 1847. Prof. Archibald Liversidge, F.R.S.
November 18, 1869. Hon. Sir Arthur Stanley, G.B.E.
November 18, 1855. Prof. Archibald Barr, F.R.S.

Dr. LAURIE was educated at Edinburgh Academy. He graduated at the Universities of Edinburgh and Cambridge. Sometime lecturer in physics and chemistry at St. Mary's Hospital Medical School, London, he has been professor of chemistry, Royal Academy of Arts, since 1912; in 1914 he became a member of the Chemical Products Supply Committee, Board of Trade. He has written many illuminating memoirs on artists' pigments and mediums. Dr. Laurie is principal of the Heriot-Watt College, Edinburgh.

Dr. M. O. FORSTER studied at Finsbury Technical College, and the Central Technical College, South Kensington. From 1902 until 1913 assistant professor of chemistry at the Royal College of Science, he became the first director of the Salters' Institute of Industrial Chemistry (1918–22), retiring to take up the directorship of the Indian Institute of Science, Bangalore. Dr. Forster was president of Section B (Chemistry) at the Edinburgh meeting of the British Association in 1921, delivering an address on "The Laboratory of the Living Organism." *Inter alia* he asked, "What is breakfast to the average man?" He answered the question by saying that it was a "hurried compromise between hunger and the newspaper." In 1915 Dr. Forster was awarded the Longstaff medal of the Chemical Society.

Prof. B. L. ROBINSON, botanist, was born at Bloomington, Illinois, U.S.A. He was educated at the Universities of Harvard and Strasbourg. Since 1899 he has been Asa Gray professor of systematic botany in Harvard University, whilst being from an even earlier date curator of the celebrated Gray Herbarium. Prof. Robinson is a foreign member of the Linnean Society. He is the author of numerous papers on the classification of the higher plants of the United States, Mexico, and tropical America.

Mr. ROBERT INNES, astronomer, was born at Edinburgh. From 1903 until 1911 he was director of the meteorological department, Transvaal, South Africa, becoming then chief of the Union Observatory, Johannesburg. He is the author of many astronomical memoirs.

Prof. BRØGGER, the distinguished geologist, rector of the University of Christiania (Oslo) and one of its alumni, is a foreign member of the Royal Society and of the Geological Society. Sometime an assistant on the Norwegian geological survey, he became professor of geology in the University of Stockholm. Since 1890 he has held the chair of geology and mineralogy at Christiania (Oslo). He is Hon. LL.D., Glasgow, Hon. Sc.D., Cambridge, and Hon. D.Sc., Oxford. In 1911 the Geological Society of London awarded Prof. Brøgger its Wollaston gold medal (twenty years

earlier he had been allotted the Murchison medal) at the hands of Prof. W. W. Watts, then president. It was remarked that Prof. Brøgger was an accomplished chemist, skilful mineralogist, and great petrologist. His researches on the Cambrian and Ordovician rocks of his own country had indicated that he was a gifted palæontologist and stratigrapher. His detailed mapping and interpretation of the structure of the Christiania area and his explanation of the origin of the Christiania Fjord had proved him to be a tectonic geologist of a very high order.

The EARL OF IVEAGH, whose interest in the movements of science and appreciation of its needs are well known, has been Chancellor of the University of Dublin since 1908.

Prof. PORTER, dean of the Faculty of Science in University College (University of London), occupies there the chair of physics. Honorary secretary of the Institute of Physics, he is a past president of the Röntgen Society and of the Faraday Society.

Prof. F. G. BANTING was born at Alliston, Ontario. Educated at the Alliston Public and High Schools, he graduated in the medical faculty of the University of Toronto. From a physiological post in the University of Western Ontario, London, Canada, he returned to Toronto to become a lecturer in pharmacology. He now occupies the chair of medical research established lately in the University. Prof. Banting, with Prof. J. J. R. MacLeod, received in 1923 the distinction of the Nobel prize in physiology and medicine for their discovery of insulin.

Prof. BENEDICT, who occupies the chair of applied mathematics and astronomy, and is dean of the College of Arts in the University of Texas, was born at Louisville, Kentucky, U.S.A. He was educated at the Universities of Texas, Harvard, and Virginia. Sometime an assistant in the Leander McCormick Observatory of the University of Virginia, he also held a mathematical professorship in Vanderbilt University.

Prof. LIVERSIDGE, the veteran chemist and mineralogist, was born at Turnham Green, Middlesex. His studies were pursued at the Royal School of Mines, South Kensington, Royal College of Chemistry, and Christ's College, Cambridge. Appointed so far back as 1873 to the chair of chemistry in the University of Sydney, he occupied that post for thirty-five years. He has rendered distinctive service to science and technical education in Sydney, and also far beyond its boundaries. He was a founder of the Australasian Association for the Advancement of Science, and was its honorary secretary for a number of years; afterwards he became president. Prof. Liversidge has written numerous memoirs on chemistry and mineralogy. He is Hon. LL.D., Glasgow.

Sir ARTHUR STANLEY, who was educated at Wellington College, entered the diplomatic service, filling various posts before retirement. He is chairman of the Joint Council of the British Red Cross Society and Order of St. John, and is also treasurer of St. Thomas's Hospital. Sir Arthur is especially interested in the work of the British Empire Cancer Campaign. He is a Commander of the Legion of Honour.

Prof. BARR, Regius professor of civil engineering and mechanics in the University of Glasgow from 1889 until 1913 (earlier he held a similar chair at the Yorkshire College, Leeds), was born at Glenfield, Renfrewshire. In collaboration with Prof. W. Stroud he has invented several types of range finders. Of these, one designed for use at sea is extensively employed in the British Navy. Prof. Barr is Hon. LL.D., Glasgow and Birmingham.

Societies and Academies.

LONDON.

Royal Society, November 4.—H. C. H. **Carpenter** and S. **Tamura**: Experiments on the production of large copper crystals. Crystals exceeding 4 in. in length have been grown in polycrystalline copper strip of section 0·5 in. × 0·125 in. by the method of critical strain followed by appropriate heat treatment. These crystals, however, are not, strictly speaking, single crystals, since they contain numerous twins which may be oriented in so many as three directions. It has not been found possible to produce large copper crystals by this method without at the same time producing twins. The complete removal of strain in recrystallised copper strip is only achieved by prolonged heating. On account of the presence of twins, the large crystals thus prepared only possess about one-third of the ductility of polycrystalline copper. Their tenacity, however, is almost the same. Their ductility is still more inferior to that of single-crystal copper prepared direct from the liquid which is free from twins.

H. C. H. **Carpenter** and S. **Tamura**: The formation of twinned metallic crystals. The principal cause of twinning seems to be crystal growth. Deformation is an indirect cause of twinning, merely because it causes subsequent growth on annealing. In some cases the orientation of annealing twins indicates that they have grown along certain crystallographic directions; most frequently they are rectilinear. The capacity for forming annealing twins appears to be closely related to the atomic arrangement in the crystal lattice. Those metals which crystallise in the face-centred cubic, tetrahedral cubic, and face-centred tetragonal lattices produce annealing twins after suitable treatment, whereas metals possessing other atomic arrangements have not been found to produce them. Metals which crystallise in the close-packed hexagonal lattice, *e.g.* zinc and cadmium, have no possible planes of twinning, and what is called twinning in these metals is probably parallel growth.

G. I. **Taylor** and C. F. **Elam**: The distortion of iron crystals. Specimens cut from crystals of iron were subjected to uniform distortion both in compression and in tension, and the distortion analysed and the orientations of the crystal axes determined by X-rays. Distortion is due to slipping in a direction parallel with the perpendicular to a {111} plane. This plane of slip had different orientations with respect to the crystal axes in different specimens, and its orientation round the direction of slip was determined chiefly by the direction of stress. A uniform shear, for which the direction of slip is a crystal axis while the plane of slip is not a crystal plane, arises from a condition of slipping in which the particles of the material stick together in rods instead of in planes. This conception of the mechanism of distortion in iron accounts for the fact that the general direction of the slip lines which appear on a polished surface coincides with the trace of the plane of slip and has no direct connexion with the crystal axes.

W. **Rosenhain** and A. J. **Murphy**: The metallography of solid mercury and amalgams. Carbon dioxide snow has been employed to attain the low temperature required, and specimens having a smooth surface have been obtained by solidification against a glass surface or by polishing. The cast surfaces have been etched electrolytically in hydrochloric acid and examined microscopically.

C. F. **Elam**: Tensile tests of large gold, silver and copper crystals. Crystals of gold, silver and copper

8 in. long and 0·25 in. in diameter have been prepared by lowering a graphite tube full of the molten metal slowly through an electric tube furnace, so that freezing proceeds from the bottom upwards. The position of the crystal axes was determined by means of X-rays, and the rods extended in a tensile testing machine. The crystal axis of the specimen moved in the same direction as in aluminium during extension. As these metals have the same crystal structure as aluminium, it was concluded that distortion was similar in every case, and that gold, silver and copper crystals distort by slipping on a (111) plane in a (110) direction. The crystals all harden during the process of deformation, but when the shear stress is plotted against the extension, the form of the curves is different for each metal.

R. E. **Gibbs**: The polymorphism of silicon dioxide and the structure of tridymite. The structure of tridymite was similar to that of ice, *i.e.* D_{6h}^4, with four molecules per cell, in which $a=5\cdot03$ and $c=8\cdot02$. The framework can be considered as a close-packed arrangement of oxygen atoms of diameter about 2·6, whilst the silicon atoms occupy the spaces between four neighbouring oxygens. It is probable that the structures are ionic in nature, being variations of a two-to-one packing of oppositely charged ions. Possible modes of β-β transitions lead to the idea that these sluggish changes are characterised by a change of partners between neighbouring ions. On other hand, the α-β transition, at least in the case of quartz, is merely a small atomic rearrangement not sufficiently drastic to involve a change of neighbours. The α-states are probably created by distortions of the β-forms involving lower symmetry and possibly larger cells. α-tridymite is orthorhombic, having a cell $a=9\cdot9$, $b=17\cdot1$, $c=16\cdot3$, in which the units must be polymerised groups $n\mathrm{SiO_2}$, where n is larger than two and probably equal to eight. The existence of a third form α' of tridymite resembling the ordinary α-form was confirmed.

Twenty-six papers were read by title only.

Royal Microscopical Society, October 20.—A. **Piney**: A method of silver impregnation of Zenker-fixed sections. The method is only a modification of Bielchowsky's technique and is designed to apply to tissues fixed in mercuric chloride solutions. The essential point is the removal of all traces of the mercuric salt, followed by removal of the iodine, which was employed for this purpose. The wax is removed from the section with xylol, and the section is then placed in 0·4 per cent. iodine in 80 per cent. spirit for 10 minutes. Some of the iodine is removed by soaking the section for 30 minutes in 70 per cent. alcohol, but the remainder is got rid of by immersion in 0·25 per cent. sodium thiosulphate dissolved in 50 per cent. alcohol (not in water as recommended by Heidenhain). The section is now washed in water for an hour, and then immersed in 0·25 per cent. potassium permanganate in water, swilled in distilled water, placed in 5 per cent. aqueous oxalic acid for 20 minutes, washed for 2 hours in running water, and then stained by the Bielchowsky method. Toning with 1 per cent. gold chloride and fixation with 5 per cent. hypo are an advantage, as is also counter-staining with Weigert's iron hæmatoxylin and van Gieson's solution. The method is particularly adapted for the demonstration of reticular fibrils in hæmatopoietic tissues.

PARIS.

Academy of Sciences, October 11.—V. **Grignard** and P. **Muret**: Pyrosulphuryl chloride. In the production of this substance by the reaction between sulphur trioxide and carbon tetrachloride there are difficulties in purification. Utilising the reaction between carbon tetrachloride and chlorsulphonic acid, the conditions have been studied with the view of obtaining a purer product. The decomposition resulting from rise of temperature has also been studied.—Henri **Jumelle**: New observations on tombak tobacco. The identification of the species is complicated by the fact that there are several tombak tobaccos. One tobacco sold under that name has proved to be *Nicotiana rustica*. It contains a high proportion of nicotine (6-12 per cent.) and may be of service as a source of nicotine for viticultural or horticultural purposes.—T. **Rado**: The calculation of the area of curved surfaces.—Paul **Flamant**: The continuity of the distributive transmutations and the extension of a transmutation defined for polynomials.—Paul **Dumanois**: The importance of the combustion yield in internal combustion engines. According to the theory of combustion and detonation developed by the author in previous communications, a mixture of petrol and methyl alcohol should give a higher efficiency than petrol alone. Experimental proof of this is now given: the fuel used contained 70 per cent. of methyl alcohol and gave an increase of 15 per cent. in efficiency over pure petrol.—Th. de **Donder**: The application of the quantification deduced from the Einsteinian gravific.—L. **Meunier** and G. **Rey**: The action of ultraviolet light upon wool. Under the action of sunlight or the mercury vapour lamp, the condition of the sulphur in the wool is changed; part is converted into sulphur dioxide, which is partially oxidised to sulphuric acid. These changes can be followed by an indicator such as methyl red. Reactions of the insolated wool with nitroprusside, quinone, alloxan and ninhydrin are also described.—W. J. **Richards**: The effect of α-rays on supersaturated solutions. It might be expected that α-particles would produce crystallisation in supersaturated solutions. Negative results were obtained with solutions in water of sodium sulphate, potassium sulphate, calcium chromate and lithium carbonate. Negative results were also obtained with aqueous sugar solutions and with fused salol.—Louis **Grenet**: The limiting states of alloys.—M. **Ballay**: The Ludwig-Soret phenomenon in alloys. The concentration changes produced in solutions unequally heated are shown experimentally to exist in alloys, and this phenomenon must be taken into account in a general discussion of the phenomena of segregation.—V. **Hasenfratz** and R. **Sutra**: Some derivatives of harmalol and harmol.—Marcel **Frèrejacque**: Vaillantite, an agent of sulphomethylation. Formation of a new active camphorsulphonic acid.—H. **Prophète**: Contribution to the study of the wax of flowers: rose wax. Study of its unsaponifiable matter.—Germain **Chalaud**: The first phase of the evolution of the gametophyte of *Fossombronia pusilla*.—Jean Jacques **Trillat**: The action of X-rays of long wave-length on micro-organisms. The case of *B. prodigiosus*. These researches showed the bactericidal influence of primary X-rays of long wave-length.—Auguste **Lumière** and Félix **Perrin**: A new class of hypnotics. The dialkylphenylacetamides. Dipropyl-, propylallyl-, and diallylphenylacetamide have been prepared and possess hypnotic properties, but the ratio of their active dose to the toxic dose is rather high.—**Javillier** and H. **Allaire**: Phosphorus ratios in the tissues.

ROME.

Royal National Academy of the Lincei: Communications received during the holidays.—G. **Fubini**: The theory of R surfaces and their transformations.—

Giorgio Dal **Piaz**: The discovery of a supposed vein of post-glacial volcanic rock in the neighbourhood of Bressanone (Upper Adige).—Giuseppe **Corbellini**: A class of variety characterised by means of parallelism.—V. **Hlavatý**: Local parameters in a Riemann variety.—J. **Soula**: Functions defined by Dirichlet's series.—Oscar **Zariski**: The development of an algebraic function in a circle containing several critical points.—Filippo **Burzio**: Order of magnitude of quantities relative to the second ballistic problem. A formula for ballistic nutation.—A. **Weinstein**: Liquid jets with given walls.—Bruto **Caldonazzo**: An extension of Bernouilli's theorem. This theorem, which is valid for the stationary motion of a perfect fluid, is extended to meet certain cases of variable motion.—Mentore **Maggini**: Interferometric measurements on the four large satellites of Jupiter. Observations on the changes of figure and on the axial inclinations of these satellites are described.—Vasco **Ronchi**: Further concerning "flying shadows." D'Arturo's criticisms of the author's conclusions are refuted.—Franco **Rasetti**: The Doppler effect in sensitised fluorescence.—G. **Wataghin**: The ballistic hypothesis and the Doppler effect. The two treatments as yet known of the Doppler effect both lead to results unfavourable to the ballistic theory of this effect.—G. **Natta** and F. **Schmid**: Oxides and hydroxides of cobalt (ii.). The crystalline structure of the saline oxide of cobalt. The oxide Co_3O_4 crystallises in the monometric system and is isomorphous with magnetite. The size of the elementary cell of the crystalline lattice, which is of the spinel type, is 8·02 Å.U. and contains eight molecules. The density is calculated to be 6·21, which lies among the somewhat discordant experimental values.—E. **Repossi** and V. **Gennaro**: The minerals of the serpentine of Piossasco (Piedmont). The mineral species so far identified in this serpentine are ilmenite, magnetite, calcite, aragonite, diopside, granite, vesuvianite, chlorite, titanite, perowskite, apatite, and, probably, gavite.—Sabato **Visco**: The behaviour of the hepatic glycogen in fasting animals treated with insulin. The administration of insulin to fasting rabbits diminishes the loss in weight. The liver and spleen increase in weight, whereas the heart, kidneys, suprarenal capsules and lungs show slight and variable changes in weight. The amount of glycogen in the liver is increased very considerably by treating the fasting animal with insulin.

SYDNEY.

Linnean Society of New South Wales, August 25.—C. H. **Anderson**: A revision of certain Australian Rhenopodiaceæ. The paper embodies a critical examination of the two species, *Bassia tricarnis* (Benth.) F.v.M. and *Bassia enchylænoides* F.v.M. A new genus is proposed to take in one of the species, and the other is transferred to the genus Kochia.—E. **Cheel**: Notes on *Melaleuca pubescens* Schauer and *M. Preissiana* Schauer. The author's view is that *M. pubescens* Schauer has priority, that the Victorian plants are merely forms of *M. pubescens*, and that the Western Australian plants known as "Ironwood" are glabrous forms of the same species.—Rev. H. M. R. **Rupp**: Description of a new species of Diuris from Barrington Tops, N.S.W. The species described as new is closest to *D. spathulata*, from which it differs in its venation, more prominent lateral lobes of the labellum, and in its short and thick column.—A. M. **Lea**: On some Australian Curculionidæ. The paper contains descriptions of two new genera and sixty-five new species, one of which belongs to Rhinomacer, a genus now first recorded as Australian.

Official Publications Received.

BRITISH AND COLONIAL.

Aeronautical Research Committee: Reports and Memoranda. No. 1019 (Ae. 220): Note on a Hot-Wire Speed and Direction Meter. By L. F. G. Simmons and A. Bailey. (C. 1. Accessories, Instruments, 90.—T. 2033.) Pp. 7+7 plates. 9*d*. net. No. 1027 (Ae. 225): Test of Two Aerofoils, R.A.F. 27 and R.A.F. 28. By A. S. Hartshorn and H. Davies. (A. 3. a. Aerofoils-General, 104.—T. 2257.) Pp. 10+6 plates. 9*d*. net. No. 1038 (M. 47): Report on the Accelerated Ageing of 'Y' Alloy. By S. L. Archbutt and J. D. Grogan. (B. 1. a. Metals, 55.—T. 2251.) Pp. 10+4 plates. 9*d*. net. (London: H.M. Stationery Office.)

South Australia. Department of Mines: Geological Survey of South Australia. Bulletin No. 12: Clay and Cement in South Australia. By R. Lockhart Jack. Pp. 120+4 plates. (Adelaide: R. E. E. Rogers.)

Annual Report for the Year 1925 of the South African Institute for Medical Research, Johannesburg. Pp. 37+2 plates. (Johannesburg.)

Development Commission. Sixteenth Report of the Development Commissioners for the Year ended the 31st March 1926. Pp. 157. (London: H.M. Stationery Office.) 3*s*. net.

Our Heritage—The Empire: a Report on some Aspects of a Tour of the King's Overseas Dominions undertaken chiefly in the Interests of Empire Migration and Settlement, 1925–1926. By Commissioner David C. Lamb. Pp. 40. (London: The Salvation Army.)

Report of the Progress of the Ordnance Survey for the Financial Year 1st April 1925, to 31st March 1926. Pp. 8+5 plates. (London: H.M. Stationery Office.) 3*s*. 6*d*. net.

Transactions of the Leicester Literary and Philosophical Society, together with the Council's Report and the Reports of the Sections, 1925-26. Vol. 27. Pp. 66. (Leicester.)

Smoke Abatement League of Great Britain. Seventh Report, covering the Nine Months October 1st, 1925, to June 30th, 1926. Pp. x+22. (Manchester.)

British Museum (Natural History). Picture Postcards. Set C17: British Sea Birds, Series No. 1, Gulls. 5 cards in colour. Set C18: British Sea Birds, Series No. 2, Auks and Cormorants. 5 cards in colour. (London: British Museum (Natural History).) 1*s*. each set.

FOREIGN.

Instituts scientifiques de Buitenzorg: "'s Lands Plantentuin." Treubia: receuil de travaux zoologiques, hydrobiologiques et océanographiques. Vol. 7, Livraison 3, Septembre. Pp. 217-330. 2.50 f. Vol. 8, Livraison 3-4, Juillet. Pp. 199-512. 5.00 f. (Buitenzorg: Archipel Drukkerij.)

CATALOGUES.

Microscopes and Accessories. Pp. 92. (London: C. Baker.)

Diary of Societies.

SATURDAY, NOVEMBER 13.

ROYAL INSTITUTION OF GREAT BRITAIN, at 3.—Rev. E. M. Walker: The Study of History (2).

PHYSIOLOGICAL SOCIETY (at the London School of Medicine for Women), at 4.—R. T. Grant: An Observation on the Function of the Pericardium.—A. Levin: Fatigue, Retention of Action Current and Recovery, in Nerves of the Spider Crab.—T. Lewis and H. M. Marvin: Herpes Zoster and Antidromic Impulses.—R. W. Gerard, Prof. A. V. Hill, and Y. Zotterman: Energy Liberation of Nerve as a Function of Frequency of Stimulation.—R. W. Gerard: The Two Phases of Nerve Heat Production.—M. Lowenfeld, S. T. Widdows, M. Bond, and E. Taylor: Variations in Composition of Early Human Milk and Factors Influencing Them.—D. Woodman, E. E. Hewer, and M. L. Keene: Time of Appearance of Digestive Enzymes in the Human Fœtus.—W. C. Cullis, D. Rendel, and E. Dahl: Points in the Technique of the Ethyl Iodide Method.—Demonstrations by A. Levin: An Improved Device for Time-marking and Similar Purposes.—E. E. Hewer and M. F. L. Keene: Pineal and Choroid Plexus in the Human Fœtus.—G. Briscoe: Records of Different Types of Respiratory Movements.

MONDAY, NOVEMBER 15.

ROYAL MEDICO-PSYCHOLOGICAL ASSOCIATION (at British Medical Association, Tavistock Square), at 4.—Dr. A. Adler: The Cause and Prevention of Neurosis.

ROYAL GEOGRAPHICAL SOCIETY (at Lowther Lodge), at 5.—J. A. Steers: The East Anglian Coast.

INSTITUTION OF ELECTRICAL ENGINEERS (Tees-Side Sub-Centre) (at Cleveland Technical Institute, Middlesbrough), at 7.—J. Rosen: Address.

INSTITUTION OF AUTOMOBILE ENGINEERS (Scottish Centre) (at Royal Technical College, Glasgow), at 7.30.—J. E. Southcombe: Recent Research on Friction and Lubrication.

ROYAL INSTITUTE OF BRITISH ARCHITECTS, at 8.—H. V. Lanchester: Bridges and Traffic.

ARISTOTELIAN SOCIETY (at University of London Club), at 8.—J. C. McKerrow: Evolution and Contingency.

ROYAL SOCIETY OF ARTS, at 8.—Prof. H. L. Callender: Recent Experiments on the Properties of Steam and High Pressures (Howard Lectures) (1).

HUNTERIAN SOCIETY OF LONDON (in Cutlers' Hall, Warwick Lane, E.C.), at 8.45.—Sir Humphry Rolleston, Dr. G. Little, Dr. L. Williams, and others: Discussion on Medicine and the Press.

TUESDAY, NOVEMBER 16.

ROYAL INSTITUTION OF GREAT BRITAIN, at 5.15.—Dr. G. W. C. Kaye: The Acoustics of Public Buildings (Tyndall Lectures) (3).

ROYAL STATISTICAL SOCIETY (at Royal Society of Arts), at 5.15.—Viscount D'Abernon: German Currency: The Collapse and Recovery, 1920–1926 (Inaugural Address).

ZOOLOGICAL SOCIETY OF LONDON, at 5.30.—Dr. G. D. Hale Carpenter: The Biology of *Glossina palpalis* in connexion with Sleeping Sickness.

—R. I. Pocock: (*a*) The External Characters of the Patagonian Weasel (*Lyncodon patagonicus*); (*b*) The External Characters of *Thylacinus sarcophilus* and some related Marsupials.—H. Munro Fox: General Report on the Cambridge Expedition to the Suez Canal, 1924.—G. H. Lockett and W. S. Bristowe: Observations on the Mating Habits of the Web-spinning Spiders.

INSTITUTION OF CIVIL ENGINEERS, at 6.—T. B. Hunter and A. L. Bell: H.M. Dockyard, Rosyth.

INSTITUTION OF ELECTRICAL ENGINEERS (East Midland Sub-Centre) (at Leicester), at 6.45.—L. M. Jockel: Boiler Plant.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN (Scientific and Technical Group), at 7.—Dr. K. C. D. Hickman: A Chemical Aspect of Sulphide Sensitivity.—S. O. Rawling: The Sensitivity of Photographic Emulsions. Part II. Hydrion Concentration and the Silver Bromide-Thiocarbamide Complexes.

INSTITUTION OF ELECTRICAL ENGINEERS (North Midland Centre) (at Hotel Metropole, Leeds), at 7.—W. W. E. French: Chairman's Address.

INSTITUTION OF ELECTRICAL ENGINEERS (North-Western Centre) (at Engineers' Club, Manchester), at 7.

INSTITUTION OF AUTOMOBILE ENGINEERS (Wolverhampton Centre) (at Engineering Club, Wolverhampton), at 7.30.—G. F. Mucklow: The Effect of Reduced Intake-Air Pressure and of Hydrogen on the Performance of the Slow-Speed Solid Injection Engine.

INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND (at 39 Elmbank Crescent, Glasgow), at 7.30.—D. M. Shannon: Diesel Engines.

WEDNESDAY, NOVEMBER 17.

SOCIETY OF GLASS TECHNOLOGY (Anniversary Meeting) (at Sheffield University), at 2.45.—W. Butterworth, sen.: Presidential Address.

ELECTRICAL ASSOCIATION FOR WOMEN (at 15 Savoy Street, W.C.2), at 3.—Miss M. Partridge: A Talk on Tariffs.

ROYAL METEOROLOGICAL SOCIETY, at 5.—E. W. Bliss: The Nile Flood and World Weather.—D. Brunt: (*a*) An Investigation of Periodicities in Rainfall, Pressure and Temperature at certain European Stations; (*b*) The Period of Simple Vertical Oscillations in the Atmosphere.

GEOLOGICAL SOCIETY OF LONDON, at 5.30.—Dr. C. J. Stubblefield and Dr. O. M. B. Bulman: The Shineton Shales of the Wrekin District, with Notes on their Development in other parts of Shropshire and Herefordshire.

INSTITUTION OF CIVIL ENGINEERS (Students' Meeting), at 6.30.—J. E. W. Monkhouse: Address.

INSTITUTION OF ELECTRICAL ENGINEERS (South Midland Centre) (Wireless Section) (at Birmingham University), at 7.—Prof. C. L. Fortescue: Address.

INSTITUTION OF ELECTRICAL ENGINEERS (Sheffield Sub-Centre) (at Royal Victoria Hotel, Sheffield), at 7.30.

MERSEYSIDE AQUARIUM SOCIETY (at 1 Falkland Road, Egremont), at 7.30.—A. Wilkinson and J. Gould: Exhibition of Pond-Life, etc., under the Microscope.

ROYAL SOCIETY OF ARTS, at 8.—T. Brough: Artificial Silk.

INSTITUTE OF CHEMISTRY (London and South-Eastern Counties Section), at 8.—Annual General Meeting.

C.B.C. SOCIETY FOR CONSTRUCTIVE BIRTH CONTROL AND RACIAL PROGRESS (at Essex Hall, Strand), at 8.—Dr. Marie Stopes: The Birth Control Movement To-day after an Eventful Year (Presidential Address).

EUGENICS SOCIETY (at London Day Training College), at 8.—Discussion on Mental and Physical Deterioration; Differential Birth-rate. Chairman: Sir Bruce Bruce-Porter. Speakers: Dr. D. Ward Cutler and Dr. C. V. Drysdale.

ROYAL MICROSCOPICAL SOCIETY, at 8.—Dr. H. A. Baylis: Pwdre Ser—The "Rot of the Stars."—M. T. Denne: A New Apparatus for Casting Paraffin Imbedding Blocks.—Dr. C. Tierney: Caballero's Technique for Mounting Diatom and other Type Slides.

THURSDAY, NOVEMBER 18.

ROYAL SOCIETY, at 4.—Special General Meeting.—At 4.30.—Major W. S. Patton and E. Hindle: Reports from the Royal Society's Kala-azar Commission in China. Nos. 1-5.—*To be read in title only*:—R. Hill: The Chemical Nature of Hæmochromogen and its Carbon Monoxide Compound.—H. Gremels and R. Bodo: The Excretion of Uric Acid by the Kidney.—Prof. C. H. Browning, Prof. J. B. Cohen, S. Ellingworth, and R. Gulbransen: The Antiseptic Properties of the Amino Derivatives of Styryl and Anil Quinoline.—T. S. P. Strangeways and F. L. Hopwood: The Effects of X-rays upon Mitotic Cell Division in Tissue Cultures *in vitro*.—Sir Charles Sherrington and R. S. Creed: Observations on Concurrent Contraction of Flexor Muscles in the Flexion Reflex.—Prof. S. B. Schryver and H. W. Buston: The Isolation of some hitherto undescribed Products of Hydrolysis of Proteins. Part III.—Prof. J. A. Crowther: The Action of X-rays on *Colpidium colpoda*.

LINNEAN SOCIETY OF LONDON, at 5.—Miss E. R. Saunders: A Remarkable Specimen of Matthiola.—The President: The Recent International Congress of Plant Studies, Ithaca, New York.—Miss A. E. Chesters: The Vascular Supply of the Bracts of Some Species of Anemone.

ROYAL INSTITUTION OF GREAT BRITAIN, at 5.15.—Dr. R. R. Marett: The Archæology of the Channel Islands. I.: Palæolithic Period.

CHILD-STUDY SOCIETY (at Royal Sanitary Institute), at 6.—Miss Barbara Low: The Cinema.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—Dr. A. Ekstrom: The Applications of Electricity to Agriculture (Lecture).—J. W. Beauchamp: Exhibition of a Film entitled American Agriculture and Farm-house Electrification.

INSTITUTION OF AUTOMOBILE ENGINEERS (London Graduates' Meeting) (at Watergate House, Adelphi), at 7.30.—S. Miall: Worm Gears.

INSTITUTE OF CHEMISTRY (Edinburgh and East of Scotland Section) (jointly with Society of Chemical Industry—Edinburgh and East of Scotland Section) (at North British Station Hotel, Edinburgh), at 7.30.—J. A. Watson: Some Chemical Aspects of Geology.

CHEMICAL SOCIETY, at 8.—R. F. Hunter: The Unsaturation of Heterocyclic Ring Systems. Part I. The Benzthiazole and 1:2 Dihydrobenzthiazole System.—R. F. Hunter and H. Morland: The Unsaturation Heterocyclic Ring Systems. Part II. The 2-imino 4-keto Tetrahydrothiazole System.—G. A. R. Kon and J. H. Nutland: The Chemistry of the Three-Carbon System. Part X. The Mobility of Some Cyclic Ketones.

ROYAL SOCIETY OF TROPICAL MEDICINE (Laboratory Meeting) (at London School of Hygiene and Tropical Medicine), at 8.15.—Demonstrations by Drs. H. B. Newham, P. H. Manson-Bahr, C. M. Wenyon, H. H. Scott, J. G. Thomson, P. A. Buxton, J. W. A. Cameron, Aldo Castellani, C. A. Hoare, A. C. Stevenson, and H. M. Shelley.

ROYAL AERONAUTICAL SOCIETY.—Flight-Lieut. R. S. Capon: Methods of Performance Testing and Analysis.—Major J. S. Buchanan: The Two-Seater Light Aeroplane Competitions, 1926.

INSTITUTION OF MECHANICAL ENGINEERS (at Manchester).—Prof. E. G. Coker: Elasticity and Plasticity (Thomas Hawksley Lecture).

INSTITUTION OF MINING AND METALLURGY (at Geological Society).

FRIDAY, NOVEMBER 19.

TUBERCULOSIS SOCIETY (at Royal Society of Medicine), at 5.—Dr. Strandberg: The Treatment of Laryngeal Tuberculosis by Heliotherapy and Artificial Light.

ROYAL COLLEGE OF PHYSICIANS OF LONDON, at 5.—Dean Inge: Racial Degeneration (David Lloyd Roberts Lecture).

SOCIETY OF CHEMICAL INDUSTRY (Liverpool Section) (at Liverpool University), at 6.—F. H. Carr: Chemical Industry and its Relationship to Delicate Plant and Animal Products.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—T. A. F. Stone: Electric Locomotives: a Method of Classifying, Analysing, and Comparing their Characteristics.

ROYAL PHOTOGRAPHIC SOCIETY OF GREAT BRITAIN, at 7.—F. C. Tilney: Pictorial Tradition.

PHOTOMICROGRAPHIC SOCIETY (at 4 Fetter Lane), at 7.—Members' Evening.

JUNIOR INSTITUTION OF ENGINEERS, at 7.30.—B. J. Axten: Short Wave Wireless Communication.

ROYAL SOCIETY OF MEDICINE (Electro-Therapeutics Section), at 8.30.—Dr. W. J. Turrell: The Physico-chemical Action of Interrupted Currents in Relation to their Therapeutic Effects.

SOCIETY OF DYERS AND COLOURISTS (Manchester Section) (at Manchester).—W. F. A. Ermen and S. H. Jenkins: The Action of Caustic Soda on Cotton Cellulose.

SATURDAY, NOVEMBER 20.

ROYAL INSTITUTION OF GREAT BRITAIN, at 3.—Rev. E. M. Walker: The Study of History (3).

BRITISH MYCOLOGICAL SOCIETY (at University College).

PUBLIC LECTURES.

SATURDAY, NOVEMBER 13.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—H. N. Milligan: The Life of a Sea-Urchin.

SUNDAY, NOVEMBER 14.

GUILDHOUSE (Eccleston Square), at 3.30.—Dr. E. E. Fournier d'Albe: Eyes and Ears of the Future.

MONDAY, NOVEMBER 15.

ROYAL INSTITUTE OF PUBLIC HEALTH, at 4.—Prof. W. W. C. Topley: Quantitative Experiments in the Study of Infection and Resistance (Harben Lectures). (Succeeding Lectures on November 18 and 22.)

ROYAL SOCIETY OF MEDICINE, at 5.15.—Prof. H. J. Fleure: Racial Characters of the Human Skin and Racial Types in relation to Health (Malcolm Morris Memorial Lecture).

BIRKBECK COLLEGE, at 5.30.—Dr. E. Deller: University Education in the United States.

TUESDAY, NOVEMBER 16.

KING'S COLLEGE, at 5.30.—A. H. Hannay: The Modern Problem of Form and Content in Art.

WEDNESDAY, NOVEMBER 17.

PARENTS' NATIONAL EDUCATIONAL UNION (at Shelley House, Chelsea Embankment), at 3.—Dr. Elizabeth Sloan Chesser: The Development of Personality.

LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE, at 6.—S. Downes: The Uses of 'Powers' Machines.

THURSDAY, NOVEMBER 18.

COLLEGE OF NURSING (Henrietta Street, W.1), at 5.30.—Dr. J. A. Hadfield: The Contribution of Psychology to Social Hygiene.

KING'S COLLEGE, at 5.30.—Prof. A. P. Laurie: Modern Research on Fifteenth-Century Methods of Oil Painting, and its Application to the Work of Modern Artists.

UNIVERSITY COLLEGE, at 5.30.—Miss E. Jeffries Davis: Some London Place Names. (Succeeding Lectures on November 25, December 2, 9, and 16.)

FRIDAY, NOVEMBER 19.

UNIVERSITY OF DURHAM COLLEGE OF MEDICINE (Newcastle-upon-Tyne), at 4.45.—Dr. C. Singer: The History of Medicine.

LONDON SCHOOL OF ECONOMICS, at 5.—Prof. Cyril Burt: The Vocational Adviser and the Young Delinquent.—A. E. Cutforth: Amalgamations. (Succeeding Lecture on November 26.)

INSTITUTE OF CHEMISTRY, at 8.—F. C. Robinson: The Chemist in the non-Ferrous Metallurgical Refinery (Streatfeild Memorial Lecture).

SATURDAY, NOVEMBER 20.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—H. MacLeod: Eclipses of the Sun.

SUNDAY, NOVEMBER 21.

GUILDHOUSE (Eccleston Square), at 3.30.—Dr. G. C. Simpson: Meteorology in the Service of Man.

CONGRESS.

NOVEMBER 16.

NATIONAL CONFERENCE ON MILK IN RELATION TO PUBLIC HEALTH (at King George's Hall, Caroline Street, W.C.1).