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Books, Libraries and Languages.

THE work of the third conference of the Association of Special Libraries and Information Bureaux (A.S.L.I.B.) held recently at Oxford had many points of contact with the world of science, and among the more interesting papers in this connexion was one read by Dr. J. E. de Vos van Steenwijk on the subject of international scientific bibliographies and information bureaux. The author is assistant-chief to the Section of Scientific Relations of the International Institute of Intellectual Co-operation, which acts as a permanent bureau to the International Commission of Intellectual Co-operation set up by the League of Nations. Both the Commission and the Institute are working on the compilation of analytical bibliographies of current scientific literature; physics was the first science to be taken up, economics is now being approached, and the biological sciences are to be considered next. In the last-named subject Dr. de Vos stated that in the United States the publication entitled *Biological Abstracts* expects to give yearly about 50,000 abstracts derived from 4000 to 5000 periodicals; and by this means it is hoped to save much unnecessary duplication or multiplication.

The second important task which the Institute has set itself is to inquire into the ability and readiness of libraries to act as information bureaux. It has issued a circular to some 2000 libraries in different countries with the object of finding out which of them contain collections on special sciences, and are able and willing to answer inquiries of a bibliographical nature. The use to which this information will be applied has not yet been decided, but it is suggested that the Institute might act as an international clearing-house for distributing the information collected. In Dr. de Vos' opinion, some central organisation, national or private, should be appointed in each country to collect information concerning the present position of its libraries and, in addition to ascertaining the locations of special collections, to find out where the necessary specialists are to be obtained.

The question whether an international organisation should undertake the production of bibliographies is one that merits consideration, and also one upon which opinion is likely to be divided. Since the International Catalogue of Scientific Literature ceased publication, no work of its kind has, so far as we know, been done, and many will want to know to what extent such work is needed. In this respect different sciences appear to have different requirements. In chemistry so many abstracts are produced by chemical societies throughout the civilised world that the necessity for another organisation appears to be negligible; in fact,

the International Catalogue has scarcely been used at all by chemists. Chemistry, however, is exceptional; some other sciences are far less well served, and unless the societies concerned, or private bodies, intend to undertake the work of abstracting or of compiling bibliographies in a comprehensive way, there appears to be scope for an international effort of this kind.

Related to this subject of abstracts is that of the use of scientific and technical libraries. We greatly appreciate the action of those learned societies which open their doors to students and to others who are not members. For example, in 1919, as a result of a conference of chemical and allied societies, the Chemical Society extended the chemical equipment of its library and admitted as readers the members of the Association of British Chemical Manufacturers, the Biochemical Society, the Faraday Society, the Institute of Chemistry, the Society of Chemical Industry, the Society of Dyers and Colourists, and the Society of Public Analysts. The effect of this wise policy is partly shown in the number of books borrowed during the year. This has risen from 2905 in 1918 to 4950 in 1925. During the year 1925, there were 6994 attendances of readers in the Library of the Chemical Society, of which 4746 were made by fellows and 2248 by members of contributing societies.

There is, of course, a difficulty in opening the doors of a library too widely: there may not be seating accommodation for all who would come in. As time goes on, many scientific libraries find their shelves fully occupied and are at a loss to know how to provide room for the new volumes.

Some libraries contain many volumes they do not really need which would be much more appropriately placed in some other institution. The Association of Special Libraries will be doing good work if it takes this matter in hand and induces each library to exchange or dispose of such works as it does not need and thus make room for books or periodicals more directly connected with its own special subject.

It is by no means desirable that all the older scientific books should be destroyed on the ground that they are out-of-date, for many of these books are valuable historical evidence of the state of scientific knowledge and theory at the time they were written. Indeed, some of them contain original observations which have since been overlooked. But provided that it was assured that a certain number of copies of these works would be preserved, the remainder might cheerfully be removed.

The Association of Special Libraries is not, however, concerned alone with the use of books: its object is "to facilitate the co-ordination and systematic use of sources of information in science, industry, commerce, public affairs, etc." It was appropriate, therefore, that in a paper entitled "A National Intelligence Service," Mr. J. G. Pearce should raise the question as to what is the most efficient method by which scientific and technical workers throughout the country may receive early information about new discoveries and new developments in the subjects with which they are concerned.

A central institution of the kind would have classified index-cards, each bearing the full reference to a book or paper, with a summary of its contents. When it is remembered that some 24,000 periodicals which may contain scientific articles are published throughout the world, and that to this number pamphlets and books must be added, it will be seen that the number of index-cards required to be prepared every year would be very large, probably at least a quarter of a million. The work of selection and indexing must be done by experts in each subject, and then the cards must be written, typewritten, or printed. When an inquiry was received, the staff of the institution would look up the index-cards bearing upon the subject, and would send copies of these, obtained either by typing or by photography.

The Association proposes to make use of the special libraries and information bureaux which already exist in Great Britain. There are several hundreds of these, including the libraries of learned societies, universities, colleges, public libraries, libraries of research associations and libraries of manufacturers and business firms. The first step is the preparation of a Directory of Special Libraries in Great Britain and Ireland. The general editor for this Directory is Mr. G. F. Barwick, late keeper of printed books at the British Museum, whose name is a guarantee that the work will be well done. It is hoped to publish the directory in the summer of 1927. Such a directory will indicate the library or libraries where information on a given subject is likely to be found. Apart from this directory, the Association proposes to answer inquiries from its members as to the literature on a particular subject by giving the names of those libraries that are likely to be able to give the information required.

There are divergent opinions concerning the desirability and practicability of special scientific libraries undertaking the work of information bureaux. Libraries undertaking this work would require greatly enlarged staffs. Information-hunting is a long and arduous pursuit, and we are informed by two experts in this business that the average time required to answer a single inquiry is about two days. On the other hand, the expense should not be prohibitive, for, as Dr. de Vos remarked, an information service should be made to pay for itself: firms and individuals could

afford to pay high fees if they were relieved from doing the work themselves. A second difficulty would be to find the personnel. Information work demands very special qualifications, both in regard to knowledge of books and other sources of information, of at least one science, and a natural *flair* for finding things out. Special training might solve this difficulty to some extent, and a real demand would probably create a supply. Large firms and institutions would, however, probably continue to employ their own information officers, so that the work of information bureaux set up in connexion with special libraries would consist mainly in serving the needs of individuals and small institutions. A further hindrance to the realisation of the scheme would be found in the inability of scientific libraries owned by learned societies to undertake work for outside firms and individuals; charters of incorporation would have to be carefully scanned before action was taken.

The language difficulty is a perennial one in the sphere of the dissemination of scientific knowledge, present methods being prodigiously wasteful in time, effort and money. Translators who possess the qualification of expert knowledge of science and language, including its idioms and technical terms, are exceedingly rare, and as a rule the work is badly remunerated. At the Oxford meeting, Mr. P. K. Turner, of the Research Department of Burndept Wireless, Ltd., spoke in no exaggerated terms of these difficulties, and his suggested solution—the adoption of an international auxiliary language—though old, is one that cannot be overlooked.

Following closely on the lines of the International Auxiliary Language Committee of the British Association, Mr. Turner considered the rival claims of a dead language, a modern national language, and an invented language, and came to the conclusion that Latin is too difficult for the purpose, a modern language would inevitably raise international jealousies, and that an invented language, easy to learn, precise, and capable of providing new words for new concepts, would be best. Of the artificial languages now current, only Esperanto, its offshoot Ido, and Interlingua (Latin without inflexions) are of serious importance, and of these Esperanto has undoubtedly made the greatest headway. We have recently read a scientific treatise on the elementary principles of radio-communication written in Interlingua, the language sponsored by Prof. G. Peano, of the University of Turin, and were much impressed by its ready intelligibility and its brevity; but probably any of the three languages named would serve, with or without modifications, for international abstracts and bibliographies.

The fact remains, however, that none of these invented languages has made any progress in the scientific world. Whenever they are suggested they seem to raise a perfect *furore* among partisans of the dead and national languages. We hold no brief for any one of these linguistic devices which, like shorthand, mathematical, chemical and musical notations, have been invented to serve a special purpose, but in view of the very great advantages that would follow the adoption of a suitable medium for international communications in science, we think that the subject should not be allowed to drop. If the world were ruled by reason (which it is not, and probably never will be) an international auxiliary language would have been adopted many years ago; it remains to be seen how far civilisation will succeed in promoting the dictates of reason against the opposition of instinctive tendencies and age-long prejudices.

Propaganda and Philosophy.

(1) *The Gist of Evolution.* By Prof. Horatio Hackett Newman. Pp. x+154. (New York: The Macmillan Co., 1926.) 6*s.* net.

(2) *Selected Articles on Evolution.* Compiled by Edith M. Phelps. (The Handbook Series.) Pp. liii+283. (New York: The H. W. Wilson Co.; London: Sir Isaac Pitman and Sons, Ltd., 1926.) 2.40 dollars.

(3) *Science as Revelation.* By John M. Watson. Pp. 303+7 plates. (New York: The Macmillan Co., 1925.) 10*s.* net.

(4) *God and Evolution.* By the Rev. W. R. Matthews. (Liverpool Diocesan Board of Divinity Publications.) Pp. ix+58. (London: Longmans, Green and Co., Ltd., 1926.) 3*s.* net.

SO far as one can see from current apologetic literature, England and America present rather a strong contrast. The religious problem across the Atlantic seems merely to be the limited one of evolution *versus* the book of Genesis, an issue which engaged the attention of Englishmen half a century ago, when Americans were getting over their disastrous civil war. The three volumes from America before us all deal more or less directly with the Fundamentalist controversy, the seriousness of which is not understood in England, where we are inclined to laugh at it. It is, however, no laughing matter. It is already being converted into a political issue; the "Bible Schools" where non-graduates are trained for the ministry are engaged in an industrious propaganda, and in some places no political candidate would stand a chance of election who did not profess 'Biblical' views, and no teacher in a public institution could retain his position if he favoured evolution.

(1) In his volume, Prof. H. H Newman, who

participated in the Scopes trial, contributes a brief and clear statement of modern biological doctrines, written for popular use and avoiding technical language so far as possible. The late Lord Acton somewhere tells a story of a great medical specialist unable to pronounce definitely upon a case brought to him. As a clear plain verdict was insisted on by the patient's friends, the great man replied: "I cannot tell you myself, but I can recommend you to fifty doctors who would." The fact is that ignorance can always be dogmatic, and this is where the conscientious man of science is at a disadvantage. "The chemist, the astronomer, the geologist, equally with the biologist and the physicist, feel the inadequacy of their present knowledge of their subjects," writes Prof. Newman. The Fundamentalist has no such searchings of heart, and his omniscience is a controversial asset. Still, we may hope that Prof. Newman's "Gist of Evolution" will be read and pondered by intelligent people in America. It is admirably lucid, its topics are well chosen, and it is neither heavy nor verbose.

(2) Miss E. M. Phelps's book is a compilation of carefully selected articles on evolution, expressions of opinion on both sides of the controversy being included. We cannot imagine anything more useful for one anxious to get a clear grasp of the issue. Although a number of these articles might be selected for attention, that of Prof. John Dewey strikes us as peculiarly valuable as a diagnosis of the situation. It appeared in the *New Republic* of April 2, 1924. He points out that whereas in times past there were two parties to a dispute of this kind, *i.e.* the theological and the scientific specialists, nowadays there is a third, the general public. The real issue now "concerns the growing influence of the general public in matters of thought and belief, and the comparative failure of schooling up to the present time to instil even the rudiments of the scientific attitude in vast numbers of persons, so as to enable them to distinguish between matters of mere opinion and argument and those of fact and ascertainment of fact. . . .

"The realities of the situation centre about what can be done to ally the forces which have democratised society with the mental and moral attitudes of science. The worst of the predicament is a tendency towards a vicious circle. The forces that compel some degree of general schooling also make for a loose, scrappy, and talkative education, and this education in turn re-enforces the bad features of the underlying forces."

(3) These remarks seem applicable to the third volume under review. Mr. J. M. Watson's "Science as Revelation" is a book of rather ambitious scope, attempting to put in clear, brief, and popular form the results of research in all the sciences from physics to psychology. There follow two chapters on ethics and philosophy, and then two more on the new religion, and the new revelation, of science. We are inclined to think that so far as religion and ethics are concerned, our author unduly simplifies the problems. The real issues, namely, as to whether biological science does supply us with an enlightened ethic, and whether the cosmic process is for us or against us (as Huxley taught), he does not seem to face. He sometimes covers up the difficulties with rhetoric, as when he tells us that "Truth is the ONE GREAT GUIDE, and he who closely adheres to it cannot possibly go wrong." Surely this is prolix nonsense: for what the truth is about these matters is just what we would like to discover. Mr. Watson evades the real religious problem, which is not: Does God exist? but, What sort of a God exists? The book seems to us to preach a sort of inverted Fundamentalism; it strikes us as well-intentioned but shallow.

In England, as was observed above, the Genesis *versus* science issue has retired into the background. This may be because there exists a higher level of general education and intelligence in this country; or it may be that amongst ourselves the general public takes little interest in religious problems, so that they are left to the experts who naturally treat them with more intelligence. Between these alternative explanations, we hesitate to pronounce. At any rate, in reading Dr. Matthews' book (4), we breathe a different air; the atmosphere of embittered polemics is absent.

This does not mean that Dr. Matthews sees no important difference between the views he himself holds and those held by some evolutionary philosophers and men of science. He devotes a certain amount of attention to Mr. H. G. Wells and Mr. Bernard Shaw; but, as he says, "there is no arguing with prophets," and we are relieved when he turns "to the less inspiring but more coherent writings of systematic thinkers." His treatment of Prof. Alexander interests us most. There has always seemed to us a difficulty, or even an inconsistency, in the views of this highly original thinker. He asserts that there exists in the universe a tendency, or 'nisus,' to produce a series of qualities of existence; a series like a hierarchy of values which increase as the process continues. We have matter, life, mind, and, in due course (we may hope), deity. But there is no 'purpose' or plan behind this. The elements of the series just 'emerge'; and we must accept their 'emergence' with 'natural piety,' *i.e.* with a devout agnosticism. But what *is* this 'nisus'? Is it just a word to signify that the world is so constructed that, as a matter of fact, it does produce what 'emerges' (in which case the word really has no meaning)? Or does it signify that there is an 'urge'

in the universe which makes it creative? If so, we have got something indistinguishable from 'purpose.' Prof. Alexander is too clear a thinker to talk about 'unconscious purpose,' which is a contradiction in terms, and he prefers not to use the word at all. But 'nisus,' if it means anything, must end by meaning this.

Dr. Matthews seems to us at his best when engaged in philosophical criticism. We doubt if many biologists would follow him in attaching much importance to the views of Driesch, and although all the world recognises the debt which physiology owes to Dr. J. S. Haldane, few take his vitalistic theories seriously. The tendency now is clearly and strongly in favour of mechanistic interpretations. One strong point in Prof. Alexander's work is that he recognises this. We doubt if Dr. Matthews strengthens his case by patronising obsolete scientific theories. The most damaging criticisms of naturalism come from insistence on "the difficulties which inhere in any philosophy which excludes all idea of a supra-temporal reality" (p. 37). As a philosophical system, evolutionary naturalism is beset with difficulties: as a religion, it "is founded on as great an act of faith as any which the Christian doctrine of God requires of us." How true this is—but how unpopular!

We may hope that many students of science, as well as students of theology, will peruse these lectures. They are of a very high quality. We should like to wish them a good circulation in America as well as in Great Britain, when the contagion of Fundamentalist frenzy has passed. J. C. H.

The Races of Mankind.

(1) *Les races et les peuples de la terre.* Par Dr. J. Deniker. Deuxième édition revue et considérablement augmentée. Pp. 750. (Paris: Masson et Cie, 1926.) 75 francs.

(2) *Race and History: an Ethnological Introduction to History.* By Prof. Eugène Pittard. (The History of Civilisation Series.) Translated by V. C. C. Collum. Pp. xxiii + 505. (London: Kegan Paul and Co., Ltd.; New York: Alfred A. Knopf, 1926.) 21*s.* net.

THE reluctance of anthropologists whole-heartedly to apply to the human family the strict principles of classification and phylogenetic arrangement adopted in the wider field of biology is a very curious phenomenon. Yet it is a fact that students of man, even biologists, commonly disregard the significance usually associated in biology with such terms as race and species; and even when this element of confusion is eliminated there still remains some uncertainty as to what constitute the criteria of race. Many years ago Huxley humorously claimed exemption from the disturbing influence of race consciousness that so obviously distorts the outlook of many, if not most, writers on anthropology, on the ground that he enjoyed the serene impartiality of a mongrel.

This factor of personal or racial bias has been a potent factor in causing confusion in the study of race. When, early in the nineteenth century, efforts were made to emancipate the Greeks from Turkish rule, ethnology was used as a political instrument. Ever since then scarcely any national or social conflict anywhere in the world has been free from anthropological irrelevances, which have had the disastrous effect of hampering the calm and dispassionate study of a subject that teems with intrinsic difficulties. One has only to recall the distorting effects of such national prejudice in the claims for Teutonic ascendency and the northern origin of civilisation, the conflicts associated with the phrases 'Yellow Peril' and 'Nordic Race,' and the ever-present antagonism between black and white in the United States, to realise how scientific impartiality has been warped.

Even when such influences are exorcised, two other disturbing factors remain. There is first the selection of the qualities to be used in the determination of race and the estimation of their relative value. Secondly, the factor of racial admixture must be given due consideration by making allowance for its effects. The chief element of confusion in the definition of human races has been due to the former factor, and especially the lack of a due sense of proportion. Examples of this are the exclusion of Bushmen from the Negro race because their skin is not black, suggesting a close affinity between aboriginal Australians and Europeans because there are similarities in the hair, or between Negroes and Mongols because they both have flat noses. But perhaps the most potent element of confusion is the persistence of the term Caucasian, which involves the failure to accord adequate recognition to the fact that there are at least three definite and distinct races, commonly called Mediterranean, Nordic, and Alpine, in the population of Europe and western Asia. Even when the six easily differentiated races—Australian, Negro, Mongol, Mediterranean, Alpine, and Nordic are recognised, there still remains the problem of assigning to each its degrees of affinity to the rest. This can only be done by devising a tentative phylogenetic tree to indicate which races are primitive and which are specialised or advanced.

No work has yet been published that deals with the question of race in such a way as to give adequate recognition to these principles, but the books by Dr. Deniker and Prof. Pittard make a serious attempt to introduce some sort of order and a right perspective

into these questions and to deal with the problems of race in a strictly biological way. They also emphasise the need for caution—never more necessary than at the present time—of not confusing race with culture, language, political aptitude, or distinctive moral qualities.

(1) Of the works dealing with the whole world, perhaps the sanest and the best-balanced is that written in 1900 by the late Dr. Deniker, the learned librarian of the Natural History Museum in Paris. By dealing with both race and culture in intimate association one with the other, he was immune from the sort of errors which writers are liable to commit when they deal with only one aspect of anthropology and neglect the other. Another factor that enhanced the value of Dr. Deniker's book was the information derived from Russian and other Slavonic literature, which is a sealed book to most western anthropologists. At the time of his death in 1918 he was engaged in the task of preparing a revised and considerably enlarged edition of his excellent book. With the help of a number of his colleagues in Paris the author's family has just brought out this new edition after a lapse of eight years. During this time anthropology has made great strides. Hence this book can scarcely be regarded as quite up-to-date. Nevertheless, the improved edition of a book which for more than a quarter of a century has been the standard text-book on the subject is most welcome.

(2) In his foreword to Prof. Pittard's book, M. Henry Berr tells us that in 1912 Dr. Deniker promised to write a volume on race and history for the series of monographs he is editing under the title "L'Évolution de l'humanité" (which is now being issued in English under the general title "The History of Civilisation"). On the death of Dr. Deniker he entrusted the task to Prof. Eugène Pittard, of the University of Geneva, who is well known as an industrious and careful worker in physical anthropology, especially of Switzerland and the Balkan area.

The book is not a treatise on race, nor does it deal in the strict sense of the term with history. It is rather a series of essays on some of the more contentious problems in which factors of race came into some relationship with history. The method of treatment is cautious, if not elusive. In fact much of the book is written in the form of questions to which the author gives no decisive answer. Here is a typical example of Prof. Pittard's method of exposition:

"The abuse of the influence of physical environment as the principal determinant of variations in man reveals to us another attempt at facile explanation in the application of the law of minimum effort. What has not been solemnly put down to it? With what assurance has it been sought to convince us that environment is everything, that men are eminently plastic beings, submitting without protest to every sort of influence! No single character could resist the moulding hand of environment, that all-powerful sculptor who, just as education renders our intellect and moral character rigid, petrifies as with a glaze our different morphologies. Has not the influence of environment been invoked to explain the anatomical variety seen in Jews, thenceforward acquired by very reason of such influence? Does not the morphological Americanisation of various European immigrants in America call, on certain points, for all reserve on our part? What mechanism other than hybridisation could environment employ to mould the cranial character of the new Americans? No one is able to tell us." (P. 14.)

This quotation is typical of the style and method of the book as a whole. Two-thirds of the volume are devoted to Europe. The remaining third deals with Turks, Phœnicians, Jews, Arabs, Iranians, and Tatars, with brief essays on the peoples of India, China, Japan, Egypt, Mexico, the Malay Archipelago, and Oceania.

The book as a whole is a welcome corrective to much that is misleading and confusing in modern anthropological literature. Prof. Pittard does occasionally relent from his attitude of cautious avoidance of direct expression of his views. On most of these occasions he reveals a very conservative adherence to the opinions generally held by French anthropologists, and in particular by Prof. Boule. Thus he accepts without question the opinion that the figurines of the so-called Upper Palæolithic, so misleadingly described as steatopygous, afford evidence of the former presence of people of Hottentot affinities in Europe, a fallacy that Prof. Verneau justly exposed in his Huxley Lecture to the Royal Anthropological Institute in 1924. But Prof. Pittard also adopts Prof. Boule's theory that Verneau's Grimaldi race is really negroid and affords corroboration of the Hottentot speculation! Having recently examined the two skeletons from the Grottes des Enfants at Monaco, I am convinced that there are no just reasons for calling the 'Grimaldi race' negroid.

Prof. Pittard pours gentle scorn on the recent campaign in favour of the supremacy of the Nordic race. Nevertheless he ironically says that the

"despised brachycephals, these representatives of the inferior race *Homo alpinus*, would seem to have invented and propagated two things of capital importance to the progress of civilisation. It is to them that we probably owe the culture of cereals and animal domestication, and that is by no means a small contribution. It might even be said to outweigh a certain number of raids and massacres. Did not these inventions, indeed, have a larger part in determining social progress, and for a longer time, and was not their influence of wider extent than all the warlike disturbances of the Northerners put together?"

There are, however, no valid reasons for assuming that the Alpine people did invent these fundamental contributions to civilisation. At the meeting of the Australasian Association for the Advancement of Science in 1921, Prof. Thomas Cherry set forth evidence establishing the fact that it was members of the Mediterranean race who made these inventions (see also NATURE, June 10, 1920, p. 474).

The problems of determining the ancestry and the original home of the human family, and whether men everywhere spontaneously invented the Chellean *coup de poing*—which Prof. Pittard calls the hypothesis of prehistorians—are brushed aside in two pages of provocative queries, none of which are answered. Instead of this Prof. Pittard says "an attitude of doubt is the wisest." "If an answer must be given to the question put, we shall have to be honest and say that we do not know."

The book affords an amazing revelation of the extent of the misconceptions concerning the Piltdown skull still entertained on the continent. The Piltdown cranium reveals a closer approximation to the condition found in the young chimpanzee than any other human skull does. Yet Prof. Pittard tells his readers (p. 56) that it "would seem to indicate a more highly evolved race" than Heidelberg man. But he goes further than this when he suggests

"the possibility of the Heidelberg race having given birth to the Piltdown race, and the Piltdown race of the type with progressive characters which we meet with in Aurignacian times."

In spite of these defects the book is valuable and interesting. If it adds a few more misunderstandings to the literature of anthropology, it more than atones for this by helping to remove a host of others.

In her translation Miss Collum has wisely kept as near as possible to a strictly literal version of the French. If at times the idiom is uncouth, it enables the reader to realise exactly what the author wrote in a highly controversial subject. The word 'humanité' would be more correctly rendered into English by 'mankind' and not by 'humanity.' The word 'peninsula' is wrongly spelt throughout the book. In fact both in Deniker's and Pittard's book there is an unusually large series of typographical errors.

G. ELLIOT SMITH.

The Influence of Science.

Science and Civilization. Essays Arranged and Edited by F. S. Marvin. (The Unity Series, 6.) Pp. 350. (London: Oxford University Press, 1926.) 6*s.* net.

RATHER more than nine centuries ago, Avicenna bestowed the title of "The Remedy" upon his great treatise on natural philosophy. It is not difficult to appreciate the meaning which lay behind the choice of this unexpected name: natural philosophy, or simply science as we prefer to call it now, was in Avicenna's opinion the cure for the manifold ills of mankind and a tonic to brace humanity for the future. The natural supplement to this opinion is Comte's statement *Savoir afin de prévoir*, which is the motto of the present book. It is now three years since "Science and Civilization" was first published, and because, amid the flood of ephemeral literature which issues from the innumerable presses of the world, those books which are of lasting value run a grave risk of being swept away, we are grateful to Oxford for this new and cheaper edition. The essays which Mr. F. S. Marvin has here edited are, indeed, so valuable and so inspiring that we could have wished for an even less expensive edition: six shillings, though a modest price for a book in these days, is still too much to allow of that wide diffusion which all of us would like to see in the present instance.

No one can feel satisfied with the results which the widespread teaching of science in Great Britain has so far produced. The majority of men appear not to have retained the merest fragment of the scientific facts they presumably learnt at school, and they certainly show no sign of having assimilated scientific principles and method. Even among men of science themselves it is not rare to find science regarded as a craft rather than as a philosophy, and a successful chemist or physicist is often on no higher an intellectual level than a skilled motor mechanic. In these circumstances, science will still advance so long as destiny throws up from time to time the man of insight and genius—the Dalton, the Clerk-Maxwell, the J. J. Thomson—but is that progress likely to be as thorough or as rapid as would be desirable? Is it in the least degree probable that the intellectual advance of the nation at large will keep pace with even a comparatively slow advance of science if present conditions continue? It seems that the answer to both these questions must be a regretful "No"; whereupon the further question arises: What will be the effect upon civilisation if the general intellectual level lags seriously behind the progress of science? In the last year or two this question has been discussed by several talented and imaginative novelists, philosophers and men of science, but we may draw a lesson from the past—the mobilisation of scientific resources for purposes of wholesale destruction during the War showed us only too well what fate may lie in store for the world if the powers and forces of science are misapplied.

It is a common plea that men of science, collectively, are not responsible for the evil uses to which mankind may put scientific knowledge, but is not the argument

fallacious? A man who invents a new weed-killer and leaves it lying about, so that his child poisons himself with it, cannot be absolved from blame on the score that his invention was wrongly applied. If a chemist produces a tremendously effective explosive, fully realising that in all probability the first use men will make of it will be to destroy one another, it is very difficult to acquit him altogether. Read this extract from an account of the Spanish operations in Morocco: "Like the fiery rain of Dante, the bombs crashed from the skies, smashing villages, burning crops, slaying the wounded and murdering women and children. . . . For these bravos of the air there were not even the usual sporting risks of war—no fearless hostile airmen to grapple with; no anti-aircraft guns to face. A good breakfast, a pleasant ride, a few brave men killed, a few children rendered homeless and orphans—then back to a good dinner." Has science, which made things like this possible, no responsibility? Am I my brother's keeper?

In a certain sense, of course, science is non-moral, and in the illustration given above it is clear that the wrongful action lay not in the invention of the weed-killer but in the carelessness which left it unguarded. Science *qua* science is not responsible for its misuse, and we are perfectly justified in insisting upon this when the opponent of progress points to the ruined village, the slave of cocaine or the blinded victim of the vitriol-thrower. It is, however, impossible to divorce science from the scientist, and the latter is human and shares human responsibilities. To adopt a sentence of Dean Inge's in a sense different from that in which he used it, "we must not regard the world of science as an objectively existing fact, wholly independent of us who observe it." The scientist, in fact, has a double duty; he must not only further the course of science but must also do his utmost to ensure the right use of the control of Nature he places in men's hands.

Such books as "Science and Civilization" are eminently serviceable for the latter purpose, since they make the unreflective man of science reflect and at the same time manifest to the general public, in a way which more technical books could not, what Sir Richard Gregory has happily called the "Spirit and Service of Science."

Of all the good things which Mr. Marvin has collected for us it is difficult to single out any particular essay for special mention, but the attention of all who are engaged in teaching science—whether in universities, colleges, or schools—may be earnestly directed to the essay on "Science and Education." For the root of the whole problem appears to us to lie in the way in which science is taught, and more especially in the way in which it is taught in our schools. Mr. Heath's thoughtful study should be read by every schoolmaster, whether a science master or not, and although his warm approval of the methods of Sanderson of Oundle may leave some of us cold, all of us will realise better than we did before the magnitude of our responsibility and of our opportunity.

The essays which deal with the history of science in its social aspects are still, as when first published, the best of their kind; they show that a true internationalism, which the League of Nations is laboriously striving to effect in the world of politics, has already and for centuries past been effected in the world of science. Scientific internationalism, superior to but not destructive of local patriotism, affords the best safeguard for the future of civilisation, and Mr. Marvin and his collaborators have the solid satisfaction of knowing that they have made a not insignificant contribution to this end.

E. J. HOLMYARD.

Modern Industrial Chemistry.

(1) *An Introduction to Industrial Chemistry.* By Dr. S. I. Levy. Pp. xiii+288+16 plates. (London: G. Bell and Sons, Ltd., 1926.) 15*s.* net.

(2) *Industrial Chemistry: a Manual for the Student and Manufacturer.* Edited by Allen Rogers. Fourth edition. In 2 vols. Vol. 1: Inorganic. Pp. xx+511+xxiii. Vol. 2: Organic. Pp. iv+512-1267. (London, Bombay and Sydney: Constable and Co., Ltd., 1925.) 52*s.* 6*d.* net.

(1) IN his introduction to industrial chemistry, Dr. Levy presents an aspect of a branch of technology which is not usually portrayed in treatises dealing with the application of chemical principles to factory operations. The new departure consists in directing special attention to the utilisation of all factors involved in efficient large scale production, these essential factors being grouped under the heading of "Costing."

As a typical example the author selects the manufacture of aniline from such commercially available materials as benzene, sodium nitrate, sulphuric acid, and iron filings. The factory method of keeping stock accounts of raw materials, intermediates, and final product is illustrated. Plant record sheets and overall consumption figures are also computed and furnish data for the tabulation of a flow sheet showing the efficiency of the process at each stage. The cost price of the final product is determined by drawing up a cost sheet, taking into account not only the price of materials but also overhead charges and the cost of various services. The exact incidence of the separate items on the cost of production is readily revealed by expressing these data in simple graphical form.

Following on this concrete example of the importance of process costing, the author deals with such typical large scale operations as heating and cooling, pulverising, mixing, filtration, extraction, distillation, sublimation, and desiccation. A short section is devoted to the works equipment required in the storage, transportation, and manipulation of gases, liquids, and solids.

A general survey of chemical industry condensed into 40 pages is so sketchy that it is of doubtful utility and detracts from the merit of a treatise which otherwise sets up a new standard of excellence among technological text-books. A similar criticism applies to the short chapter on the fuel industries.

To the topic of sulphuric acid, however, an authoritative chapter is devoted which contains valuable details and includes the author's war experiences as shown by the data then collected in regard to the relative costs of production of sulphuric acid by the chamber process and by the various contact processes. The concluding sections deal with the alkali industry and with the manufacture of intermediates and explosives. The economic factor is again emphasised and flow sheets are appended giving the costs of production of the principal service explosives.

As indicated by Sir William Pope in his introduction to this volume, the treatise is modelled on unconventional lines and may accordingly be read with advantage by every one interested in the industrial applications of chemistry.

(2) These two volumes are the fourth edition of a comprehensive manual written by a group of American chemists and covering a wide range of industrial topics.

Vol. 1, which deals mainly with inorganic subjects, commences with a chapter on general processes as carried out in the factory; but sometimes, as in the case of autoclaves, the information given is only slight. Water for industrial use, a matter of general interest, receives attention in a separate chapter having its own bibliography. A very readable essay on sulphuric acid contains interesting details, especially in regard to American practice, but English readers will be surprised to find no mention of Messel and his associates in the survey of the historical development of the contact process.

A chapter on elements and compounds, arranged alphabetically, contains references to these materials which are sometimes misleading and generally too fragmentary to be of any practical value. Cobalt is dismissed in a few lines as colour producing element, but its increasingly important alloys are not mentioned. Under the heading of hydrogen peroxide there is no reference to the concentrated forms of this oxidising agent. The statement that sodium nitrite is prepared by heating sodium nitrate and metallic lead refers to an unhealthy process which happily has become obsolete. Altogether this section on elements and compounds is a hopeless attempt to compete with the larger chemical encyclopædias.

Ozone is discussed in the foregoing section and again in the section on electro-chemical industries, so that in future editions the editor might well consider the desirability of having a separate chapter on the atmospheric gases, including in this section oxygen and ozone.

The second and larger volume of this treatise contains instructive essays on various industries based on organic chemistry. The products of the distillation of coal are discussed from different viewpoints in several chapters, and the destructive distillation of wood is the subject of a separate section. In view of the increasing production of synthetic methyl alcohol, a chapter might appropriately have been added on this alcohol and its derivatives, including formaldehyde and its industrially important condensation products. The section on explosives is too short to be of value for reference purposes, and the following statement is misleading (p. 1183): "Titra-nitroaniline (*sic*) made by nitrating aniline." The patented nitration starts from *meta*-nitroaniline prepared from dinitrobenzene.

There are, however, many excellent monographs in this organic section, and among them may be mentioned the informative articles on essential oils, perfumes, and flavouring materials, on resins, gums, and turpentine, and on leather.

What is Mind?

Mental Life: an Introduction to Psychology. By Dr. B. Edgell. Pp. xvi+275. (London: Methuen and Co., Ltd., 1926.) 7*s.* 6*d.* net.

PSYCHOLOGISTS are faced with the difficult task of clearly distinguishing their field of study, on one side, from philosophy and, on the other, from biology. The domains of other sciences were originally defined in naïve, common-sense terms that raised no initial difficulty. On the basis of common experience every one knew what was meant by 'heat,' but with its scientific study, unexpected difficulties arose. The 'caloric' proved weightless, and 'heat' was then described as a mode of motion. The facts of radiation raised fresh difficulty, and theory gave, first, 'insensible heat' and then motion of an immaterial ether. This entailed the difficulty of a kinetic energy from which the term mass had vanished: to be dealt with in turn by recasting the meaning of energy in the light of electro-magnetic theory and the theory of relativity.

Still, however, the definition of 'heat' presents difficulties which are but evaded in the modern tendency to fall back on some reference to crude introspective evidence and common-sense belief such as: 'The agent which produces in us certain sensations.'

Put 'mind' in place of 'heat' and just because 'mind' is of greater interest we find that, before the days of experimental science, it had been so studied that the problem of its ultimate nature had already reached the almost hopeless position in which 'matter' and 'electricity' now find themselves. Modern psychologists are tempted to benefit by the experience of experimental science and leave to philosophy their ultimate problem. Not—What is mind? but—What are its activities? seems problem enough. Psychology becomes the "science of mental life" (p. xi).

'Life' however is as elusive as 'mind.' Biology disowns the problem of 'life' and is content to be the 'science of living things.' Possibly, shorn of all that is best left to metaphysics, nothing remains of a 'science of mental life' that is not well within the purview of the 'science of living things'! Accept this conclusion and psychology becomes the 'science of behaviour.' But the crude facts of mental activity are known to every one, and even medicine has found in *mental* sickness, as opposed to *organic* lesion, the easiest explanation of certain forms of bodily incapacity. Explanatory theory in terms of 'unconscious mental activity' follows and leads the way into highly speculative regions of 'new psychology,' in which an attempt is made to supply the need felt of an abiding something that, through all changes, continues. Psychology becomes the 'science of the unconscious.' Physics in similar straits formulated the theory of the ether.

As a result of this difficult position, many an 'introduction' to psychology, after a few words on the foolishness of 'the old psychology,' reveals itself as concerned only with some particular modern development or school of thought. It is therefore refreshing to meet a work that is entitled to its claim: an introduction to *psychology*. With clear knowledge of the 'old,' Dr. Edgell has reviewed much of the 'new' and given it its place in that evergrowing body of knowledge in the formulation of which Aristotle played no unimportant part.

The general line of treatment follows James and Ward and brings their work up-to-date with new facts and theories that have taken sufficiently definite shape to be presentable in form suitable for the general reader and beginner.

Controversial matter has of necessity been included, and psychologists will welcome the author's statement of position on 'Freudian theory' and 'behaviourism.' Considering the theories of Freud, Adler, and Jung, she writes: "All attempts to reduce primitive values to one inclusive category seem futile, for, even when combined, these three types of appeal may be far from exhausting primitive possibilities" (p. 157). Then, dealing with Freudian theory in more detail, "It may well be that, notwithstanding the success attendant on psycho-analysis, the unconscious as conceived by Professor Freud, is a 'false cause' . . . the Freudian theory appears to conflict with any intelligible view of mental life" (p. 160).

In opposition to the narrow Freudian view of 'the unconscious' the author uses the term for the "organisation of meanings and values (knowledge and character) . . . the abiding structure of mind" (p. 158). This leads to interesting corollaries including apparently a disavowal of the fundamental Freudian belief in unconscious mental activities (p. 173).

Behaviourism is reviewed in an appendix. The inadequacy of the experimental basis to support the deductions drawn therefrom is stressed. Really to secure the behaviourist position "conditioned reflexes should be established in circumstances where there is reasonable evidence of the complete absence of what the psychologist calls consciousness" (p. 265). Behaviourism "breaks down as a system of psychology and is no more successful in shelving the problem of mind and body than was its precursor, epiphenomenalism" (p. 268).

The definition 'science of mental life' also attempts to shelve the difficulties surrounding the idea of mind as an abiding entity (p. xi), but leads to a position almost identical with that of James when he wrote: "The thoughts themselves are the thinker." "We must be on our guard," writes the author, "against treating . . . the subject or individual experient [as if he] were something over and above his experience" (p. 19). We find difficulty in attempting to harmonise this with the 'unconscious' as "an organisation . . . the abiding structure of mind." Then we realise that much of the book is concerned with this 'structure' rather than with 'experience,' and reading, "This structure is being built up by the events of mental life; in its turn it determines the function of mental events, their meaning and their value" (p. 126), we again grow hopeful that it will yet be possible for psychologists to follow Prof. McDougall back to the definition 'science of mind' as the best to cover both "facts of mental activity and facts of mental structure" ("Outline of Psychology," p. 41). In such a definition any particular theory of the ultimate nature of mind is no more posited or necessary than were theories of the ultimate nature of electricity and matter in the original definitions of the fields of study of the physicist and chemist.

R. J. BARTLETT.

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.*]

Spectrographic Junction between the X-ray Region and the Extreme Ultra-Violet.

IN previous papers (*Comptes rendus*, **182**, 1083, and 183, 193, May and July 1926) a method was given, suitable for spectrographic work in the unknown region between 20 and 150 Ångström units. In the meantime, some $K\alpha$ lines belonging to light elements (oxygen, carbon, boron), and a few N barium lines, have been measured. It was interesting to apply the new method to the detection of lowest frequency N and O series of a heavy element. Thanks to the kind help of Dr. Holst, Director of the Philips Laboratory, I obtained a sample of thorium wire, prepared by Dr. de Boer, and I used it as a hot cathode in the X-ray tube of my vacuum spectrograph. With an exposure of 4 hours, with a current of 29 milliamperes under 2·8 kilowatts peak value, I obtained good thorium spectra. The middle part of each plate is covered by a filter consisting of goldbeater's foil, 7×10^{-6} cm. thick, used to estimate penetrating power and order of spectra. All the lines detected are new N and O thorium lines of very low frequency. A very strong 45·3 Å.U. line coincides with the $K\alpha$ line of carbon, but is a different one. This is proved by three facts: that tantalum, molybdenum or zirconium hot-wire cathodes, used in the same conditions, do not show the carbon line; that the thorium deposit on the target was very important and visible to the naked eye; that measurements of critical potentials, made with another apparatus, by the ionisation method, do not show at all the carbon K critical potential (287 volts) but the two well-defined N_3 (355 volts) and N_{12} (312 volts) thorium critical voltages, corresponding to the respective emission of 45·3 and 51·5 Å.U. lines.

The strong 45·3 Å.U. line appears in three successive orders and covers, by its broadness, a new line, 48·2 Å.U., which appears only in the second order. This one cannot be the first order line, as it is shown by application of the combination principle, and is, in fact, the highest frequency line in the O series. All the recorded lines fit very closely into the theoretical requirements. Only one line, O_5P_3, is missing, probably owing to faintness, its probable intensity being supposed to be only half of that of the 71 Å.U. line.

These lines are tabulated below and designated by the usual terminology:

λ: Å.U.	ν/R.	Line.	Intensity.	Combination.	Corresponding Energy Levels: ν/R.
45·3	21·0	$N\beta$	very strong	N_3-O_{12}	$N_3=26·2$ (directly measured); $O_{12}=5·2$
48·2	18·9	$O\delta$	medium	O_6-P_{12}	$O_6=20·4$; $P_{12}=1·5$
51·5	17·7	$N\alpha$	strong	$N_{12}-O_{12}$	$N_{12}=23·0$ (dir. m.); $O_{12}=5·3$
71·0	12·8	$O\gamma$	faint	O_4-P_3	$O_4=14·8$; $P_3=2$
121	7·5	$O\beta$	faint	O_3-P_{12}	$O_3=8·5$; $P_{12}=1$

The only low-frequency line escaping detection ($O\alpha$) would have a wave-length of about 230 Å.U. It is the last pure Röntgen line waiting to be found. In the short wave-length side of the spectrum, higher frequency N lines are faint and fogged by the strong optical reflection upon the grating of very soft X-rays. Nevertheless two faint lines, 26 and 27·2 Å.U., have once been found.

Remarkable is the simplicity of these spectra in which there is neither spark- nor semi-optical lines, thanks to the small exciting potential. This series of measurements completes in this way our knowledge of Röntgen series and atomic levels and, at the same time, leads to the long-desired spectrographic junction between ordinary X-rays and Millikan optical spectra in the extreme ultra-violet (136 Å.U.: short wave-length limit of aluminium).

A. DAUVILLIER.

Laboratoire de Recherches Physiques,
sur les Rayons X,
12 Rue Lord-Byron 8e Arrt., Paris,
September 16.

Prof. Labbé's Production of "Allomorphs."

PROF. LABBÉ in a recent paper (*Arch. Zool. Exp.*, t. 62, p. 498, 1924), in speaking of some copepods and other animals, has made the following statement:—

"The eggs of species A laid in a medium of pH 8·2 would give the form A, but at pH 8·4 would give the form A', and at pH 8·6 the form A''. . . .

"It is exact for Artemia, but for the other forms the fact is more important, for it brings about the transition [il conduit à l'émiettement] of one species to another; this is what I shall call the *allomorph* or the allomorphs of the species."

The paper then goes on to state that various allomorphs have been obtained experimentally by a gradual increase in pH. It also claims that *Cyclops helgolandicus* Rehberg is an allomorph of this type, *Cyclops bicuspidatus* Claus being the real species.

Mr. Robert Gurney (NATURE, vol. 118, p. 336, 1926) has severely criticised Prof. Labbé's statements and leads one to think that the necessary attention to detail has not been given and that the allomorphs were not really the offspring of the species described. Mr. Gurney suggests that the mistake might have arisen through the accidental introduction of the minute larvæ of other species.

I wish to bring forward evidence of an entirely different nature which leads to the same conclusion as that of Mr. Gurney.

For the last three years I have been making a detailed study of the genus Cyclops, an important group of copepods, and in every case the pH value of the water in which the animals were actually living was taken. In this way in Great Britain alone I have recorded 31 species, 5 of which are new to the country and 3 new to science. I do not propose to give here either a full list of the species or of their ranges of pH since the work is by no means finished, but I will give simply the ranges observed for a few of the better known ones:

Species.	Range of pH.
Cyclops vulgaris	4·6-9·8
,, *strenuus*	4·6-8·6
,, *lucidulus*	4·4-7·4
,, *robustus*	4·6-8·2
,, *pulchellus* (syn. *bicuspidatus*)	5·8-8·6
,, *signatus* (syn. *fuscus*)	5·0-8·0
,, *annulicornis* (syn. *albidus*)	4·4-9·8
,, *serrulatus* (syn. *Leptocyclops agilis*)	4·6-9·8
,, *prasinus*	4·6-9·8
,, *fimbriatus*	5·0-8·1
,, *nanus*	4·4-7·2
,, *venustus*	5·1-7·4

It is more than likely that as time goes on these ranges will be increased, but I have carried out observations in the following districts: The Isle of

Skye, Perthshire, Folkestone and Hythe, Dartmoor, Cambridge, Oxford, and of course Wilts.

When it is found that a number of well-known species such as those given above can be found with such large ranges of *p*H, it seems impossible to accept Prof. Labbé's statement that a small increase of *p*H is responsible for the transition of one species into another.

In this connexion further observations may be cited. I have found *Cyclops fimbriatus* living in three inches of foul muddy water and dredged it up on the same day in 100 feet of clear water from a Scottish loch. Prof. Sars records the dredging of exactly the same species from 300 feet of water. This is by no means an isolated case. In addition, many of the species of Cyclops are absolutely cosmopolitan, the same species being recorded from the Arctic Circle to the equator wherever there is fresh water.

As a third kind of direct observation I should add that in a series of experiments on the spine formulae of *Cyclops lacunae*, I bred several generations of the well-known species *C. signatus* and *C. albidus*. The description of these experiments is now in the press and full details are given; suffice it to say here that the animals were bred in jars in an incubator, as controls, and that during the experiments the *p*H gradually went up from 7·2 to 8·6. The spine formulæ were observed as carefully as possible and both species bred absolutely true to type, and I do not know of any more exacting test.

My experiments and observations therefore do not agree with those of Prof. Labbé, and it is surely now almost an established fact that the alterations of *p*H within reasonable limits have little or no direct effect on freshwater entomostraca or insect larvæ, but a profound effect on most of the protozoa. It is well known of course that certain animals bred in captivity and under abnormal conditions may give rise gradually to a series of monstrosities, *e.g.* the Chinese gold-fish described by Tornier, but there is nothing in these experiments comparable to the transition of one species into another in Nature.

Finally, there is abundant literature, including that given by Prof. Labbé himself, dealing with the continual change of *p*H that takes place normally in any exposed piece of water, and since the entomostracan fauna often remains practically unchanged for weeks and in some cases for months, it is surely obvious that most of the species are not affected by small changes of *p*H, and in some cases they are not affected even by considerable changes.

A. G. LOWNDES.

Marlborough.

'Pwdre Ser' (The Rot of the Stars).

PERHAPS I may be allowed to reopen a subject which gave rise to a very interesting correspondence in NATURE in 1910. I refer to the mysterious jelly-like substance found lying about in open spaces, and popularly connected with 'shooting-stars,' about which Prof. T. McKenny Hughes contributed an interesting article to these columns on June 23, 1910. Many suggestions as to the origin of this substance were made both by Prof. Hughes and by later correspondents, but no definite conclusion seems to have been reached. Of course it cannot be taken for granted that the 'jelly' is always of the same nature. It may well be that the 'jellies' recorded by some observers were the plasmodia of Myxomycetes, or masses of Nostoc or some other organism. But it seems to have been suggested so early as 1667 by Merrett that the jelly consisted of the viscera of frogs. He says (I quote from Prof. Hughes) ". . . Regiae Societati palam ostendi solummodo oriri ex intestinis ranarum a corvis in unum locum congestis, quod aliis etiam ejusdem societatis viri praestantissimi postea confirmarunt."

The German observer Melsheimer, again, as was pointed out in these columns by Dr. G. H. Pethybridge, considered the jelly to be the remains of the oviducts of frogs. Melsheimer (*Jahresber. Westfälischen Provinzial-Vereins für Wiss. u. Kunst*, Münster, Sitzung February 28, 1908, p. 53) believed that these were left on the ground, or thrown up undigested, by some animal which devoured frogs, such as the heron, polecat, or water-vole. He also carried out experiments which showed that the oviducts of frogs, if dissected out and exposed to moisture, formed just such masses of jelly, and in some cases eventually became covered with colonies of algæ of the type of Nostoc.

I am in a position to state that the explanation offered by these writers is, at least in some instances, the correct one. My father, the Rev. F. Baylis, who has for some years visited Dartmoor during the summer and autumn, has both last year and this found such jelly-like masses lying on the moor. This year he has forwarded his 'finds' to me for examination, and I have been able to satisfy myself that they consist of parts of the viscera of either frogs or toads. In one specimen the 'jelly' was accompanied by portions of both oviducts in a fair state of preservation, with part of the ovaries, containing the characteristic black eggs, resembling shot, and with the greater part of the animal's alimentary canal, to which the urinary bladder was attached.

What appears to happen is that the gelatinous secretion of the glands lining the oviducts, when exposed to moisture, swells up to such an extent that the oviducts split open longitudinally, and their contents soon assume the appearance of an amorphous jelly. With advancing decomposition, the jelly persists for some time, but the tissue from which it originated may become unrecognisable. I have carefully examined stained microscopic preparations of the tissue, which was on this occasion comparatively fresh, and compared them with similar preparations of the wall of the oviduct of a known frog, supplied by my colleague, Mr. H. W. Parker. By this means both Mr. Parker and myself were able to satisfy ourselves completely that the tissues were of the same kind. From the fact that the stomach, which evidently belonged to the same animal, contained recognisable remains of a fairly large earthworm, I am inclined to believe that the animal was a toad rather than a frog.

The question now arises: How do the viscera of toads or frogs come to be lying on the ground in such situations? One specimen came from near the top of a 'tor.' If the animal had been swallowed by a heron or other bird, and its remains disgorged, it seems probable that these soft parts would have been digested more rapidly than the muscular and bony portions, of which there is no trace. I am inclined, therefore, to believe that some carnivorous creature (such as the weasel, stoat, badger, crow, or buzzard) is in the habit of disembowelling toads or frogs, and leaving some of the viscera on the site of the 'kill.' It would be interesting to know whether any direct observations have been made which bear upon this question.

H. A. BAYLIS.

British Museum (Natural History),
Cromwell Road, London, S.W.7,
September 21.

Science and Psychical Research.

IN Dr. Tillyard's rejoinder to my letter on this subject, published in NATURE for August 28, he cites Richet as one of the great scientific men who have studied psychical phenomena and have become convinced of their genuineness. He couples Richet with Crookes, Lodge, and others in this respect, but without even suggesting any difference between the individual beliefs of these eminent men. Since I read this my attention has been directed to a statement published by Richet only a little more than two years ago, which appears to me to be of the highest importance.

As we know, Crookes believed that the phenomena which he observed were due to spirits—that is to say, to the discarnate manes of deceased human beings—and Lodge too appears clearly to be of the same opinion. From every human point of view this, of course, is a momentous belief, as indicating the survival after death of human personality. But what does Richet believe?—Richet, who is put by Dr. Tillyard in exactly the same category as Crookes and Lodge.

In the *Proceedings of the Society for Psychical Research* for May 1924, in an article on "The Difficulty of Survival from the Scientific Point of View," Richet, after some evident hesitation, makes the uncompromising statement: "I am forced to regard the spiritistic hypothesis, not only as undemonstrated, but, still more, as being in formal opposition to a great number of facts."

Some may perhaps criticise the word 'spiritistic' which Richet uses. It does not appear to be a dictionary word; but it seems clear from the rest of Richet's article that he uses it as meaning 'pertaining to spirits,' and that what he wishes to convey is that he is quite unconvinced that psychical phenomena are in any way due to spirits, or that such phenomena afford any evidence that spirits exist.

It seems to me, therefore, entirely wrong to class Richet as a spiritualist like Crookes and Lodge, as to do so is most misleading.

A. A. CAMPBELL SWINTON.

Amsterdam,
September 28.

As Mr. Campbell Swinton has directed attention to the National Laboratory of Psychical Research in his letter published in NATURE of September 25, I may perhaps be allowed to modify his observations, which I strongly suspect were intended to be disparaging.

The National Laboratory is no more and no less a "purely private concern" than any other society founded for the purpose of scientific investigation and research. The institution is presided over by Lord Sands, and its vice-presidents and correspondents include Viscountess Grey of Fallodon and many eminent psychists and university professors in all parts of the world. The National Laboratory is governed by a council consisting of well-known London medical men and others whose concern is solely to elucidate the deep mysteries of psychic phenomena and, if possible, to discover the laws governing them. A perusal of our list of members would reveal to Mr. Swinton many names famous in various branches of science.

If we have erred in the naming of our organisation, fellow-sinners to the extent of seven columns in the "Telephone Directory" have committed the same 'crime.' Only lack of intelligence or gross carelessness could possibly account for any confusion between the name of our institution and that of the National Physical Laboratory. Both organisations are engaged in an endeavour to increase the sum total of the world's knowledge by scientific means, the only difference being that the National Physical Laboratory is supported by the taxpayers and we are not. I admit that the substitution of the word 'International' for 'National' would more properly describe our activities. Mr. Swinton's remark that the name of our laboratory seems to be *suggestio falsi* is as untrue as it is unjust.

It is curious that 'emotional disturbances' have never before been recorded by means of a thermograph; it is still more curious that at séances with eminent mediums the changes in the sitters' thermal conditions should exactly synchronise with the production of phenomena, witnessed under excellent lighting conditions and simultaneously recorded by means of a dictaphone. The fact is, of course, that when no medium is present the graph shows a steadily rising curve with no lowering of the temperature. But if we have proved that 'emotional disturbances' on the part of the sitters three feet away from the thermograph will lower the temperature several degrees, the founding of the National Laboratory of Psychical Research will not have been in vain!

HARRY PRICE.
(Honorary Director.)

National Laboratory of Psychical Research,
16 Queensberry Place, London, S.W.7,
September 29.

I WOULD not follow Mr. Campbell Swinton further—I have already done so in the correspondence columns of four newspapers—if he did not make a specific attack upon my accuracy. I must vindicate this by explaining the incident mentioned, while admitting that his misreading of it is not unnatural.

I had seen a representative of the *Morning Post* and had suggested that the picture be published. He told me that he feared it would not reproduce. After one interview I thought that I would at least send it up, and I did so, quoting what their representative had said. Therefore I am quite accurate when I say that when I *first* approached the *Morning Post* I made no suggestion that the photograph would not reproduce. How could I, who profess no knowledge of such matters, instruct a newspaper as to whether they could reproduce or not?

ARTHUR CONAN DOYLE.

Windlesham,
Crowborough, Sussex,
September 30.

Distribution of Intensity in the Spectrum of γ-Rays.

NEW information concerning the spectrum of γ-rays may be obtained if we consider the energy of Compton's recoil electrons. As has been shown already (NATURE, 116, p. 206, 1925), these electrons can be observed in a Wilson's cloud expansion chamber. In the case of very fast electrons, their velocity is determined from the curvature of the tracks photographed in a homogeneous magnetic field. The energy of recoil E and the frequency ν of the primary rays are connected by the following relation of Debye and Compton:

$$\frac{E}{h\nu} = \frac{2\alpha}{1 + 2\alpha + (1+\alpha)^2 t_g^2 \theta}, \quad . \quad . \quad (D.\text{-}C.)$$

where $\alpha = h\nu/mc^2$, m is the mass of the electron, and θ is

the angle between the direction of the recoil and that of the primary rays.

Using photographs of the tracks, it is not possible to attain the same accuracy as with the usual methods. But, though only approximate values of the frequency ν can be obtained, this method, nevertheless, provides quite satisfactory results as regards the distribution of energy in the spectrum. Wilson's cloud expansion chamber allows a direct counting of the separate quanta of the scattered radiation, as in this case every observed recoil electron represents one single quantum.

I obtained about two hundred stereoscopical photographs of tracks of secondary electrons, produced in a gas under the action of γ-rays hardened by 3 mm. of lead. Out of all observed tracks, those were chosen where the angle θ lay approximately within the limits of 0°-20°. The value $H\rho$ (H = strength of the magnetic field, ρ = radius of curvature) was determined for 170 tracks, which satisfied the above condition.

The results are shown in the accompanying diagram (Fig. 1).

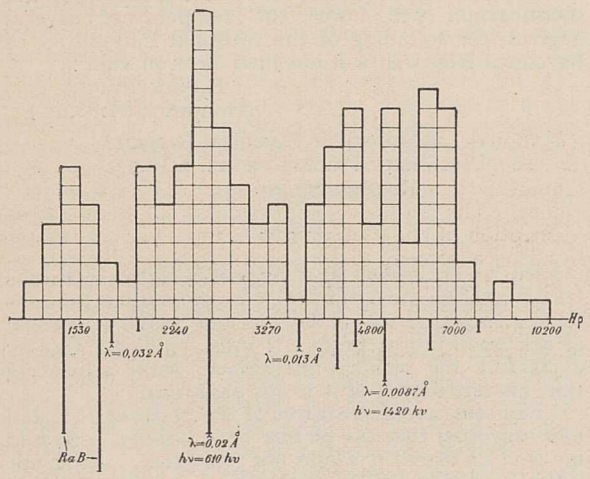

FIG. 1.

The values of $H\rho$ are plotted on a logarithmic scale, one division of which corresponds to about 8 per cent. of the value $H\rho$.

The number of squares corresponding to one division is equal to the number of observed electrons for which the value $H\rho$ was found to lie in the limits of the given division. Definite values of $H\rho$ are also given for each separate line of the spectrum of γ-rays, found by Ellis (*Proc. Cam. Phil. Soc.*, **22**, 369, 1924); these values of $H\rho$ correspond to those for the energy E, which follow from relation (*D.-C.*) in the case of ν being put equal to the frequency of the given line and the angle θ to 10°. On the diagram the separate lines of Ellis's spectrum are represented by straight lines, the lengths of which are proportional to the intensity of the corresponding line, as given by Ellis.

The distribution thus obtained corresponds, in its outlines, to Ellis's spectrum, as could be predicted from the quantum relation (*D.-C.*)

It is probable that, in the interval $0{\cdot}03 > \lambda > 0{\cdot}014$ Å.U., there exists either a continuous γ-radiation or some more lines beside those registered by Ellis. (This assumption is in accord with Thibaud's research (*Ann. de Phys.*, vol. 5, 73, 1926).)

In order to determine the intensities in the primary beam, we have still to account for the probability of recoil in the given conditions ($\theta < 20°$). Compton's theory gives a definite value for this probability. The distribution of intensities which can be deduced directly from my experimental data did not agree with the distribution obtained by Ahmad, who has used the ionisation method and also based himself on Compton's theory (*Proc. Roy. Soc.*, **109**, 206, 1925).

D. SKOBELTZYN.

The Physical-Technical and
Polytechnical Institutes,
Leningrad, August 22.

Light-Organs in Littoral Cephalopoda.

THE large group of pelagic 'squids' known as the Egopsida, which includes the greatest number of families of living cephalopods, is characterised by the frequent occurrence of light-organs situated in a variety of places both on the outer surface and within the mantle-cavity. The Myopsida (which include the true squids (Loligo) and cuttlefish (Sepia)), on the other hand, are poor in luminous species. Dr. S. S. Berry in his recent survey of the occurrence of luminous organs in Cephalopoda (*Biological Bulletin*, 38, 1920, pp. 141 and 171) lists 99 luminescent species of Egopsida (57 per cent.), 27 of Myopsida (12 per cent.) and 2 of Octopoda (1 per cent.). We cannot believe that these organs are necessarily correlated with the habit of living permanently in, or periodically descending to, great depths. Many of the Octopoda are permanent inhabitants of the deeper layers of the sea and are yet devoid of luminous organs. There may be some special source of correlation between the occurrence of light-organs and abyssal habitat which may be responsible for the occurrence of the former among the Egopsida, but not among the Octopoda. Of this we have no certain evidence at present.

The view that the presence of light-organs is directly correlated with reduction of light, and hence with abyssal habitat, gains some support from the fact that, while many Egopsida have a considerable vertical range, in the Myopsida, which are regarded as mainly littoral in habit, light-organs occur in only 12 per cent. of the species. The exact vertical range of individual genera of Myopsida is a little obscure, and it is obvious that in several of them it is considerable. Due consideration must of course be given to the fact that unless a specimen is taken in a closing net the exact depth of its regular habitat cannot be satisfactorily assessed. However, there is not much doubt that the Sepiolidæ inhabit relatively shallow water (down to about 100 fathoms), while the Loliginidæ and Sepiidæ are definitely littoral, though it is at present uncertain how deep they range in the course of their reproductive cycle. Nevertheless, paired photogenic organs situated immediately over the ink-sac were recorded by W. Meyer (*Zool. Anz.*, 30, p. 388, 1906) in *Sepiola rondeletii* (surface -100 fathoms). In the Loliginidæ and Sepiidæ, two very large families, no photogenic organs at all were recorded by Berry in his survey of the group (see above). Thanks, however, to the acuteness of M. Armand Krempf, director of the oceanographical and fishery service of Indo-China, and to the courtesy of Dr. R. Ph. Dollfus, Secrétaire Général de l'Institut Scientifique Chérifien, I am able to record the occurrence of rectal light-organs, exactly similar to those of *Sepiola rondeletii*, in a new species of Loligo (shortly to be described) from Indo-China. The species in question is obviously of littoral habit.

The general considerations outlined above and this new observation render it very desirable to collect exact data as to the distribution and habits of these animals. Without such data it must remain impossible to decide whether these luminous organs are adaptive

in the usual sense of that word and, if so, to what needs they correspond (*e.g.* the search for food or the attraction of mating-partners), or whether they are at the offset developed without reference to the welfare of the organism. G. C. ROBSON.

British Museum (Natural History),
South Kensington, London, S.W.7,
September 22.

Electrostatic Moments of Molecules.

I HAVE made recently some observations on the electrostatic moments of molecules. A beam of molecules, all having sensibly parallel velocities, was passed through an electrostatic field, so arranged that the quantity d^2v/dx^2 (x measured perpendicular to the direction of the molecular motion) was of the order of 10^6 e.s.u./cm.^{2}. Experiments were made on the metal potassium and on the compounds sodium chloride, mercuric chloride, and arsenic trioxide. It was found that potassium had a moment too small to detect, and it has been impossible so far to induce any polarisation in the molecule in the largest field used—330 e.s.u./cm. There was no deflexion which might be put down to the molecules (K)n. If such are present their concentration must be very small—less than 1 per cent. of the total number, or they have no moment and the field cannot polarise an appreciable number of them.

Some experiments of a qualitative sort have been done on the binary and ternary compounds sodium chloride and mercuric chloride. The molecules of both these substances were deflected appreciably by the field, and the moment was estimated to be of the order of magnitude 10^{-18} e.s.u. cm. As these experiments were done with the aid of a knife edge, it is difficult to estimate the field through which the molecules passed.

With a much better apparatus in which a charged wire was placed in the path of the moving molecules, an experiment was done on arsenic trioxide. In this case several deflected lines were visible, and the moment deduced appears to be somewhat larger than in the case of the other two salts. It is difficult without a systematic series of experiments to offer a definite interpretation of these observations, as there is to be taken into consideration a number of possible effects, for example, the rotational energy of the molecules, the polarisation which the field may induce in them, and finally, effects due to different molecular states. R. J. CLARK.

The Cavendish Laboratory,
Cambridge.

Lengthened Chain Compounds of Sulphur.

IN a recent issue of NATURE (August 21, p. 283) attention is directed to some lengthened chain compounds of sulphur described by Sir P. C. Rây and K. C. Bose-Rây (*J. Indian Chem. Soc.*, 1926, 3, 75) as products of the interaction of dithioethylene glycol and ethylene dibromide. Of the three points which are emphasised by the authors, namely, (*a*) the isolation of a compound containing bromine, (*b*) the high molecular weight of this compound, and (*c*) its formulation as having a long chain structure, two cannot be regarded as new, whilst the evidence for the third is unconvincing. For the very similar reaction of ethylene dibromide with potassium sulphide was shown by Crafts so long ago as 1863 (*Annalen*, 128, 220) to yield such substances of presumably high molecular weight containing 12-28 per cent. of bromine and with a ratio of C : H = 1 : 2. Moreover, the suggestion that these substances have a long open chain structure has recently been put forward on more than one occasion (*J. Chem. Soc.*, 1921, 119, 1861; 1925, 127, 2676).

It seems probable that such products are mixtures of substances of the general formula A . $(S . C_2H_4)_n$. S . B, where A and B may be alike or different and have any of the structures: $-CH_2 . CH_2OH$, $-CH : CH_2$, or $-CH_2 . CH_2X$ (where X is a halogen). If n be large, the composition of the whole will differ very slightly from that of a polymer of ethylene sulphide. But at the same time the easy isolation of a single pure chemical individual from such a mixture of closely related substances is not to be expected.

The experiments recorded by Sir P. C. Rây do not in fact provide any convincing evidence that such a separation of pure substances was effected, although it is claimed that this was so after one or two crystallisations. There are also several indications in the paper that the "compounds" were still mixtures. For example, it is improbable that members of what would constitute a single homologous series of compounds of the general formula Br . $C_2H_4(S . C_2H_4)_n$. Br would have the following melting points when pure:

Value of n	10	12	16	24	26	32	40	48
Melting point	120°	100°	162°	147°	145-155°	157-159°	170°	163°

In no case was the molecular weight of one of these substances satisfactorily confirmed. The ebullioscopic determination made on one of them led to a value about half of that expected (1486 in place of 3068). The authors attribute this to a surprising disruption of the molecule by the ethylene dibromide used as a solvent, but it is much more likely to be due to the presence from the first of a mixture of substances some of which do not contain bromine. In any case it cannot reasonably be claimed that any substance was shown to have the high molecular weight stated. G. M. BENNETT.

The University,
Sheffield.

Prof. Paul Kammerer.

I REGRET to have to announce the death of Prof. Dr. Paul Kammerer, who shot himself on the Hochschneeberg, near Vienna, on September 23. In a letter (received after his death) he accuses himself of failures in his personal affairs, but emphasises that he has never committed the scientific tricks hinted at by some of his critics. He deemed the rest of his life too short to be able to take up again the same experiments, and declared himself too weary for this task. Although other than these seem to have been the main causes for his weariness of life, yet this sad end to a precious life may be a warning to those who have impugned the honour of a fellow-worker on unproven grounds. It is in fulfilment of a wish expressed by Kammerer that I beg the editor of NATURE to publish his last word on the much-debated but not solved question of a particular one of his specimens. Having convinced himself of the state it is in now, Kammerer alleges that someone must have manipulated it; he does not allude to a suspicion whom this might have been.

Need I add that Kammerer's work on the modifiability of animals, especially on poecilogony and adaptation to colour of background in Salamandra and the reappearance of functional eyes in Proteus kept in appropriate light, will secure him a lasting place in the memory of biologists, even if some other of his papers were open to criticism.

HANS PRZIBRAM.

Vienna II. Prater, "Vivarium."

English Provincial Universities: Demand and Supply.

THE elevation of University College, Reading, to full university status has naturally led to a certain amount of speculation as to the prospects of other colleges which aim at achieving a like development. A careful survey of the demand for and supply of university education in Great Britain was included in last year's Report of the University Grants Committee, which pointed out that in spite of serious financial distress among the classes from which university students are mainly drawn, in spite of a rise in fees and in personal expenses, there were 56·9 per cent. more full-time students of both sexes at British universities and colleges than before the War. There can, the committee thought, be little doubt that the demand for university education cannot long remain stationary even at this higher level, and that it will continue to grow both in volume and intensity. The growth is, in fact, clearly traceable to causes which are likely to operate in the future with increasing force.

One may distinguish between the demand for professional or vocational education at a university—the bread-and-butter studies—and the demand for the other advantages which a university education offers, advantages associated with the ideal of a 'liberal education.' Both have been and are being stimulated by the rapid increase in the secondary school population, which has multiplied the number of young people fitted for and capable of appreciating the value of university training while creating a demand for more teachers which the universities alone can properly supply. The ever-extending applications of science to industrial purposes, the instalment by industrial concerns of private laboratories and research departments, and the development of industrial research associations, provide an ever-widening field for men and women trained in the scientific departments of universities. There is, moreover, in the world of commerce and industry a growing appreciation of the value of the university-trained mind, and the opinion gains ground "that for the direction of operations which tend every day to become more and more dependent for their success upon the understanding of a complicated network of world conditions, disciplined imagination, breadth of outlook, and mastery of general principles are the qualities needed—qualities which it is the object of a good university education to develop." Meanwhile the demand of the learned professions and the public services grows no less, and the local government authorities have begun to compete with the central government for the services of university graduates.

Partly as a result of the widening of the university area of influence, there has come about a broadening of the basis of university studies in all faculties, and this has tended to increase the number of those who would pursue at a university the ideal of a 'liberal education.'

A potent cause of growth in the *effective* demand for university education in Britain has been the generous provision by local authorities of scholarships tenable in universities. It has been estimated that this amounts to something like 300,000*l.* per annum.

So much for the demand. In discussing the question whether the supply would be able to meet it, the committee directed attention to its statistics of students in attendance at each of the universities, and pointed out that there are few at which there is not ample scope for expansion without any danger of introducing the methods of mass production—expansion which would meet all the needs likely to arise for a good many years to come, at much less cost than would be incurred in creating new universities or raising to the university level institutions which are now below it: "We consider that a relatively small number of universities, staffed and equipped on a worthy scale, will be of more value to the nation than a larger number of universities of inferior strength."

Turning now from these general considerations to particular examples, the present position and prospects of the three university colleges at Nottingham, Southampton, and Exeter may be briefly described as follows:

University College, Nottingham.

This College was founded by the municipality of Nottingham and opened in 1881 by the Duke of Albany; it took up the Cambridge extension courses, of which Nottingham was one of the earliest centres, and the evening classes which for many years had been held at the Mechanics' Institution. From these beginnings it has developed its present work.

The College building, which houses also the Free Public Library, is situated in the centre of the city, but new buildings are in process of erection on a very fine site, three miles distant, presented by Sir Jesse Boot as part of a gift of 350,000*l.* made in 1920 to the city of Nottingham. From the gift, 110,000*l.* was allocated to the new buildings, for which Sir Jesse Boot made supplementary gifts amounting to 40,000*l.* An anonymous donor gave 100,000*l.* in 1922 as a contribution towards the establishment of an "East Midlands University," and this sum was added to the building fund, making 250,000*l.* in all. Sir Jesse Boot has since added to his benefactions; among other gifts he has provided 12,000*l.* more for the buildings and 9000*l.* for the sports ground. The present buildings in Shakespeare Street will continue to house the technical day courses and the evening classes.

At the ceremony of laying the foundation-stone of the new building on June 14, 1922, Lord Haldane suggested that a university for the East Midlands might be organised on something like the pattern which is now in operation in Wales, the university looking to the constituent colleges to develop the teaching of their own students and preserve all the records and to conduct examinations for degrees under the university's supervision. He thought it would be possible to start a university on these lines with four faculties: arts, science, engineering, and commerce. The other constituent colleges of the projected university were not named, but Leicester, Loughborough, and Derby are all within easy reach, and the colleges at those places would presumably come into the scheme.

The instruction at University College, Nottingham, is organised in faculties of arts (including education and music), economics (including commerce and law), pure science (including pharmacy), and applied science (engineering and technology, textiles and mining). A department of adult education is conducted by a whole-time professor, assisted by four staff tutors, two organising lecturers, and about thirty-five part-time tutors and lecturers. The College has shown

great enterprise in developing this department to a high degree of efficiency since the War. It makes special provision for the instruction of foreign students throughout the academic year.

Much advanced work is carried on, there having been in 1924–25 twenty-four research students in addition to students doing post-graduation work in education or in secondary training. The total number of full-time students in 1924–25 was 472, including 175 women. The distribution by faculties was: arts and economics, 204 (women 130); pure science, 204 (women 45); medicine, 6; technology, 58. Ninety-seven students were accommodated in residential halls. Part-time students numbered 734 (women 97), and there were in addition 1545 students taking courses not of a university standard, and 1867 university tutorial class three-year students.

On the score of amount of instruction provided and research work undertaken, Nottingham ranks higher than Reading. It is in provision of residential halls for its students and in finance that it falls short. A scheme for providing additional halls of residence both for men and for women has, however, been begun and has already received contributions and promises of support. The total income of the College in 1924–1925 was 59,609*l.* as against Reading's 84,159*l.*, and its income from endowments 1600*l.* as against 12,148*l.* Its grants from local authorities amounted to 14,532*l.* plus 2500*l.* set apart for scholarships, hostels, etc.; its parliamentary grants to 25,548*l.*, its tuition and examination fees to 12,878*l.*, and other income to 5051*l.*

The book value of its lands and buildings and permanent equipment is 495,888*l.*, and its endowment investments 2381*l.* A few more bequests such as that of Mr. W. H. Revis (37,000*l.*) would enable the College, either alone or in association with others, to make out a very strong case for a university charter.

University College, Southampton.

The College at Southampton originated in the Hartley Institute for Technical Training, founded in 1850 and formally opened by Lord Palmerston in 1862. For thirty years its function was that of a technical college only, but in 1899 it was recognised by the Board of Education as a training college for teachers. Three years later (after investigation and report by the Treasury) the College was promoted to a place in the list of university colleges in receipt of Treasury grant. New buildings on the outskirts of the town were opened on June 20, 1914, by Lord Haldane. On the outbreak, six weeks later, of the War, the College authorities handed over the buildings to be used as a hospital, and it was not until October 1919 that the College actually took possession of its new home. The buildings are not yet completed, and a good deal of the work now being done is carried on with huts as lecture-rooms and laboratories.

The College prepares students for degree examinations of the University of London, the examinations of various professional bodies such as the Pharmaceutical Society, Institute of Chemistry, Institutions of Mechanical, Civil and Electrical Engineers, Royal Institute of British Architects, Surveyors' Institution, Law Society, etc., and for its own diplomas in engineering, commerce and economics, geography, law, music, and English (for foreign students). Its department of education for the training of teachers has a high standard of admission (London matriculation) and prepares students not only for the Board of Education's Certificate examination (conducted internally, at the College) but also for the teachers' diploma and higher diploma in pedagogy of the University of London and other advanced examinations in professional subjects. An increasing number of these students take also university degree examinations. The original work of the College as a technical institution still flourishes in the shape of evening classes in arts, pure and applied science, engineering, etc. There is an old students' association with nearly two thousand members.

In 1925–26 the number of full-time students was 316, including 157 women. The number resident in college hostels was 192 (women 94). Two-thirds of the full-time students (82 men and 131 women) were working in the Faculty of Arts; 86 were students of pure science; 17 were engineering students. Part-time students numbered 294, including 28 women. In addition, there were 253 students taking courses not of a university standard and 112 students attending university tutorial (three-year) classes. The book value of lands and buildings as at July 31, 1925, was 64,591*l.*, and endowment investments amounted to 12,347*l.* The total income of the year 1924–25 was 31,962*l.*, derived from: parliamentary grants (15,139*l.*, increased in 1925–26 by 4000*l.*), local authorities' grants (9236*l.*), tuition and examination fees (6094*l.*), endowments (644*l.*), and other sources (849*l.*). Student expenses have been kept low, and it is claimed that a university education may be acquired at Southampton at an inclusive cost of 105*l.* a year.

Although the College is able at present to pay its way, further expansion and improvement are dependent on the success of efforts now being made to raise additional funds. In May 1925 an appeal was launched for 500,000*l.* for the endowment of chairs and the provision of additional buildings, with the view of eventually obtaining a charter for a projected "University of Wessex." Geographically, Southampton would seem to be the most appropriate centre for university education for East Dorset, South Hants, the Isle of Wight and Channel Islands, and West Sussex. The towns of Poole, Bournemouth, Salisbury, Portsmouth, Winchester, and Chichester are all within easy distance. In 1925–26, 119 out of the total number (316) of full-time students lived at home, and 72 others came from homes within a radius of thirty miles, whilst 125 came from beyond that radius.

The case for a University of Wessex rests partly on the regional demand, present and prospective, for regional facilities for university education, and partly on the incidental and indirect benefits likely to accrue to the inhabitants of the region in consequence of having a university in their midst. It may be anticipated, therefore, that Southampton will, like Nottingham, largely develop its university extension activities and its commercial and technological departments. Southampton being within such easy reach of French ports, a university with a strong faculty of commerce would attract many students from France. The engineering department of the College is at present a small one, but its efficiency is proved by the fact that the students when they leave college readily obtain employment, and some of them have already risen to very considerable distinction. Were money forthcoming, this department would be capable of important developments, especially in the study of marine and aeronautical engineering, for which Southampton offers excellent opportunities.

University College, Exeter.

The University College of the south-west of England, Exeter, formerly known as the Royal Albert Memorial College, originated in 1865, when memorial buildings consisting of a museum, a library, and adjuncts for the study of art, science, and literature were erected. With the co-operation of the Local Lectures Syndicate of the University of Cambridge, the work of the

institution was re-modelled and co-ordinated in 1893, when the first principal was appointed, but it was not until 1901 that the educational work was organised for development on the lines of a university college with the provision of a curriculum for the external examinations of the University of London.

The College was placed upon the list of university institutions in receipt of grant from H.M. Treasury as from August 1, 1922, when it was incorporated under its present name as a company limited by guarantee, and the college buildings and halls of residence were transferred to it by the Exeter City Council. From that time its progress has been rapid, the number of degree students in the four years ending 1924–25 having been 96, 139, 187, and 211 respectively. The total number of full-time students in 1924–25 was 332, of whom 221 were in the teachers' training department. Residential halls provide accommodation for 134 women and 110 men students. Part-time students numbered 38 and occasional students 40. There are departments of biology, chemistry, classics, education, English, geography, history and economics, law, pure and applied mathematics, modern languages, music, philosophy, physics, and extra-mural studies. The total income was 29,067*l.*, including parliamentary grants 12,317*l.*, grants from local education authorities 10,384*l.*, tuition and examination fees 504*l.*, income from endowment 674*l.*, and from other sources 1112*l.* The book value of its land, buildings, and permanent equipment is 81,433*l.*, and its endowment investments 11,603*l.*

These figures do not suggest that the College is likely to qualify soon for full university status, but it might conceivably join with the Technical Schools, Plymouth, the Seale-Hayne Agricultural College, Newton Abbot, and the Camborne School of Mines, to form a federal university. An important scheme for co-operation with the Technical Schools, Plymouth, has been worked out providing for degree and diploma courses in civil, electrical, marine, and mechanical engineering and in commerce at Plymouth, and the extension of the law teaching and extra-mural work already carried on there by the College. An appeal was launched in October 1925 for 100,000*l.* for the equipment and endowment.

UNIVERSITY COLLEGE, HULL.

The plans for the proposed University College for Hull, for which the Right Hon. T. R. Ferens gave 250,000*l.*, provide for an organisation somewhat similar in scope to that of University College, Southampton, with the addition of a department of agriculture and, eventually, departments of shipbuilding and applied chemistry of the oil, colour, gas, and spirit industries.

Lest the account already given of the policy of the University Grants Committee in regard to proposals for establishing new universities should be misunderstood, it must be added that the Committee is careful to point out that its "view of what is prudent at one particular stage of our history betokens no lack of sympathy with the general desire for a wider avenue to university education, or with the ambitions of certain large and populous cities to rival the more fortunate communities which already possess universities of their own." The Committee hopes that "as returning prosperity enables the schemes of local education authorities under the Education Act to be carried into effect, the local colleges will play an increasingly distinguished part in the higher education of the people, and will steadily raise the level of national knowledge and culture. It may well be that some of these will, in course of time, establish a claim to university rank and receive charters as independent universities."

Fluctuations in the Abundance of a Species considered Mathematically.[1]

By Prof. VITO VOLTERRA, For. Mem. R.S., President of the R. Accademia dei Lincei.

A CONSIDERATION of biological associations, or of the mutual interactions between two or more species associated together, has led me to certain mathematical results which may be set forth as follows.

The first case I have considered is that of two associated species, of which one, finding sufficient food in its environment, would multiply indefinitely when left to itself, while the other would perish for lack of nourishment if left alone; but the second feeds upon the first, and so the two species can co-exist together.

The proportional rate of increase of the eaten species diminishes as the number of individuals of the eating species increases, while the augmentation of the eating species increases with the increase of the number of individuals of the eaten species. Having determined the laws of this increase and diminution, it is possible to establish two differential equations of the first order, non-linear, which can be integrated. The integrals reveal the fact that the numbers of individuals of the two species are periodic functions of the time, with equal periods but with different phases, so that each species goes through a cycle relative to the other during a period, a process which may be called the 'fluctuation of the two species.' Figs. 1 and 2 give representations of different possible cycles, corresponding to different initial values of the number of individuals of the two species: ordinates representing the eating, and abscissæ the eaten species.

The co-ordinates of a point on a cycle are the concurrent values of the numbers of individuals of the two species, those of the central point Ω being the mean values; and the following laws have been deduced from integration of the differential equations which represent the fluctuation:

I. The fluctuation of the two species is periodic, the period depending only on the coefficients of increase and of destruction of the two species, and on the initial numbers of the individuals of the two species.

II. The average numbers of the two species tend to constant values, whatever the initial numbers may have been, so long as the coefficients of increase or of destruction of the two species and also the coefficients of protection and attack remain constant. (Laws I. and II. are illustrated in Fig. 2.)

III. If we try to destroy individuals of both species uniformly and proportionately to their number, the average number of individuals of the *eaten* species grows and the average number of the eating species diminishes (see Fig. 1). But increased protection of

[1] V. Volterra.—Variazioni e fluttuazioni del numero di individui in specie animali conviventi.—*Memorie della R. Accademia dei Lincei* (Cl. di Sci. Fis. etc.), ser. 6, vol. ii. fasc. 3, 85 pp., 1926.

the eaten species increases the average numbers of both.

In the case of small fluctuations, we have the following approximate laws:

(1) Small fluctuations are isochronous, *i.e.* their period is not sensibly affected either by the initial

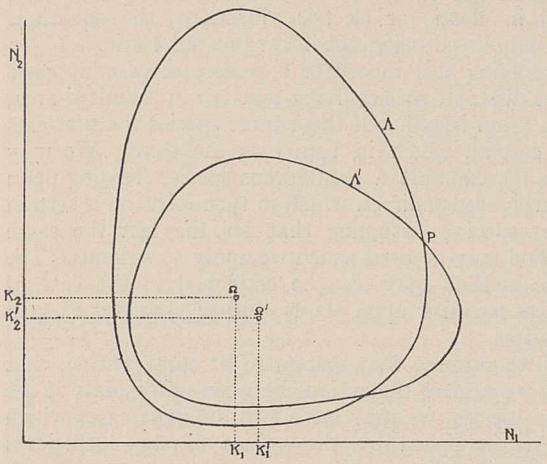

FIG. 1.

number of individuals, or by the conditions of protection and offence.

(2) The period of fluctuation is proportional to the product of the square roots of the time required for the first species to double itself, and for the second species to reduce itself to half. If the first species doubles itself in the time t_1 and the second species is reduced to half in the time t_2, the period is $T=\frac{2\pi}{\log_e 2}\sqrt{t_1 t_2}=9{\cdot}06\sqrt{t_1 t_2}$.

(3) The steady destruction of individuals of the eating species accelerates the fluctuation, and the destruction of individuals of the eaten species retards it.

With the contemporaneous and uniform destruction of individuals of the two species, the ratio between the amplitude of the fluctuation of the eaten species and that of the eating species tends to increase.

In Fig. 1 are represented two cycles, the second of which corresponds to a perturbation produced in the first by a constant and proportionate destruction of the individuals of the two species. The centre Ω′ of the perturbed curve is displaced, in respect to the centre Ω of the primitive curve, downwards and to the right; this reveals an augmentation of the average number of individuals of the first species, and a diminution of the average number of the second.

Law III. is undoubtedly the most interesting of all, because it affords the best actual verification so far found of the theory. For Dr. U. d'Ancona, comparing fishery statistics in the Adriatic Sea before the War, during the War (when fishing almost ceased), and after fishing was resumed at the end of the War, has ascertained that the voracious species (selachians), which feed on other fishes, had increased during the War as compared with the preceding and following periods, while the contrary had been the case for the number of individuals of the eaten species.[2] In other words, a complete closure of the fishery was a form of 'protection' under which the voracious fishes were much the better and prospered accordingly, but the ordinary food-fishes, on which these are accustomed to prey, were worse off than before. This is in agreement with Fig. 1, and with Law III. My theoretical researches, which I was induced to undertake by the statistical studies begun by Dr. d'Ancona, correspond accordingly with his results.

Charles Darwin had an intuition of these phenomena in relation to the struggle for existence when in Chap. iii. of his "Origin of Species" he wrote: "The amount of food for each species of course gives the extreme limit to which each can increase; but very frequently it is not the obtaining food, but the serving as prey to other animals, which determines the average number of a species. Thus there seems to be little doubt that the stock of partridges, grouse, and hares on any very large estate depends chiefly on the destruction of vermin. If not one head of game were shot during the next twenty years in England, and at the same time if no vermin were destroyed, there would in all probability be less game than at present, although hundreds of thousands of game animals are now annually shot."

Law III. is, however, true only up to a certain limit. It is evident that if the destruction of both species continue, their exhaustion will ensue. It is therefore necessary to ascertain up to just what point it is profitable to destroy both species in order to obtain the greatest augmentation in the average number of the eaten species. We arrive in this manner at a curious example of a mathematical *upper limit* without the existence of a *maximum*. There is in fact a limit of destruction beyond which both species are exhausted. If we remain below it, the average number of the eaten species grows as this limit is approached; but once the limit is reached, the eating species tends to exhaustion and the fluctuation ceases, while the number of individuals of the eaten species tends asymptotically

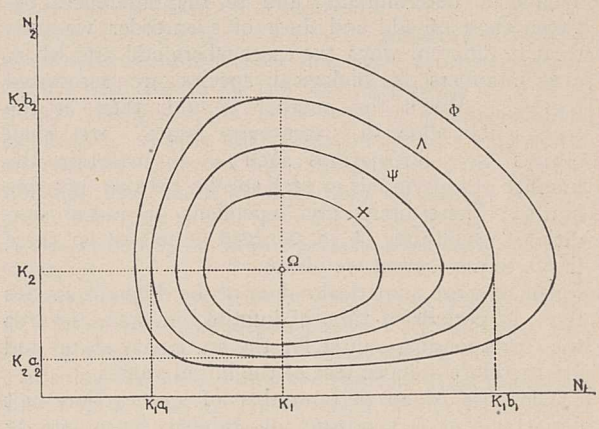

FIG. 2.

towards a value which is less than the average formerly reached.

Besides the case dealt with above, a study of variations in the number of individuals of two associated species can also be made in all cases in which the species interact either favourably or injuriously, in all possible degrees or combinations. All such cases can be classified in distinct types, and in each of these it is possible to

[2] U. d' Ancona.—Dell' influenza della stasi peschereccia del periodo 1914-1918 sul patrimonio ittico dell' Alto Adriatico.—*Memorie del R. Comitato Talassografico Italiano* (in course of publication).

follow the numerical variations of the two species by the help of formulæ, or of diagrams to correspond. It is easy to see from these diagrams *which species is winning in the struggle for existence, and which of them is in process of extinction.*

Again, it is certain that many facts of medical interest may be classed among phenomena resulting from concurrent and reciprocal action between different species—between the human species and pathogenic germs, between parasitic species and those on which they are parasites. The periodicity of epidemics may be connected with the same phenomena.

A second part of my investigation is devoted to a general study of biological association, where any number of species may be living together. I have studied two types of association, and have called them *conservative* and *dissipative associations.*

For the first or conservative association, equivalent values may be assigned to the different species so that the destruction of a certain number of individuals belonging to one species by another species, to its own benefit, corresponds to an increase in numbers of the latter species, in the precise ratio which the said equivalents express. Moreover, in a conservative association, the number of individuals of every species has no influence on its own augmentation. The case of two species, already dealt with: the case of n species, where individuals of the first eat those of the second, and the latter those of the third, and so on to the nth; the case of four species so connected that the first eats the second and the second is also eaten by the third, which in its turn is eaten by the fourth; all these cases are examples of biological conservative associations, if we neglect actions between individuals of the same species. The variation in numbers of the conservative associations depends on a system of differential quadratic equations associated with a skew-symmetric determinant.

Owing to the peculiar properties of these skew-symmetric determinants, and to the differences between those of odd and those of even order, we must treat in different ways the cases where odd and where even numbers of biological species are associated together. When the number is odd, then, if the coefficients allow a 'stationary state,' we shall always have fluctuations such as to maintain the number of individuals of each species between positive limits. These limits are dependent on initial conditions, which may be so assumed as to restrict these limits to any extent we please.

The average numerical values of the different species tend, in periods of time of infinite duration, towards the corresponding values for the stationary state, and are therefore independent of the initial values.

The case of an odd number of species does not correspond to a condition of stability for a strictly conservative system.

In the case of associations which I call *dissipative*, if a stationary state exists, the variations will be fluctuations which slowly extinguish themselves, or are asymptotical. From an analytical point of view, the dissipative association is characterised by a definite positive quadratic form.

The analogous form is null in the case of a conservative system. The dissipative actions work in a way analogous to friction in a mechanical system.

Therefore the terms conservative and dissipative may also be applied to the fluctuations, which in the first case continue to exist, and in the second are dissipated. It will be observed that to prove the existence of the fluctuations, we follow an analysis different from that used in elastic or electric vibrations, the equations here employed being not linear but quadratic.

Applying this theory to a particular case, suppose three different species living together in a limited area, such as an island. Of these three species the first eats the second, which in turn eats the third. We may take for example a carnivorous species, feeding upon a herbivorous animal, which in turn feeds on a certain plant species—assuming that for the last the same method may be used which we apply to animals. The same method may also be employed in the case of insects parasitic upon plants, and of parasites of such parasites.

If we suppose that system to be conservative, that is, if we neglect the actions between individuals of the same species, we may have two different cases which are distinguished by the values of the coefficients occurring in the equations:

(1) The food which reaches the carnivorous species through the herbivorous is not sufficient to maintain the carnivorous species; and so the latter is exhausted, while the herbivorous animal and the plant tend to a periodical fluctuation.

(2) The vegetable species grows indefinitely. This case is, however, incompatible with the limitation of the island, which does not allow the indefinite multiplication of the plant. It is therefore necessary in this case to suppose the system to be dissipative, admitting that the coefficient of increase of the vegetable species is dependent on the number of existing plants, and then we have three cases: Either (1) both animal species are exhausted; or (2) only the carnivorous species is exhausted, while the herbivorous and the plant tend to a fluctuation of gradually diminishing amplitude or to an asymptotic variation; or (3) all three species live together without exhausting themselves, but vary asymptotically in a common fluctuation of gradually diminishing amplitude, the characteristic elements of which can be determined.

Side by side with the general theory, we may make various special inquiries. Thus, for example, we may suppose the coefficient of increase of the species to have an annual period, a supposition tending to establish a law of forced fluctuations superposed on the free fluctuations of the biological association considered.

We may also study how exhaustion takes place of a species in a biological conservative association of an uneven number of species; or in general how exhaustion takes place of species in dissipative associations; or what perturbation is produced when a new species is introduced into an association in equilibrium.

Seeing that a great number of biological phenomena are characteristic of *associations* of species, it is to be hoped that this theory may receive further verification and may be of some use to biologists.

Obituary.

ARTHUR WALTON ROWE.

HARD as it is to see friends go who have played their part upon our shifting stage, it is still harder to lose those who are in the plenitude of their power, before they have fully delivered the message you know they have in them. Arthur Rowe was one of the most remarkable, complex and cryptic natures it has been my fortune to encounter. During the past five and twenty years, probably no one has been on closer terms of continued intimacy with him than I was. We came together in a curious way. At the close of 1900, I had a bad attack of influenza. Feeling very miserable and having little faith in local medical opinion, I said I should go to Margate and put myself into the hands of a physician there who, I knew, had done remarkable geological work: therefore, should be of exceptional intelligence. I did so and fortunately called in Rowe—only to discover that I had pneumonia upon me. Happily we soon disposed of this and then began to talk shop together. I had advisedly taken with me a bookful of my photographs displaying the geology of the Dorset coast. He had just published the first of his papers on "The Zones of the White Chalk of the English Coast—Kent and Sussex," unillustrated. He proposed that we should join forces. So it came that I illustrated for him Parts II. to V. (Dorset 1901, Devon 1903, Yorkshire 1904, the Isle of Wight 1908), which were published by the Geologists' Association.

Rowe was born September 27, 1858. He died September 17, 1926. He was the son of Dr. Thomas Smith Rowe of Margate. He led a very lonely childhood and started geology when quite a boy—in fact, he was a naturalist from birth. His parents were very strict with him, stinted his pocket money and allowed him no youthful companions. He was educated at King's School, Canterbury, at the University of Durham and St. Mary's Hospital.

Rowe began to practise with his father in 1884 and held the house surgeonship at the Royal Sea Bathing Hospital at about that time. He retired in 1910, after having long been the leading practitioner in Margate. He was adored by his patients. He worked very hard at his practice and was able to develop his bent as a scientific inquirer only on Sundays and holidays—a fortnight at Easter and a fortnight in the autumn.

Rowe was a very difficult character to understand. Naturally reticent, his reticence was accentuated by the overmastering tendency of medical etiquette to compel reticence and he became more and more asocial with time. He was given to hobbies and an unusual mixture of the naturalist-collector with the highest type of scientific inquirer—I use the term inquirer advisedly. Excepting Lapworth, no one has so impressed me in the field. He had an exceptional faculty of learning and mastering a subject, an exceptional sense of order and exactness, an exceptional care for truth. His devotion to work was extraordinary. The phrase used by W. P. D. S. in the *Times*—"Whatever he took up (and he took up many things) he did more thoroughly than any other man I have known"—is an exact description of him. Whatever subject he took up, for the time being he thought of nothing else and could talk of nothing else. Unfortunately, he had in him no element of personal ambition—years ago, when some of us wished to prefer his claim to the Royal Society, he would allow nothing of the kind. As the Society has no means of discovering modest men, he remained unencouraged—except by the Geological Society, which gave him the Wollaston award in 1901 and a Lyell medal in 1911. Quite exceptionally, two Lyell medals were awarded that year, the other recipient being Dr. Bather. There was a tie in the voting between amateur and professional.

We owe the earliest attempts at zoning the Upper Cretaceous to Price and Barrois. Little was done, especially with the Upper Chalk, until Rowe took it in hand. He had developed a beautiful method of uncovering and displaying the exterior characters and internal structure of fossils, especially the more delicate forms preserved in the Chalk (involving the use of the dental engine). This enabled him to reveal minute variations in shape and aspect previously unsuspected. Collecting the material personally, he noticed that these variations were in sensitive relation with the exact position of the organisms in the succession of the Chalk strata and it occurred to him that the fossil sea urchins in particular might be useful as indicators of the age of any particular portion of the Chalk sequence: in fact, his first scientific contribution was "An Analysis of the Genus Micraster" (1899). A trial in the Dover area convinced him that he had found the key to the succession and he used this in many localities and published many maps and correlating memoirs which have thrown clear light upon the lapse of time and upon geological evolution in the later Cretaceous period. His methods proved to be of use in the hands of other observers and practically the whole of the British Chalk has now been zoned and correlated, Rowe's services being not merely those of a pioneer but the generous helper and inspirer of his contemporaries and successors.

There also fell into Rowe's hands, possessed as he was of an accurate and delicate time scale, most important details with regard to the time succession of evolutionary changes in the chief types of organisms that he studied. He was able to put on record a long series of accurately observed facts bearing upon their evolution and thus made contributions to zoology as important as those which he made to geological science. It should be added, he was greatly aided by C. Davies Sherborn.

Rowe lived at the back of Margate, at Shottendane, in a most beautiful sylvan hollow. He acquired the site in 1903 and very soon developed a passion for gardening which for a time overcame all other interests. About three years ago, he suddenly dropped gardening to excavate an old Roman site, near at hand, work which he did almost entirely himself. He had a profound knowledge of Margate history and had accumulated an invaluable collection of prints and documents. He was also a student of words, having been influenced in early life by Trench's fascinating book. At one time, he was very active in local affairs and did much to raise public taste in music. He sang well in early days and his wife was an accomplished musician. Their son inherits the gift of music.

Year after year I have urged him to get back to his chalk work. We had even talked of producing a chalk atlas together. I am glad to say that his interest in geology was so far revived that only six weeks before he died, when I was about to visit him, he wrote to me that he was ill but had finished a paper on the serpulids and I hear also one on "The Great Chalk Sea," which he probably, of all men, was the most competent to picture. He had been in bad health but would not give in until the papers were written and told his medical adviser, his former partner, that he had waited to send for him until they were finished. The act was characteristic of the man—he never thought of sparing himself. It is sad that the world is ever selfish and has no way of caring for such men and providing that they use themselves with consideration and full effect: we respect genius but little until we can no longer use it. Some day, when work such as Rowe's is described in readable form, the walls of ignorance will be shattered and the wondrous beauty of the lowly organisms of which chalk is composed will be made manifest. Our present indifference to geology is little short of criminal, seeing that it is the story of our earth.

HENRY E. ARMSTRONG.

REV. F. D. MORICE.

THE Rev. Francis David Morice, well known as an authority on certain families of Hymenoptera, died at Woking in his seventy-eighth year, on September 23. Educated at Winchester, from which he passed in 1866 to New College, Oxford, he gained high distinction as a classical scholar, and in 1874 was appointed a master at Rugby under Dr. Jex-Blake. Here he remained for twenty years, retiring ultimately in 1894 to Woking, where he took a house next to his great friend Edward Saunders, and devoted himself to entomological research.

During the latter half of the years at Rugby, Mr. Morice had frequently consulted Saunders regarding his captures of local bees and wasps. The results were published from time to time (1888–92) in the *Report* of the School Natural History Society. From this time until recently Mr. Morice made numerous contributions to the literature of his subject, at first dealing mainly with the chrysids (cuckoo wasps), aculeates, and fossores, but latterly confining himself almost solely to the Tenthredinidæ (saw-flies). Here, probably, his most valuable work was done in his careful tabulation of British native species (1903–16). His conclusions were arrived at only after full discussions with continental students and an exchange of material, and it had long been his wish to gather his scattered papers in monographic form. But he had barely begun this revision when his death occurred.

Mr. Morice wielded a considerable influence, both among British and continental Hymenopterists. His knowledge of the palæarctic non-parasitic Hymenoptera, and of their distribution, was comprehensive and exact, and he had besides made several specialised studies, *e.g.* on the structure of the terebra in saw-flies. In nomenclatural discussion also his opinions were valuable, backed as they were by a sound scholarship, aware not merely of the rules but also of the elasticity in practice of classical usage. He will be remembered, however, chiefly as a consultant and helper of younger workers. A constant stream of collections, small and great, found its way to Woking for identification, and the work was never refused.

Mr. Morice joined the Entomological Society in 1889, and became its president in 1911. He was a regular attendant at entomological gatherings, and so recently as July of last year was present at the third International Entomological Congress held at Zurich; for, to the end, he greatly enjoyed the society of his fellow-workers. He also spent much time as a voluntary worker on the British Museum collections at South Kensington, to which institution he presented the important British collection formed by Edward Saunders. His own collection he bequeathed to Oxford.

J. W.

WE regret to announce the following deaths:

Mr. G. W. Lamplugh, F.R.S., lately assistant director of the Geological Survey of Great Britain, and president in 1918–20 of the Geological Society, on October 9, aged sixty-seven years.

Major W. E. Marshall, Principal Medical Officer of Health to the Sudan Defence Force, formerly an assistant bacteriologist at the Lister Institute of Preventive Medicine, on September 24.

Mr. H. W. Page, consulting surgeon to St. Mary's Hospital, London, past president of the Neurological Society of London, and the author of numerous contributions to medical and surgical literature, on September 9, in his eighty-first year.

News and Views.

DURING the recent Church Congress at Southport, one day was largely engaged with discussion on the 'religion and science' issue. The most notable utterances were a sermon by Dr. Lang, the Archbishop of York, and a paper written by the late Vice-Chancellor of the University of Liverpool, the distinguished pathologist Dr. Adami, whose recent death was a grave loss to medical science. Dr. Lang directed attention to the change of outlook in contemporary science, which "is beginning to ask questions about fundamental presuppositions hitherto taken for granted, about the meaning of the universe as a whole." Science, in other words, seems to be becoming more philosophical. The Archbishop then made a strong plea that this new orientation in science should be met, on the part of the Church, by "an attitude of the fullest sympathy and trust." "The Church will not merely be detached. Its members will be ready to accept whatever truths in the region of natural science or historical criticism seem to be really established, and to welcome them as new revelations of the divine working." This must rank as a really significant utterance, and, if it speaks for the Church of England as a whole, is a most hopeful sign of the times.

DR. ADAMI'S paper to the Church Congress outlined the attitude of the man of science towards faith and

the spiritual life. Three possible attitudes are indicated: (1) Negation of everything that is outside the boundaries of the senses and therefore incapable of being tested by physical means. (2) Acceptance of and belief in things of the spirit as of a world that is wholly apart from the material universe, and so from science. This was the attitude of Pasteur (under whom, it is interesting to note, Dr. Adami studied). (3) Belief that science and faith are governed by the same laws and that their methods are essentially identical. Rejecting the first two attitudes, Dr. Adami developed the third, showing how scientific knowledge advances by the use of hypotheses and the perpetual revision of theories in respect to new facts. Thus the Newtonian physics has been revised by Einstein, and Dalton's chemistry by J. J. Thomson and Sir Ernest Rutherford. The method of science is that of a search after truth by "progressive assumptions," and the search for religious truth is guided by a similar principle. It, too, is 'pragmatic,' and based on hypothesis and experiment.

DR. ADAMI'S paper was followed by one read by the Rev. J. C. Hardwick, which dealt primarily with certain ethical difficulties presented by the facts of biological science, instancing the behaviour of the ichneumon wasp. He suggested that the difficulties arise from regarding Nature as a completed system rather than as an incomplete process, various stages of which co-exist and find themselves in disharmony. If Nature is to be judged, she should be judged by her latest products, *i.e.* in the light of man and his ideals, rather than by the wasp or the slug. It was refreshing to find authoritative spokesmen expressing views which cannot fail to create a new atmosphere. How far the audience realised the implications of all they heard may be doubtful. Dr. Lang's allusion to the results of "historical criticism" is especially significant, for it is these, rather than the facts of natural science, which create problems for theologians to-day. Furthermore, Dr. Adami's policy of revised hypotheses would spell the end of all theological finality; though, to be sure, this might give religion a new lease of life.

SIR OLIVER LODGE, on October 7, began at the Mansion House, London, a series of lectures endowed by Mr. Halley Stewart on the general theme of religion and science, with special reference to human progress. Sir Oliver said that he is impressed with the majesty and possibilities of the universe, as contrasted with the comparatively narrow outlook of the average of those engaged in the work of the world. With regard to religion and science, he does not feel oppressed by any conflict between them when both are reasonably understood. Both involve knowledge of certain aspects of the same universe, and controversies arising between them must spring from misunderstanding and limitation of outlook. As for scientific knowledge, we little know whither its increase will lead us. The aspect of science which appeals to the majority of mankind is to be found in the applications and conveniences which can be derived from it. But the power to control the forces of Nature and to adapt them to our ends must depend for its value on what those ends are. The uses we now make of our increased powers may not be such as really conduce to the progress of humanity. In spite of the scientific and mechanical progress of the nineteenth century, no one can feel that we have arrived at a stable and satisfactory stage of civilisation. Though material development ought to conduce to human progress, there is no inevitable connexion between the two. Increased power over Nature involves increased power to destroy. Yet, on the other hand, if competition gave place to co-operation, and if each individual sought the welfare of the whole, the possibilities of life on this planet would be found to be such as have scarcely yet been imagined. Sir Oliver is inclined to believe that the possibilities of Christ's teaching of love and forgiveness are to-day being more clearly realised, and there will come a day when human intercourse will be saturated with it. The lecture was characteristic of the new outlook which sees that the chief problem raised by the rapid development of scientific technique is an ethical problem, and it is doubtful if this can be solved in isolation from religion.

MR. DANIEL GUGGENHEIM, the copper magnate, has given a sum of 500,000*l.* for the promotion of aeronautics. His son, Mr. Harry Guggenheim, is president, and Admiral H. I. Cone is vice-president, of the board of management of the fund. Admiral Cone was in command of the U.S.A. naval forces on foreign service in 1917–18, was wounded in the sinking of a British destroyer by submarine, is a Commander of the British Empire, and holds the Distinguished Service Order. Major R. H. Mayo, well known in British technical aeronautics, represents the board in Great Britain, and has assisted the president and vice-president, during a recent visit, in considering methods of applying the fund. They have come to the conclusion that the Royal Aeronautical Society is an appropriate body through which direct expenditure may be made in Great Britain towards co-ordinating international scientific and technical information, and a grant of 1000*l.* has been made for the year 1926–27. In the U.S.A. 60,000*l.* has been allocated to each of two Californian institutions—the Leland Stanford University at Palo Alto and the California Institute of Technology at Pasadena—for the purpose of equipping and carrying on schools of areonautics. Prof. W. F. Durand holds the chair of engineering at Leland Stanford University, and Dr. R. A. Millikan is president of the California Institute of Technology; their names suggest a due balance between technical development and physical research.

THE seventh year of the Tidal Institute of the University of Liverpool, according to the annual report for 1925 just issued, has been devoted mainly to the analysis of tidal observations and the preparation of tide tables. The method devised in 1923 for the execution of such work on a large scale has been thoroughly tested, and has proved effective and in all respects satisfactory. New advances have been

made in regard to the prediction of tides in shallow waters; a request to analyse records from Avonmouth, where the shallow-water effects are extremely acute, led the secretary, Dr. Doodson, to devise harmonic corrections which are more general and more widely applicable than the non-harmonic corrections hitherto used in such cases. An entirely new problem of great importance to navigation in many regions was raised by a request of the Canadian Hydrographic Office for a method of predicting the times of turning of tidal currents, affected by large diurnal constituents, from records of such times alone; Dr. Doodson has devised such a method, which is being applied and tested. The Institute has undertaken tidal analyses or predictions for the Admiralty, the Port of London Authority, the Lower Liao River Conservancy for Newchang, the International Council for the Exploration of the North Sea, the New Zealand and Queensland Governments, and the other bodies already mentioned. A radio receiving set has been installed so that weather reports may be utilised to assist in a proposed new service of daily predictions of meteorological perturbations of sea-level at Liverpool.

THE papers read at the recent Conference of Public Lighting Engineers in Newcastle-upon-Tyne dealt with matters of professional rather than scientific interest, but there were several points mentioned that are not generally known. Mr. Colquhoon, in the course of his paper, stated that Scottish boroughs have a statutory obligation to provide proper public lighting, but there is apparently no similar obligation in England, the only legal requirement being that obstructions on roadways (such as those due to repairs) must be lighted by night. Similarly, in a paper entitled "Lighting Hours," Mr. Beveredge explained that there is no standard legal schedule of the hours for which public lamps must be lighted; each authority acts at its discretion, and there is considerable variation in the practice of different towns. It is only the drivers of vehicles who are required to exhibit lights during specified hours. There was some discussion on the practicability of a standard schedule for lighting hours, but it was suggested that at least two schedules, one for the south and one for the north of England, might be required. The possibility of compliance with a rigid scheme of lighting hours also depends largely on the facilities for lighting up and extinguishing, *i.e.* the extent to which automatic methods of control are available. The question of the lighting of important arterial roads designed for motor-traffic was also discussed. There is a general feeling that the lighting of such routes ought not to be left entirely to the discretion of the individual authorities in areas traversed, and that a portion of the Roads Fund might be applied to lighting by the Ministry of Transport, which is already interested in the maintenance of the surfaces of roads.

AUTUMN in Great Britain has this year continued generally exceptionally fine and mostly warm. In September the weather was fine and dry, the total rainfall being remarkably low in some southern districts; Southampton had a total of only a quarter of an inch. The weather was very warm in the third week of September, the thermometer in the shade registering 88° at Greenwich on September 19, and in many places the highest temperature of the year was experienced. In the south-east of England, the mean temperature for the month was about 4° above the normal. There were four days during the month at Greenwich with the solar radiation temperature above 140°. For the first three weeks there was not a single day with the mean temperature below the average. There was a considerable drop of temperature after September 25. Some October temperatures during the first ten days of the month touched 70°, mostly registering about 65°; in 1921, five years ago, October was remarkably fine and warm, the thermometer at Greenwich exceeding 80° on several days in the early part of the month. There was a break on Saturday, October 9, due to the arrival over Great Britain of a vigorous secondary disturbance from the Atlantic, and gales were experienced in places on the coasts, with heavy rain-showers in places. Colder weather spread over the country in the rear of the disturbance and the conditions became more normal for the season of the year.

THE inaugural address at the opening of the eighty-fifth session of the School of Pharmacy of the Pharmaceutical Society was delivered on October 6 by Dr. J. F. Tocher, of the University of Aberdeen. In the course of his remarks, Dr. Tocher commented on the possible reasons which lead to the adoption of pharmacy as a career, and hoped for the time when students of all kinds might be classified according to their ascertained intelligence, so that their teachers would be able to impart knowledge to them more successfully. But such tests would scarcely distinguish between those who favoured pharmacy as a profession and others whose thoughts turned towards different careers. With increasing knowledge, the training of the pharmacist becomes more arduous: the rapidly expanding list of drugs used in medicine requires knowledge of their properties and uses, and of the tests necessary to ensure their purity. In the Pharmacological Laboratory which the Society has recently opened, the student will be able to gain first-hand experience in the testing of those drugs which require for their assay the use of animals. Thus although the minimum standard of knowledge has been raised with the advance in knowledge in the other sciences, the enthusiastic student will find ample opportunity not only to reach this standard but also to progress beyond it.

A REPORT by Prof. J. Borozdin, quoted by the Riga correspondent in the issue of the *Times* of October 8, gives a brief account of the results of excavations carried out by Prof. Farmakovsky in the neighbourhood of Nikolaieff, where he has been working for the last twenty years, on the site, hitherto not identified, of the Milesian colony of Olbia (which was described by Herodotus), at the mouth of the River Bug. The excavations now embrace an area of 287,000 sq. yd., not including a necropolis, and the objects brought to

light include dwellings, temples, and vaults. In the centre of the town stand the ruins of a temple of Apollo. Nine successive strata of remains have been discovered; these show a variety of influences from several sources, including Attica and the Roman Empire as well as Miletus. Of even greater interest are the excavations at the village of Usatoff, some five miles out of Odessa. Here a culture has been found which is said to exhibit the transition from neolithic to bronze and to be advanced of its type. It is that of a settled agricultural community with earthen dwellings closely resembling the culture of Tripolje. The pottery is of the characteristic painted type, having strong points of resemblance to the widely diffused painted pottery which, with wide divergences and of varying epochs, it is true, is found in China, central Asia at Anau, India, Elam, Mesopotamia, Cappadocia, and Syria, and in Europe in southern Russia, Rumania, Bulgaria, Thessaly, and southern Italy. An example is said to have been discovered in the Crimea. Further information will no doubt confirm the importance of the discovery, which should serve to throw additional light on the difficult question of the relationship and lines of diffusion of this remarkable type of prehistoric ware.

THE Trueman Wood Lecture of the Royal Society of Arts will be delivered on October 27 at 8 P.M. by Dr. R. J. Tillyard, chief of the Biological Department of the Cawthron Institute of Scientific Research, Nelson, New Zealand, who will take as his subject "The Progress of Economic Entomology."

THE James Forrest Lecture for 1926 of the Institution of Civil Engineers, which was to have been given in May, will be delivered at the Institution on Tuesday, October 26, at 6 o'clock, by Senator G. Marconi, who will take as his subject "Radio Communications." Before the lecture, the Kelvin Medal for 1926, which has been awarded by the Kelvin Medal Committee to the Hon. Sir Charles A. Parsons, will be presented to him by Sir William Ellis, president of the Institution.

PROF. HANS THIRRING, professor of physics in the University of Vienna, will deliver a lecture in English on October 19, on "The Position of Science towards Psychical Research," at the National Laboratory of Psychical Research, 16 Queensberry Place, South Kensington, London, S.W.7. This lecture is one of a series arranged for the season 1926–27, which includes one by Mr. Stanley de Brath on "Animism, Spiritism and Spiritualism" (February 15), and another by M. René Sudre (in English) on "Psychical Research and Psychology" (March 15).

THE three Cantor Lectures on thermometry which have been given by Mr. W. F. Higgins of the National Physical Laboratory to the Royal Society of Arts are reproduced in the issues of the *Journal* of the Society for September 3, 10, and 17. They furnish the best account available in English of the properties and behaviour of the mercury-in-glass thermometer, of the methods used in its standardisation, and of the precautions to take in order to obtain the most accurate results from it. Mr. Higgins looks forward to the time when the mercury-in-silica thermometer will be substituted for the mercury-in-glass thermometer for all accurate work.

THE seventy-ninth annual meeting of the Palæontographical Society was held at Burlington House on October 1, Dr. F. A. Bather, vice-president, in the chair. The annual report announced the completion of Miss Chandler's monograph of the Upper Eocene flora of Hordle, and the early issue of further instalments of the monographs of Gault Ammonites, Malacostracous Crustacea, and Palæozoic Asterozoa. The council appealed for the help of more personal subscribers, the larger number of the supporters of the Society being now public institutions. Prof. W. T. Gordon, and Messrs. G. Barrow, A. T. Hopwood, and J. Pringle were elected new members of council. Mr. E. T. Newton was re-elected president, and Mr. Robert S. Herries and Sir A. Smith Woodward were re-elected treasurer and secretary respectively.

THE council of the Institution of Civil Engineers has made the following awards for the session 1925–1926 in respect of selected engineering papers, published without discussion: A Telford Gold Medal and the Indian Premium to Mr. C. R. White (London); a Telford Gold Medal to Mr. E. L. Everatt (Bombay); and Telford Premiums to Dr. B. Hague (Glasgow); Prof. A. H. Gibson (Manchester) and Mr. S. Labrow (Bury) jointly; and Dr. W. J. Walker (Johannesburg). The following awards have been made in respect of papers read at students' meetings in London or by students before meetings of local associations during the same session: The James Forrest Medal and a Miller Prize to Mr. D. S. Matheson (London); and Miller Prizes to Mr. H. R. Lintern (Shepton Mallet), Mr. R. D. Carr (Cupar), Mr. C. Peel (Frodsham), Mr. R. S. Bamber (Leeds), Mr. N. R. Rice (Dar-es-Salaam), Mr. J. G. Kimber (Eastbourne), and Mr. J. B. Mayers (Birmingham).

THE Earl of Balfour presided at a congregation at Cambridge on Tuesday, October 5, when the University commemorated the three-hundredth anniversary of the death of Francis Bacon, Lord Verulam, by awarding honorary degrees to the Cavendish professor of physics, Sir Ernest Rutherford, and to Prof. W. S. Holdsworth, Vinerian professor of English law in the University of Oxford. The public orator spoke of Bacon, eminent in civil law and natural science, as a follower of the Stoics, who taught us to strive to adjust our laws to the laws of Nature; Dr. C. D. Broad, Trinity College, who lectured to the University on Bacon, described him as the father of inductive philosophy, one who discovered and explicitly stated the methods and principles of scientific research, which his successors have used with success. An afternoon reception was given by Trinity College and a dinner in the evening, at which the Earl of Balfour spoke to the toast of Bacon's memory.

A RECENT issue of the *Weekly News Bulletin* of the U.S.S.R. Society of Cultural Relations with Foreign Countries contains under the heading "Scientific

Life" an account of measures recently adopted for encouraging intellectual activity. The title "merited" has been established, to be conferred for distinguished service by scientific and technical workers. Money premiums are to be given for inventions and suggestions, even though they may not directly result in the saving of expenditure. Instances of pensions for prominent services in science are also mentioned. Under "International Cultural Relations" are reports of visits to Russia by Profs. Erlander of Stockholm, Wiegond and Rodenwald of Berlin, and Tenier of Strasbourg, and visits to Egypt by the Rector of the Russian Hydrological Institute to take part in the International Navigation Congress at Cairo, and to the Balkan countries and Italy by N. P. Sycher of the Russian Academy of History of Material Culture.

WE have received from Messrs. Stafford, Allen and Sons, Ltd., Cowper Street, Finsbury, London, E.C.2, a sample of 'Sira' immersion oil and of 'Sira' mountant. Originally produced as a result of researches conducted at the British Scientific Instrument Research Association, these products are now prepared by the manufacturers in accordance with the directions of the Association. The refractive index of the immersion oil (1·524 at 20°) is adjusted to suit modern high-power object glasses, condensers, and micro cover glasses. An important feature of the oil is its freedom from corrosive action on metals or on optical glass. 'Sira' mountant, being quite neutral, may be advantageously used in place of Canada balsam, the acidic properties of which are known to affect certain stains and other substances when mounted in it. These 'Sira' products, which may be obtained from all scientific instrument makers and dealers, should prove of considerable value to microscopists whose work demands critical observation, in assisting them to obtain the best possible results from their microscope and its accessories.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned :—A pathologist for the City of Nottingham—The Town Clerk, Guildhall, Nottingham (October 18). A junior inspector of mines for North Wales (Lancashire and North Wales Division)—The Under-Secretary for Mines, Establishment Branch, Mines Department, Dean Stanley Street, S.W.1 (October 25). A mycologist under the Ceylon Rubber Research Scheme—The Private Secretary (Appointments), Colonial Office, 38 Old Queen Street, S.W.1 (January 1). A lecturer in physics in the University of Otago, New Zealand—The High Commissioner for New Zealand, 415 Strand, W.C.2. A junior technical officer at an Admiralty Experimental Establishment, with good theoretical and practical manufacturing knowledge of the design of electrical apparatus—The Secretary of the Admiralty (C.E. Branch), Whitehall, S.W.1. A lecturer in mechanical engineering at the School of Science and Art, Newark-on-Trent—The Secretary, Old Magnus Buildings, Appleton Gate, Newark-on-Trent. A junior mathematical mistress—subsidiary subjects geography and botany—at the Southport High School for Girls—Application forms from the Director of Education, Education Office, Southport, but returnable to the Headmistress.

Our Astronomical Column.

MINOR PLANETS.—Vol. 9, No 9 of the *Journal des Observateurs*, contains a study of the orbit of No. 117 Lomia by M. Henri Blondel. This covers the period from 1913 to 1925, and includes the perturbations by Jupiter and Saturn. A good agreement with observation is obtained. It is noted that observations over a period of some four months are required to obtain a good orbit from a single opposition. It is suggested that ephemerides should be extended over a longer range than is usually done.

This is a favourable time for observing the interesting planet 132 Aethra, which was recovered a few years ago after being lost for half a century. It is in high north declination and of magnitude 11. Ephemeris for 0^h by H. Hartog (*Astr. Nach.* 5464) :

	R.A.	N. Decl.
Oct. 16	$3^h\ 33^m\ 16^s$	41° 16′
,, 28	3 23 36	40 30

ANOTHER DETONATING FIREBALL.—Mr. W. F. Denning writes that a very large meteor was visible on the evening of Saturday, October 2, at $19^h\ 25^m$ G.M.T. As observed at Bristol, its path was from 330° − 7° to 34° + 14°. A considerable number of observations have been received, and a comparison of these shows that the object passed from over the English Channel (45 miles south of Brighton), northwards over the western suburbs of London, and on to the northern region of Hertfordshire, where it exploded at a height of about 11 miles. The radiant point was in Capricornus at 305° − 13°. The velocity of the fireball was about 13 miles per second along a real course of about 125 miles. The nucleus was green, followed by red sparks. The weather being generally clear in the south of England, the phenomenon was pretty generally witnessed, though observers differ materially in their impressions concerning it. The radiant of the fireball agrees with that of a well-known shower in July and August.

C. SCHOCH'S RESEARCHES ON ANCIENT ECLIPSES.—Allusion has already been made in these columns to Schoch's conclusions on the eclipse of the Odyssey, which he identified as that of April 16, B.C. 1178. He has now discussed a still more ancient eclipse, that in the tenth year of the Hittite king Mursilis II. He identifies this as the annular eclipse of B.C. 1335, March 13, which was central in the region of the Azzi (about Erzeroum). The total eclipse of Jan. 8, 1340, is excluded, since military operations would not take place so early in the year in that elevated region. Schoch notes that the region is the same as that afterwards traversed in the retreat of the Ten Thousand. He has also identified various eclipses mentioned by Greek poets :

Poet.	Date B.C.
Mimnermos, same as eclipse of Thales	May 28, 585.
Stesichoros and Kydias. . .	May 19, 557.
Agathokles eclipse, concluded position of Agathokles in Straits of Messina	Aug. 15, 310.

Research Items.

The Origin of the Masai and the Wild Tribes of Borneo.—In the *Journal of the East Africa and Uganda Natural History Society*, No. 26, August 1925, Mr. C. Cardale Luck puts forward a theory that the Masai and related tribes of East Africa are the ancient Israelites, while the wild tribes of Borneo, the Kenyah, Kayan, Punam, etc., are the ancient Edomites. Merker's theory of the Semitic origin of the Masai, it is pointed out, might have been extended to identify them with the ancient Israelites, had it not been conditioned by the view that if their route of migration was through the Nile valley, it must have taken place in the prehistoric period before the Egyptian settlement. The historical evidence, however, points to the possibility of a movement of Asiatic peoples in the required direction in Egyptian historic times in the influx of Semitic peoples after the Hyksos period, the transference of captives after the Egyptian conquests, the flight of such of the Israelites as were not carried off into Assyria before the victorious armies of that power, and the desertion into Ethiopia of mercenaries, presumed to be Asiatic, under Psamtek and Tanutamen of the Nubian dynasty. Looking at the evidence afforded by the Masai and kindred tribes, distribution of language clearly suggests a north to south movement. The religion of the Masai, a trinity of Engai, a feminine supreme deity, and two inferior deities, a black or good god and a red or evil god, points to an original mother goddess worship, ultimately of Asiatic origin. The Canaanites in passing through Egypt confused her with Hathor, the minor gods of the Masai being Osiris and Set. Tribal names of the Masai also point to Canaan, Ma-a-sae, L'Aiser and Gidon being equated with Ma-na-say, Je-ezer, and Gideon. Similar equivalences are found in the Bornean religion, belief, and nomenclature and pointing to a Canaanitish origin.

Sickness, Death and Burial among the Maori.—Notes from a native source in the original and in translation relating to the ritual of death and burial among the Maori of New Zealand are given by Mr. Elsdon Best in the *Journal of the Polynesian Society*, Vol. 35, No. 1, which contain certain data not hitherto recorded, and some interesting formulæ. In former times there was little ritual pertaining to burial, and indeed the ceremonies performed over a sick person were more elaborate, possibly owing to the fact that the custom of exhumation and final disposal of the remains was looked upon as the real burial. There were several ritualistic performances by which the shamanistic adepts diagnosed the cause of illness. This was usually either black magic or infringement of the laws of *tapu*. The ceremony here quoted, for a chief seized with severe illness, involved the use of formulæ absolving a person from the polluting effect of all immoral or wrongful acts committed from childhood up to that time. The dead were usually disposed of by inhumation, but sometimes they were merely placed in a cave. The body was flexed before it was cold, the knees being drawn up to touch the trunk and bound with a cord. In a few cases it was exposed to a rude drying process. The exhumation took place some years, sometimes so many as eight, after the first burial, although, as a number of exhumations took place at one time, there must have been considerable variation. The function was one of remarkable *tapu*; it involved the employment of adepts and was carried out with an elaborate ritual; the final destination of the remains was a cave, fissure, or hollow tree. Great care and skill were exercised in removing the bones, especially in recovering the small bones. Articles placed with the dead such as weapons and ornaments, both at the primary and secondary burials, were sometimes recovered for the relatives by a priestly adept, with the performance of certain ceremonial observances.

Alien Plants in the Isle of Wight.—The bulk of vol. 1, part 5 of the *Proceedings of the Isle of Wight Natural History Society* for 1924 is occupied by a list of the alien plants of Hampshire and the Isle of Wight, by John F. Rayner. The list is a very long one and has obviously been in compilation for some years, the author being helped by a number of local botanists, as well as by veteran systematists, as Dr. Claridge Druce.

An Antarctic Flora.—The Australasian Antarctic Expedition, 1911–14, has recently published as vol. 7, part 5, some beautiful photographs of the very characteristic flora of Macquarie Island, which were not available when the late Mr. F. T. Cheeseman prepared his report on the vascular flora of Macquarie Island, owing to the disturbance of personnel and records of the expedition brought about by the War. The photographs of *Pleurophyllum Hookeri*, of *Stilbocarpa polaris*, and of such cushion plants as *Azorella selago*, are of great ecological value, some photographs giving detail of individual plants beautifully, whilst others show in a striking manner their characteristic distribution on this wind-swept antarctic island. All the conspicuous members of the flora are represented photographically in these 19 plates, while Mr. Harold Hamilton supplies brief notes on the ecology.

Pentosans and Cold Resistance in Plants.—Of recent years, American workers, especially J. T. Rosa and Victor R. Boswell, have tried to establish a connexion between the pentosan content of certain plants and their resistance to frost damage. The underlying assumption has been that the water-imbibing properties of the colloidal pentosans have enabled these plants to retain the water in this form and thus resist the tendency to ice-formation and consequent protoplasmic disorganisation. Arguing further that the retention of water by imbibition by the pentosans should be effective against force of dehydration, Rosa compared the transpiration rates and rates of drying of cold resistant and non-resistant plants. Both Rosa and Boswell agree that the hardened plants lose water more slowly under comparable conditions, and suggest in fact that this property provides a simple test, in horticultural practice, of the relative hardiness of a plant. This attractive theory comes out very badly from a thorough investigation by Prof. Doyle and Miss Phyllis Clinch, of the Department of Botany, University College, Dublin, who have tested its application to evergreens, and particularly conifers. In conifers they conclude (*Scientific Proceedings of Royal Dublin Society*, vol. 18 (N.S.) No. 21, 1926) that no relation, seasonal or otherwise, can be established between hardiness and pentosan content. Furthermore (same *Journal*, No. 24, 1926), they show that the rates of drying show no relation to pentosan content, and on physico-chemical grounds there seems little reason to expect any other result, whilst until Rosa and Boswell have repeated their drying experiments with chopped-up tissues, there is little or no reason to assume that pentosan content has any connexion with the differences in drying shown by hardy and non-hardy varieties.

MINERALS FROM THE RUBY MINE DISTRICT OF BURMA.—A notable contribution to the mineralogy of Burma is published by F. D. Adams and R. P. D. Graham in the *Trans. Roy. Soc. Canada*, Section 4, 1926, p. 113. Between the Irawadi and Mogok the exposures show alternating bands of gneiss and coarsely crystalline limestones which recall the sections through the Grenville series of the Canadian Shield. Half way along the road to Mogok a large intrusive body of granite occurs with an enormous pegmatite dyke near its eastern border. The dyke is made up mainly of kaolinised orthoclase and quartz, the latter being often in large transparent crystals. Lepidolite crystals up to six inches across are described, and muscovite, topaz and cassiterite. An interesting nepheline-sodalite rock occurs at Mogok, the sodalite from which has a beautiful deep lilac colour. The colour fades on exposure to light, and disappears immediately when the mineral is slightly warmed, this being a characteristic of all pink sodalite. A nepheline-ægerine-augite rock (urtite) was found at Sinkwa, 13 miles from Mogok. Both nepheline rocks resemble very closely varieties occurring in the Bancroft district of Ontario, and afford additional examples of the common association with crystalline limestones. Other minerals described are chrysoberyl, sillimanite and forsterite from Mogok. A more detailed description of the geology of this part of Burma, together with an account of the methods adopted in working the deposits for rubies, was given by Prof. Adams in the *Bull. Canadian Inst. Min. Met.*, **29**, Feb. 192 .

PLATINUM IN SOUTH AFRICA.—In *Economic Geology*, Nos. 2 and 3, 1926, Dr. P. A. Wagner gives a very full account of the occurrence of platinum in the Transvaal and Southern Rhodesia. As the chief deposits have already been noticed in NATURE, attention is here directed to the genetic considerations with which Dr. Wagner concludes his study. Concentrations of platinum are more widely distributed in South Africa than in any other part of the world, and the platinum-bearing rocks have been produced in practically all the periods of igneous activity from the earliest Archæan onwards. From the Vaal River to the Zambezi the principal deposits are confined to a narrow meridional belt that cuts indiscriminately across all the other structural features. Some deeply underlying region must therefore have contributed the ores, suggesting that the *sima* or peridotite zone beneath South Africa is, or has been, unusually richly endowed with platinum. J. E. Spurr has already advocated the idea of great *ore canals*, stable throughout geological time, from which igneous magmas have abstracted ores and, ascending in the crust, have concentrated the metals nearer the surface. Dr. Wagner similarly conceives the presence below the platinum belt of a great platinum-rich canal which has provided the material transferred towards the surface by successive igneous intrusions. It is also pointed out that there is an equally remarkable gold province in south-east Africa which may well have drawn its gold from the same canal. It is worthy of notice that if the hypothesis be true in the form in which it is advocated by Spurr and Wagner, it raises a most serious objection to the migration of continents over the substratum that has been envisaged by Wegener, and somewhat differently by Joly. On the other hand, the conception itself is in accord with the inference drawn by Holmes (from the atomic weight of lead) that lead ores must have had some source independent of any later concentration from the magmas of igneous rocks. Another point is that no ore deposits are found in oceanic islands, suggesting that the continental rocks are more probably the original home of most ores rather than the underlying *sima*. If this be so, then the ore canals may represent concentrations produced in and near the bases of the continents at the time of their origin. If, then, the continents moved laterally in later ages, the canals would be carried with them, and not left beneath and behind as they would otherwise be.

TIDES AND SEA SEICHES.—Tidal features of local coastal origin and sea seiches are discussed by Prof. J. Proudman in a recent *Geophysical Supplement* (vol. 1, No. 6, 1925) of the *Monthly Notices of the Royal Astronomical Society*. The paper is illustrated with many diagrams of cotidal lines relating either to actual regions or typical ideal cases (curved and rectangular capes and bays, circular and elliptic islands, and a passage between two seas). Deductions as to the deformation of the cotidal lines by such local features are made on a mathematical basis, and actual cases of the phenomena are instanced, on the British or Irish coasts. The effect of the neighbouring coast-line on sea-seiches in a narrow bay is also considered.

IRRIGATION IN INDIA.—A review of irrigation in British India during 1924–25 has been published by the Public Works Branch of the Department of Industries and Labour. During the year the monsoon, after beginning weak, was practically normal in total rainfall, and there was appreciable defect only in Orissa and Kashmir, with excess in the western United Provinces, the North-West Frontier, Rajputana, and Malabar. The total area irrigated by works of all kinds was 27·2 million acres, which was about a million acres less than in the record year 1922–23. It is of interest to note that 12·4 per cent. of the total cropped area was irrigated by Government works. The review gives full details of the financial side of irrigation and drainage works during the year.

PRESSURE AND WINDS OVER THE CHINA SEA.—A large-scale atlas of twelve maps showing the mean atmospheric pressure and wind direction and force over the China Sea for each month of the year has been published under the authority of the Governor of Hong-Kong. There is a short introduction by the Director of the Royal Observatory, Hong-Kong. The observations were collected during the years 1900–1912 from ships calling at Hong-Kong, the stations of the Chinese Maritime Customs, and various observatories in the Far East. The observations were originally tabulated in one-degree squares, but this grouping being found unjustifiable except on the main sea routes, they were collected into two-degree squares. Pressures are shown in inches, wind forces are given on the Beaufort scale, and within the wind roses are given the number of barometric observations on which each has been determined and the percentage of calms. The maps extend to lat. 34° N., 8° S., and long. 130° E. They are clearly printed, with land outlines in blue and isobars in red.

X-RAY EXAMINATION OF LONG-CHAIN COMPOUNDS.—In the *Annales de Physique* for July-August, M. Trillat contributes an important paper on the X-ray examination of long-chain compounds, and he gives values for the spacings of fatty acids containing as many as 32 carbon atoms. With the new data at his disposal he shows that the rate of increase in chain length with increase in the number of carbon atoms is slightly different for acids containing odd and even numbers of carbon atoms, although it is uniform in both cases. He also finds that by mounting a thin layer of a fatty acid on a strip of metal, a very fine

film of soap is usually formed immediately in contact with the metal surface. This film is amply sufficient for the purposes of X-ray examination by the reflection method, so that it is unnecessary, in general, to prepare a soap separately for X-ray examination. By examining the changes in the X-ray spectra of oleic, linoleic and linolenic acids in the course of drying in air, Trillat is the first to follow directly a complex chemical reaction by means of X-rays. Attention is directed to the importance of these long-chain compounds in the investigation of very soft X-rays.

THE PHYSICAL PROPERTIES OF GLASSES.—A large amount of information on the above subject is to be found in Prof. W. E. S. Turner's lecture on the relationship of the physical properties of glasses to chemical composition and mode of preparation, delivered before the Chemical Society on April 29, and published in the Society's *Journal* for August last. The preparation of commercial glass involves the fusion of a number of oxides or metallic salts, which may number as many as twelve or more, and the proportions of the constituents largely determine the physical properties. The most important properties are the transmission and absorption of light, the refractive index, the viscosity, the annealing temperature, electrical conductivity, and resistance to the action of water (which is partly a chemical process), thermal expansion and density. In many cases simple relationships are found which make it possible to prepare glasses of approximately known properties by fusing suitable oxides in the requisite proportions. A compromise is necessary in the manufacture of glass for chemical purposes, since the presence of alkaline oxides reduces the resistance to the action of acids. Modern chemical glass ware contains a high percentage of silica, with boric oxide and alumina, and only sufficient alkaline oxides to enable melting to take place fairly readily. The use of a high percentage of silica lowers the resistance of the glass towards alkalies, but the danger of breakage from sudden temperature changes is eliminated on account of its low thermal expansion.

THE USES OF TELLURIUM.—On account of its many industrial applications, tellurium is rapidly becoming of technical importance. Some notes on its uses are contained in a short article in the *Chemical Trade Journal* for September 10, and among the most important are: as a colouring agent in the glass and porcelain industry, in the preparation of organic dyestuffs, in the manufacture of electrical equipment, high resistance alloys and ultramarine, in the colouring of lithophone and the staining of silver, as a delicate test of sterilisation in bacteriology, and as a toning agent in photography. A compound of tellurium has been patented as an anti-knock constituent of motor fuels, and its use is said to lead to greater efficiency. Remarkable properties are shown by the alloys of tellurium; the tin alloys are extremely hard and have very great tensile strength, the aluminium alloys are very ductile, while the silver alloys have recently been used. The poisonous properties of the element, and its fairly ready absorption (*e.g.* from gold dental stoppings), are not mentioned in the article, but should not be overlooked.

LOW TEMPERATURE CARBONISATION.—The firm of Salermo Ltd., 17 Kingsway, London, W.C.2, has issued a brochure entitled "Low Temperature Carbonisation and the Salermo Process." It contains mainly a survey, sound in substance and temperately worded, of the processes hitherto proposed. The Salermo retort, which is new to Great Britain although tried already in the Sarre mines, is described. It consists of a series of troughs fixed adjacently and parallel and heated from below. The coal, pre-dried by waste heat, is mechanically propelled from one trough to the other, and the product is delivered in a semi-pulverised condition. High throughput is said to be associated with low capital and running costs. The product is, unfortunately, not fit for immediate domestic consumption, but might be suitable for steam boilers.

PROJECTION OF EXPLOSIVE FLAMES.—In a paper published by the Safety in Mines Research Board (No. 27) Mr. M. J. Burgess has described experiments on the distance over which a methane-air mixture, when exploded in a tube, projects its flame into the air filling a second tube attached to the explosion-tube. When the two tubes were 9 cm. in diameter the projection of flame into the air may be more than five times the length of the original column of explosive mixture. When the aperture between the two tubes is gradually reduced by an adjustable diaphragm, the first effect is an increase in the length of the projected flame—especially with mixtures containing an excess of methane. The experiments show to what a great distance flame may be projected along a gallery when a fire-damp explosion occurs in a mine.

SMOKELESS FUEL FOR POWER.—At the Conference on Smoke Abatement held at Birmingham recently, Mr. A. S. E. Ackermann read a paper on the "Engineering Aspects of the Smokeless Production of Power," a copy of which we have received. The various methods of generating power without smoke production are surveyed briefly. Pulverised fuel firing of steam boilers is favoured on account of high thermal efficiency and absence of smoke. The common view that water-power resources of Great Britain are negligible is contested. It is calculated that 500,000 H.P. might be developed by the erection of efficient installations. The combination of public hot-water supply with power stations is a means of increasing the thermal return of electricity generation. The waste heat from gas retort settings might be utilised to generate current in large quantities. Mention was made of the application to marine and locomotive work of the Still (internal combustion steam) engine, which now is the most efficient prime-mover available.

COAL TREATMENT IN THE UNITED STATES.—In the September number of the *Journal of the Franklin Institute* appears a series of papers on low temperature carbonisation, read at the "Oil and Gas Power Week" Conference at Philadelphia in April last. They reflect the growing concern as to the uncertainty of adequate supplies of mineral oil across the Atlantic. H. W. Brooks gave a general summary of European and American processes, and although unable to point to successful commercial achievement anywhere, he closed on a note of confidence that we are nearing the "Age of Coal Processing." W. H. Blauvelt read another general paper emphasising the desirability of subjecting coal to a process of fractionation and refinement analogous to that of the mineral oil industry. Perhaps the most interesting contribution technically was made by V. Z. Caracristi, who gave an account of experiences with the ingenious lead-bath carbonisation process which has aroused so much interest. This has been given trial by Henry Ford at his motor-works, where no expense has been spared in grappling with the problem of this pioneering effort. To those who speak lightly of the scientific treatment of coal, it may be a revelation to learn that already several million dollars have been spent on experiments on this one process. It is not clear whether commercial success is claimed, but it is stated that the practicability of the lead-bath as a medium for the transfer of heat has been fully demonstrated.

Forthcoming Books of Science.

Agriculture, Forestry, and Horticulture.

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Anthropology and Archæology.

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Ernest Benn, Ltd.—The Dyeing of Textile Fibres, R. S. Horsfall and L. G. Lawrie; Grammar of Textile Design, H. Nisbet, new edition; Cotton Spinning (Intermediate, or Grade II.), T. Thornley, new edition; The Dyeing of Cotton Fabrics, F. Beech, new edition; Textile Colour Mixing, D. Paterson, new edition. *His Majesty's Stationery Office.*—Third Report on the Cleaning and Restoration of Museum Exhibits; The Consistence of Cement Pastes, Mortars, and Concrete. *Crosby Lockwood and Son.*—Standard Manual of Brewing and Malting and Laboratory Companion, being a thoroughly revised and considerably augmented work, based on "A Handy Book for Brewers," by H. E. Wright, embracing the Conclusions of Modern Research, by J. Ross-Mackenzie; Mechanical Dentistry: a Practical Treatise on the Construction of the Various Kinds of Artificial Dentures, C. Hunter, new edition; Testing Milk and its Products, G. Thomson. *Macmillan and Co., Ltd.*—Lens Computing, Col. J. W. Gifford, with a foreword by Prof. F. Cheshire. *Oxford University Press.*—Preservation of Fruit and Vegetables, Margaret J. M. Watson. *Sir Isaac Pitman and Sons, Ltd.*—Scientific Pattern Construction, B. W. Poole; Introduction to Textiles, A. E. Lewis. *Scott, Greenwood and Son.*—The Manufacture of Enamel Paints, D. Wait.

University and Educational Intelligence.

THE twenty-fifth session of the work of the Sir John Cass Technical Institute was inaugurated on October 4, when an address was delivered by Alderman Sir Charles Wakefield, Bart. Before calling upon Sir Charles to deliver the inaugural address, the chairman of the Governors, the Rev. J. F. Marr, referred to the resignation of Dr. Keane, who had been principal for almost a quarter of a century, the appointment of Mr. Geo. Patchin as his successor, the generous support given to the work by the important companies connected with the fermentation and petroleum industries, and the gratifying record of university successes; one student has been awarded a D.Sc. for a thesis on research work carried out in the department of chemistry. Further facilities for study are being provided during the session, including a more advanced course of lectures in colloids and an advanced course of lectures on petroleum technology.

ONE of the papers read at the recent conference at Balliol College, Oxford, of the Association of Special Libraries and Information Bureaux was entitled "Instruction in Bibliographical Technique for University Students," by Mr. Harold E. Potts, chairman of Convocation of the University of Liverpool. He urges that all students should be given some instruction in the art of using a library intelligently. It is not intended that they should spend the time when they should be working in the laboratories in reading in the library, but that they should acquire the habit of looking for the original sources of the information given in lectures and text-books. This matter is largely in the hands of the professors, who would do well, from time to time, to recommend their pupils to read certain original papers as an example of how discoveries are made. The habit of looking at original papers instead of at text-books and abstracts is one that cannot be acquired too early. The student will be astonished to find that some mis-statements have been quoted from text-book to text-book throughout long periods before the error was discovered. At the same time it must be confessed that a student may easily spend too much time in this way to the neglect of experimental work.

WHILE the universities and university colleges in Great Britain usually possess good libraries, the technical institutes and colleges are, as a rule, very poorly supplied. In most cases the sums allowed for the upkeep of their libraries are very small. Principal J. F. Hudson, of the Huddersfield Technical College, in a paper contributed to the recent Conference of Special Libraries and Information Bureaux at Balliol College, Oxford, argues that the provision of a suitable supply of literature should be regarded as an essential part of the equipment of every scientific and technical department of a college. Most local colleges specialise in one or more departments, such as woollen textiles, rubber technology, or pottery. These schools should develop special libraries of peculiar value which should be made accessible to all who are interested in these subjects. Principal Hudson suggests that at least 1 per cent. of the annual expenditure on a technical institute should be assigned to the support of the library. He refers to a letter in NATURE for May 22, 1926, in which a correspondent asks what he can do with old scientific books which he no longer needs. As will be seen from Mr. Headicar's letter in our issue of July 3, the Universities' Library for Central Europe has taken up this problem and has arranged to act as a clearing house for the disposal of scientific periodicals.

Contemporary Birthdays.

October 15, 1884. Prof. Lewis Knudson.
October 16, 1859. Prof. James Playfair McMurrich.
October 17, 1872. Sir Cyril Reginald S. Kirkpatrick.
October 19, 1856. Prof. Edmund B. Wilson, For. Mem. R.S.
October 20, 1862. Prof. Thomas Hastie Bryce, F.R.S.
October 22, 1876. Prof. Harold Hilton.

Prof. KNUDSON, who occupies the chair of botany at Cornell University, was born at Milwaukee, Wisconsin, U.S.A. His informative lectures on plant physiology have been particularly welcomed in recent years by Spanish men of science, notably at such centres as Madrid and Barcelona. His botanical studies comprise researches in fermentation, the organic nutrition of plants, germination of orchid seeds, and the diseases of the banana.

Prof. MCMURRICH was educated at Upper Canada College, Toronto, at the University of the city, and at Johns Hopkins University, Baltimore. He has occupied posts in several universities of the United States, but since 1907 he has been professor of anatomy at Toronto. In 1922 Prof. McMurrich was president of the Royal Society of Canada.

Sir CYRIL KIRKPATRICK was educated at Repton. His engineering studies were conducted, in the first instance, at the Crystal Palace School of Engineering; afterwards he entered the service of the old London and North-Western Railway. Sir Cyril was chief engineer of the Port of London Authority from 1913 until 1924.

Prof. E. B. WILSON, distinguished as a zoologist, was born at Geneva, Illinois, U.S.A., and educated at Yale University, New Haven, and Johns Hopkins University, Baltimore. In 1883 he was a lecturer in biology at Williams College, fulfilling afterwards various important duties elsewhere until 1891, when he was appointed professor of zoology in Columbia University. Prof. Wilson is a foreign member of the Royal Society of London, and of the Linnean Society. In 1914 he delivered the Croonian lecture before the former body, taking as his subject "The Bearing of Cytological Research on Heredity." A member of the National Academy of Sciences, Washington, and of several English societies, he is Hon. Sc.D., Cambridge. Prof. Wilson is the author of a standard work, "The Cell in Development and Heredity"; originally issued in 1896, it passed recently into a third edition.

Prof. BRYCE was educated at Edinburgh Collegiate School. He graduated later at the University of Edinburgh. Lecturer on anatomy in the University of Glasgow from 1892 until 1909, he was then appointed to the chair of anatomy. The Royal Society of Edinburgh awarded Prof. Bryce its Keith prize in 1906 for his memoirs on the histology of the blood of the larva of *Lepidosiren paradoxa*. He is the author of vol. 1 of "Quain's Anatomy" and joint author of a work on the development of the human ovum.

Prof. HILTON, an old pupil of Lancing College, graduated at Hertford College, Oxford. Sometime assistant lecturer in mathematics in the University of Bangor, he afterwards joined the teaching staff of Bedford College. Since 1912 he has been professor of mathematics in the University of London. Prof. Hilton is the author of many papers in crystallography, especially the theory of crystalline structures.

Societies and Academies.

SYDNEY.

Linnean Society of New South Wales, July 28.—C. T. **White**: On a small collection of plants from the Rigo district, Papua. Two species, one of Plectronia and one Jasminum, are described as new.—C. P. **Alexander**: The Trichoceridæ (Diptera) of Australia. One genus and four species are described as new. A key is given for the determination of the genera.—R. H. **Cambage**: Notes on the native flora of New South Wales. Part xi. Moree to Mungindi and Moonie R., with a description of a new species of Eucalyptus. The paper contains notes on the early exploration, topography, etc., and a list of the plants noticed. A comparison of this flora is made with that of Tasmania, in view of the dominating influence of climate on plant distribution.—G. H. **Cunningham**: Gasteromycetes of Australasia. (v.) The genus Calvatia. The genus may be separated from Lycoperdon by the method of dehiscence, which is effected in Calvatia by the irregular falling away of the apical portion of the peridium; whereas in Lycoperdon dehiscence is effected by means of a definite apical stoma. The genus contains about eight species, of which four are present in Australia and New Zealand.—G. D. **Osborne**: Stratigraphical and structural geology of the Carboniferous rocks in the Mt. Mirannie and Mt. Dyrring districts, near Singleton, N.S.W. There are two volcanic series with associated clastic rocks, and separating these series is a set of sediments called the Main Clastic Zone. The major volcanic series comprises andesites, dacites, rhyolites and keratophyres, while the lavas in the other group are chiefly toscanitic and dellenitic. The only glacial beds occur near the top of the Kuttung Series, and Rhacopteris-bearing strata are found on two horizons. The chief tectonic feature is the great Bridgeman Fault which separates the Kuttung Series from the Permian or Permo-Carboniferous Series. This is probably an overthrust. In addition there are many normal faults connected with the late Palæozoic diastrophism which folded the area and produced two basin-structures.

WASHINGTON, D.C.

National Academy of Sciences (Proc. vol. 12, No. 8, August).—R. J. **Havighurst**: The absorption of X-rays in crystalline compounds. The mass absorption coefficient in a compound is the sum of the mass absorption coefficients of the individual atoms and has been calculated from various empirical formulæ. Measurements upon crystalline compounds are subject to large experimental error on account of "selective absorption" due to reflection of the primary ray from certain atomic planes. Compressed slabs of powders (and also Wingardh's data from solutions) give results in good accord with the calculated absorptions for sodium chloride and fluoride and calcium fluoride and carbonate.—Carl **Barus**: (1) Acoustic pressures in case of soap bubbles. A series of soap bubbles were attached to the telephonic apparatus and pinhole probe. Pressure as measured by the fringe displacement of the interferometer always corresponded with the radius of the bubble. (2) Acoustic pressure promoted by co-operating quill tubes without pinholes.—Edwin H. **Hall**: Note on the temperature relations of photo-electric emission and thermionic emission of electrons. Hall's theory of "associated" and "free" electrons in metallic conduction indicates a slight increase with temperature in the work done in detaching completely an associated electron; this accords with the fact that

the lowest frequency producing photo-electric emission is nearly independent of temperature. Also the work done in detaching completely a free electron within the metal should diminish with rise of temperature; this has not been disproved.—R. de L. **Kronig**: The dielectric constant of diatomic dipole-gases on the new quantum mechanics.—F. L. **Mohler**: A photo-ionisation experiment with hydrogen. Using a double thermionic tube, one unit of which produced a discharge while the other detected photo-ionisation excited by the radiation from the discharge, no evidence was obtained that hydrogen emits radiation which can ionise the normal molecule.—Otto **Laporte**: Series and ionisation potentials in the iron spectrum.—Carleton C. **Murdock**: The location of the electromotive force in a photo-active cell containing a fluorescent electrolyte. Semi-transparent platinum films sputtered on opposite sides of a glass test-tube serve as electrodes. The electrolyte can be illuminated before it reaches the electrode, through it, or after leaving it, and is made to flow along the surface of the electrode. The photo-active electromotive force is due, in part, to the action of light on the fluorescent electrolyte.—Richard C. **Tolman** and Sinclair **Smith**: Remarks on Professor Lewis's note on the path of light quanta in an interference field.—L. R. **Maxwell**: The mean free path of electrons in mercury vapour. An electron stream passes through a chamber the end of which is a long Faraday cage. The electron current was measured with and without the presence of mercury vapour at a pressure of 3·12 bars in the chamber. The distance traversed by the electrons was varied by raising and lowering the cage. The mean free path is calculated for accelerating potentials up to 3000 volts; at 1120 volts and 3050 volts it is 73 cm. and 144 cm. respectively.—Edward A. **Birge** and Chancey **Juday**: The organic content of lake water. Large samples from Wisconsin lakes were examined. The quantity of organic material present is much greater than, and that of the inorganic salts is far less than, that found in sea water. The dissolved organic matter forms a potential food supply several times as large as that offered by the plankton.—Thomas Wayland **Vaughan**: (1) The stratigraphic horizon of the beds containing *Lepidocyclina chaperi* on Haut Chagres, Panama. The horizon is upper Eocene, virtually the same as that of the Ocala limestone of Florida and Georgia. (2) Foraminifera from the upper Eocene deposits of the coast of Ecuador. The horizon is about the same as that at Haut Chagres; the finds indicate that the same fauna existed on both sides of America during Eocene times.—T. J. **Webb**: On the free energy of hydration of ions. The energy of hydration depends on the dielectric properties of the solvent, as well as upon the charge and effective radius of the ion.—Curt **Stern**: An effect of temperature and age on crossing-over in the first chromosome of *Drosophila melanogaster*. Susceptibility is connected in some way with the localisation of the spindle fibre attachment.

Official Publications Received.

British and Colonial.

Aeronautical Research Committee: Reports and Memoranda. No. 989 (Ae. 200): An Investigation of the Flow of Air around an Aërofoil of Infinite Span. By L. W. Bryant and D. H. Williams; with an Appendix by G. I. Taylor. (A. 3. a. Aerofoils, General, 132.—T. 1885.) Pp. 44. 1*s.* 9*d.* net. No. 995: The Behaviour of Single Crystals of Aluminium under Static and Repeated Stresses, Parts 1, 2 and 3. By H. J. Gough, Dr. D. Hanson and S. J. Wright. Work performed for the Engineering Research Board of the Department of Scientific and Industrial Research. (B. 1. a. Metals, 40, a and b.—T. 1983, a and b.) Pp. 54+35 plates. 3*s.* 6*d.* net. No. 1015 (Ae. 218): On the Drag of an Aerofoil for Two-dimensional Flow. By A. Fage and L. J. Jones. (A. 3. A. Aerofoils-General, 154.—T. 2135.) Pp. 14. 7*d.* net. (London: H.M. Stationery Office.)

Leicester Museum, Art Gallery and Library. Bulletin No. 10. Pp. 12. (Leicester.)

County Borough of Warrington: Museum Committee. Report of the Director for the Two Years ending 30th June 1926; with a List of the Principal Additions to the Museum Collections. Pp. 21. (Warrington.)

Transactions of the Royal Society of Edinburgh. Vol. 54, Part 3, No. 14: Magnetic Quality in Crystals. Part i: Discrimination of, and Stability in, Magnetic Lattices; Part ii: Stability of Magnetic Lattices; Part iii: Twinning in Crystals. By Dr. J. Forrest. Pp. 691-701. (Edinburgh: Robert Grant and Son; London: Williams and Norgate, Ltd.) 12*s.* 6*d.*

Union of South Africa: Department of Agriculture. Science Bulletin No. 45: Physiological Studies of the Grape. By Dr. Francois Jean de Villiers. Pp. 97. (Pretoria: Government Printing and Stationery Office.) 1*s.* 6*d.*

Northampton Polytechnic Institute, St. John Street, London, E.C.1. Announcements, Educational and Social, for the Session 1926-1927. Pp. 176. (London.)

Decennial Index of *The Analyst*: the Journal of the Society of Public Analysts and other Analytical Chemists. Vols. 41-50 (1916-1925). Compiled by M. B. Elliott. Pp. 353. (Cambridge: W. Heffer and Sons, Ltd.) Paper, 21*s.* net; cloth, 25*s.* net.

Transactions of the Royal Society of Edinburgh. Vol. 54, Part 3, No. 16: On the Development of the Cranial Muscles in Protopterus and Lepidosiren. By Prof. F. H. Edgeworth. Pp. 719-734+9 plates. 5*s.* 6*d.* Vol. 54, Part 3, No. 19: The Petrography of Jan Mayen. By Dr. G. W. Tyrrell. Pp. 747-765. 2*s.* 6*d.* (Edinburgh: Robert Grant and Son; London: Williams and Norgate, Ltd.)

The Journal of the Royal Anthropological Institute of Great Britain and Ireland. Vol. 56, 1926, January to June. Pp. 206+15 plates. (London.) 15*s.* net.

Aeronautical Research Committee: Reports and Memoranda. No. 1029 (E. 20): Hydrogen as an Auxiliary Fuel for a Solid Injection Oil Engine. By G. F. Mucklow. (I.C.E. 529.) Pp. 16+17 plates. 1*s.* net. No. 1032 (Ae. 224): Wind Tunnel Tests on a Wing covered with Monel Metal Gauze. By F. B. Bradfield. (A. 3. a. Aerofoils-General, 162.—T. 2239.) Pp. 2+1 plate. 4*d.* net. (London: H.M. Stationery Office.)

Report by the Hon. W. G. A. Ormsby-Gore, M.P. (Parliamentary Under-Secretary of State for the Colonies), on his Visit to West Africa during the Year 1926. (Cmd. 2744.) Pp. 188. (London: H.M. Stationery Office.) 3*s.* 6*d.* net.

British Honduras. Annual Report of the Forest Trust for the Year ended 31st March 1926. Pp. 24. (Belize, British Honduras.)

Foreign.

Proceedings of the Imperial Academy. Vol. 2, No. 7, July. Pp. xxi-xxii+299-359. (Ueno Park, Tokyo.)

Ministero dell' Aeronautica, Aviazione Civile e Traffico Aereo: Ufficio Presagi. Le condizioni meteorologiche dell' Umbria nel mese di Settembre. Pp. 12+3 tavole. (Roma.)

Agricultural Experiment Station: Michigan State College of Agriculture and Applied Science. Technical Bulletin No. 76: Concentration of Materials and Rates of Application in the Control of Apple Scab. By W. C. Dutton. Pp. 18. (East Lansing, Mich.)

Bulletin of the Experiment Station of the Hawaiian Sugar Planters' Association. Entomological Series, Bulletin No. 18: Contributions to our Knowledge of South American Fulgoroidea (Homoptera). Part i.: The Family Delphacidæ. By F. Muir. Pp. iii+51. (Honolulu, Hawaii.)

Museums of the Brooklyn Institute of Arts and Sciences. Report upon the Condition and Progress of the Museums for the Year ending December 31, 1925. By William Henry Fox. Pp. 75+3 plates. (Brooklyn, N.Y.)

Department of the Interior: U.S. Geological Survey. Bulletin 768: Geology and Oil Resources of the Puente Hills Region, Southern California. By Walter A. English. With a Section on the Chemical Character of the Oil, by Paul W. Prutzman. Pp. v+110+14 plates. 40 cents. Bulletin 776: The Mesozoic Stratigraphy of Alaska. By George C. Martin. Pp. xii+493. 75 cents. Bulletin 785-B: Potash Investigations in 1924. By Walter B. Lang. (Contributions to Economic Geology, 1926, Part 1.) Pp. ii+29-43. 5 cents. Water-Supply Paper 558: Preliminary Index to River Surveys made by the United States Geological Survey and other Agencies. By Benjamin E. Jones and Randolph O. Helland. Pp. iv+108+2 plates. Professional Paper 143: Paleontology and Stratigraphy of the Castle Hayne and Trent Marls in North Carolina. By Lewis Burnett Kellum. Pp. iii+56+11 plates. 30 cents. Professional Paper 145: Geology and Oil and Coal Resources of the Oregon Basin, Meeteetse, and Grass Creek Basin Quadrangles, Wyoming. By D. F. Hewett. Pp. iv+111+32 plates. 1 dollar. (Washington, D.C.: Government Printing Office.)

Publications of the United States Naval Observatory. Second Series, Volume 10. In 2 parts. Part 1: Observations made with the Prime Vertical Transit Instrument, 1893-1912, by George A. Hill; Part 2: Total Solar Eclipses of August 30, 1905, and June 8, 1918, with Aviators' Notes on the Total Solar Eclipse of September 10, 1923. Pp. A ccxviii+A 382+9 plates+B 416+50 plates. (Washington, D.C.: Government Printing Office.)

Ministry of Agriculture, Egypt: Technical and Scientific Service. Bulletin No. 63: An Account of Experiments carried out to Determine the Experimental Error of Field Trials with Cotton in Egypt. By M. A. Bailey and T. Trought. Pp. ii+29+23 plates. (Cairo: Government Publications Office.) 10 P.T.

Report of the Aeronautical Research Institute, Tôkyô Imperial University. No. 18: Eye-shaped end of Bar investigated by Photo-elastic Method. By Kango Takemura and Yahei Hosokawa. Pp. 127-143. 0.40 yen. No. 19: On the Distribution of Shearing Stresses in Beams of certain Cross-sections. By Tuneo Inokuty. Pp. 145-204. 1.05 yen. (Tôkyô.)

List D: Wavelength Spectrometers, Monochromators, and Specialised Spectroscopes. Pp. 21. List E: Spectrographs. Pp. 24. List L: Micrometers, etc. Pp. 5. Water Jacketed Tubes. Pp. 2. (London Adam Hilger, Ltd.)

Diary of Societies.

SATURDAY, OCTOBER 16.

NORTH OF ENGLAND INSTITUTE OF MINING AND MECHANICAL ENGINEERS (Associates and Students Section) (at Neville Hall, Newcastle-upon-Tyne), at 3.—P. F. Hope: Steam and Electric Locomotives for Colliery Purposes.

BRITISH PSYCHOLOGICAL SOCIETY (at University College), at 3.—W. J. Messer: Conative Control.—R. J. Bartlett: Does the Psychogalvanic Phenomenon indicate Emotion?

PHYSIOLOGICAL SOCIETY (in Department of Physiology, Guy's Hospital), at 4.—Demonstrations on A Substitute for Blood Fibrin in Work on Digestion, by W. M. Clifford; and Peculiar Substance in the Central Nervous System of Cats kept on Autoclaved Meat, by C. Da Fano.—A. E. Clark-Kennedy and T. Owen: The Effect of Variation of Oxygen Pressure on the Respiratory Exchange during Exercise.—T. Lewis and Y. Zotterman: Reactions of the Skin to Ultra-violet Light.—T. Lewis and I. M. Harmer: The Release of Vasodilator Bodies in Response to Mechanical Stimulation of the Skin (preliminary communication).—W. Cramer: The Transplantation of Spleen.—W. W. Payne and E. P. Poulton: The Law of the Intestines as applied to the Œsophagus.—V. de Burgh Daly: The Effect of a Negative Pressure on the Heart-Lung Preparation.—A. D. Macdonald and W. Schlapp: Adrenaline Vaso-dilation.—K. Furusawa and R. M. T. Kerridge:—The Buffering Powers of Cardiac and Skeletal Muscles of the Cat.—A. Levin: Fatigue, Retention of Action Current, and Recovery, in Nerves of the Spider Crab.—R. S. Creed and Sybil Cooper: A Reflex in the Knee Extensors caused by Active Contraction of the Flexors.—J. de B. Daly and E. B. Verney: The Site of the Receptors engaged in the Reflex Regulation of the Heart Rate.—E. B. Verney: Some Quantitative Experiments on the Secretion of Pituitrin in Mammals.—E. D. Adrian: Action Currents in the Optic Nerve.—E. T. Coxybeare, M. Maizels and M. S. Pembrey: Influence of Anæsthesia on Metabolism.—M. Maizels and A. C. Hampson: The Effects of Variations in PH on the Volume of the Red Cells (preliminary communication).

MONDAY, OCTOBER 18.

ROYAL COLLEGE OF PHYSICIANS OF LONDON, at 4.—Sir John Rose Bradford: Harveian Oration.

ROYAL COLLEGE OF SURGEONS OF ENGLAND, at 5.—C. E. Shattock: Demonstration of Surgical Conditions of Lymphatic Gland.

ROYAL SOCIETY OF MEDICINE (Social Evening), at 9.30.—Sir Arthur Keith: John Bull: a Study in Anthropology.

INSTITUTION OF THE RUBBER INDUSTRY (London Section) (at Engineers' Club, Coventry Street).—W. H. Harford: Advertising.

TUESDAY, OCTOBER 19.

ROYAL SOCIETY OF MEDICINE, at 5.30.

INSTITUTE OF TRANSPORT (at Institution of Electrical Engineers), at 5.30.—Capt. F. L. Barnard: Commercial Flying.

ZOOLOGICAL SOCIETY OF LONDON, at 5.30.—The Secretary: Report on the Additions to the Society's Menagerie during the months of June, July, August, and September 1926.—Dr. P. A. Buxton: Exhibition of Apparatus for the Measurement of Radiant Heat in the Tropics.—Miss Joan B. Procter: Exhibition of a White Example of the English Grass-Snake.—Prof. J. S. Huxley: Studies in Heterogonic Growth: the Annual Increment of the Antlers of the Red Deer (*Cervus elaphus*).—Dr. J. Waterson: On the Crop Contents of certain Mallophaga (Insecta).—J. R. Norman: A Synopsis of the Rays of the Family Rhinobatidæ, with a Revision of the Genus Rhinobatus.—Prof. D. M. Fedotov: The Plan of Structure and Systematic Status of Ophiocista (Echinodermata).—Dr. R. Anthony and G. M. Iliesco: Étude sur les Cavités nasales des Carnassiers.

ROYAL PHOTOGRAPHIC SOCIETY (Scientific and Technical Group), at 7.—T. Thorne Baker: The Use of Light-Sensitive Cells in Photometry, Wireless Picture Telegraphy and Television.

WEDNESDAY, OCTOBER 20.

SOCIETY OF GLASS TECHNOLOGY (at Leeds University), at 2.30.—General Discussion on Annealing and Lehrs.—E. A. Coad-Pryor: The Economics of the Annealing Process.—Dr. J. W. French: Glass Annealing.—Dr. S. English and Prof. W. E. S. Turner: The Relationship between Chemical Composition and the Upper Critical Annealing Temperature of Glasses.

ELECTRICAL ASSOCIATION FOR WOMEN, at 3.—Visit to London Electric Wire Co., and Smith's Ltd., Leyton.

ROYAL INSTITUTE OF PUBLIC HEALTH, at 4.—Dr. W. J. O'Donovan: The Prevention and Treatment of Eczematous Conditions of the Skin of Occupational Origin.

ROYAL SOCIETY OF MEDICINE (History of Medicine Section), at 5.—W. G. Spencer: Review of the 'Proceedings' of the Section.—Dr. Le Roy Crummer: The Anatomical Plates for the work of Geminus.

NEWCOMEN SOCIETY FOR THE STUDY OF THE HISTORY OF ENGINEERING AND TECHNOLOGY (at Iron and Steel Institute), at 5.30.—R. Jenkins: The Rise and Progress of Manufacturing Industry in England (Presidential Address).

INSTITUTION OF AUTOMOBILE ENGINEERS (Birmingham Graduates' Section) (at Chamber of Commerce, Birmingham), at 7.30.—W. Evans: Engine Lubrication.

SOCIETY OF CHEMICAL INDUSTRY (Nottingham Section) (at University College, Nottingham), at 7.30.—F. H. Carr: The Manufacture of Organic Medicinal Chemicals.

MERSEYSIDE AQUARIUM SOCIETY (at 1 Falkland Road, Egremont), at 7.30.—W. Mallinson and A. G. This: The Construction of a Simple Aquarium.

INSTITUTE OF CHEMISTRY (London Section), at 8.

C.B.C. SOCIETY FOR CONSTRUCTIVE BIRTH CONTROL AND RACIAL PROGRESS (at Essex Hall, Strand), at 8.—Dr. C. W. Saleeby: The Expectant Mother.

ROYAL MICROSCOPICAL SOCIETY, at 8.—Prof. E. Ghosh: A New Classification of Ciliata.—Dr. J. E. McCartney: The Filterable Viruses.—B. K. Mullick: Notes on some Rotifers from India.—Dr. A. Piney: A Method of Silver Impregnation of Zenker-fixed Paraffin Sections.

ROYAL SOCIETY OF MEDICINE (Surgery Section), at 8.30.—W. Low: Surgery and the Workmen's Compensation Act (Presidential Address).

THURSDAY, OCTOBER 21.

CHILD-STUDY SOCIETY (at Royal Sanitary Institute), at 6.—Miss Margaret Morris: Dancing as Physical Culture.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—Dr. W. H. Eccles: Inaugural Address.

ROYAL AERONAUTICAL SOCIETY (at Royal Society of Arts), at 6.30.—W. R. D. Jones: Notes on Magnesium and some of its Alloys.

CHEMICAL SOCIETY, at 8.—Prof. H. V. A. Briscoe, P. L. Robinson, and H. C. Smith: The Density of Boron Trichloride, and the Suspected Variation in the Atomic Weight of Boron.—W. H. J. Vernon: The Formation of Protective Oxide Films on Copper and Brass by Exposure to Air at Various Temperatures.—W. H. Gray: The Action of Antimony Trichloride upon some Diazotised Diamines.—E. H. Farmer and J. Ross: The Formation and Stability of Associated Alicyclic Systems. Part III. The Change from 'Meta-' to 'Para-' bridged Rings.

ROYAL SOCIETY OF TROPICAL MEDICINE AND HYGIENE, at 8.15.—Prof. N. H. Fairley: Studies in the Chemotherapy and Immunity Reactions of Schistosomiasis.

ROYAL AERONAUTICAL SOCIETY (Coventry Branch) (at Coventry).—Major F. M. Green: The History of the Aeroplane.

FRIDAY, OCTOBER 22.

ROYAL COLLEGE OF SURGEONS OF ENGLAND, at 5.—Sir Arthur Keith: Demonstration of the Anatomy of the Sacro-iliac Region and its Application to Practice.

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

JUNIOR INSTITUTION OF ENGINEERS, at 7.30.—R. H. Kenyon: Boiler Accidents.

INSTITUTE OF METALS (Sheffield Local Section) (at Sheffield University), at 7.30.—Prof. H. C. H. Carpenter: Sorby Lecture.

ROYAL SANITARY INSTITUTE (at Town Hall, Dover), at 7.30.—Discussions on Diphtheria Immunisation.

OIL AND COLOUR CHEMISTS' ASSOCIATION.

PUBLIC LECTURES.

SATURDAY, OCTOBER 16.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—Mrs. H. M. Dunn: Kashmir, the Country and its People.

SUNDAY, OCTOBER 17.

GUILDHOUSE (Eccleston Square), at 3.30.—Air Vice-Marshal Sir Sefton Brancker: The Scientific Problems of Commercial Aviation.

TUESDAY, OCTOBER 19.

ROYAL SOCIETY OF MEDICINE, at 5.—Prof. Abel: The Development and Present State of Public Health in Germany (Chadwick Lecture).

SCHOOL OF ORIENTAL STUDIES (London Institution), at 5.—Dr. L. D. Barnett: An Introduction to Indian Philosophy. (Succeeding Lectures on November 2, 16, 30; December 7; January 18; February 1, 15; March 1 and 15.)

KING'S COLLEGE, at 5.30.—Prof. C. Lloyd Morgan: The Place of Mind in an Organic Theory of Nature. (Succeeding Lectures on October 26 and November 2.)

UNIVERSITY COLLEGE, at 5.30.—K. Lansma: The Drainage of the Zuyder Zee.

WEDNESDAY, OCTOBER 20.

INSTITUTION OF ELECTRICAL ENGINEERS, at 5.30.—Prof. J. A. Fleming: The Interaction of Pure Scientific Research and Electrical Engineering Practice. (Succeeding Lectures on October 22, 27, 29; November 10, 12, 17, and 19.)

ROYAL SOCIETY OF MEDICINE, at 8.—Prof. Abel: The Development and Present State of Public Health in Germany (Chadwick Lecture).

THURSDAY, OCTOBER 21.

FULHAM CENTRAL PUBLIC LIBRARY, at 8.—H. T. Davidge: The Earth we Live on.

SATURDAY, OCTOBER 23.

HORNIMAN MUSEUM (Forest Hill), at 3.30.—V. Gordon Childe: The Dawn of Civilisation in Europe.

SUNDAY, OCTOBER 24.

GUILDHOUSE (Eccleston Square), at 3.30.—Prof. W. A. Bone: The Economic Aspects of Coal.

CONGRESSES.

OCTOBER 13 TO 26.

GERMAN SOCIETY FOR THE STUDY OF DISEASES OF DIGESTION AND METABOLISM (at Berlin).

OCTOBER 20 TO 22.

TEXTILE INSTITUTE (at Town Hall, Buxton).—Sir William Bragg (Mather Lecture).—J. A. Robertson: Centralised Electricity Production.—P. Bean: Sizing of Artificial Silk Yarns, and Comparison with Sizing of Cotton Yarns.

OCTOBER 21.

COKE OVEN MANAGERS' ASSOCIATION (at Midland Hotel, Manchester).—Annual General Meeting.

OCTOBER 25 TO 28.

ITALIAN CONGRESS OF SURGERY (at Padua).

Supplement to NATURE

No. 2972 OCTOBER 16, 1926

Our Bookshelf.

Ability and Behaviour.

Ability: a Psychological Study. By Victoria Hazlitt. Pp. ix+147+2 plates. (London: Methuen and Co., Ltd., 1926.) 6*s*. net.

PART 2 records three years' work on "tests for special abilities in the work for Arts and Science degrees." Part 1, the result of the author's consideration of current theories of 'intelligence,' capacity and ability in the light of this work, is a capable analytic treatment of these theories coupled with an interesting new synthesis. General capacity is inborn: special abilities are developed. "The original endowment may be used in a number of ways. However it is used, it will lead to the development of special abilities" (p. 74). Prof. Spearman's 'engines' are not innate but acquired.

The construction of tests is easier in science than in arts. This is due to two causes. First, the practical work necessary in all sciences constitutes common ground which is readily tested. Secondly, special arts abilities are intrinsically more difficult to test because "the material of the natural sciences is less complex than that of the humanities" (p. 144). Still, three tests, successful in diagnosing arts ability, have been found, and results obtained support "the hypothesis that good general intelligence is more necessary for work in the Arts faculty than for work in the Science faculty" (p. 144). R. J. B.

Brains of Rats and Men: a Survey of the Origin and Biological Significance of the Cerebral Cortex. By Prof. C. Judson Herrick. Pp. xiii+382. (Chicago, Ill.: University of Chicago Press; London: Cambridge University Press, 1926.) 15*s*. net.

IN this book Prof. Herrick attempts to interpret the behaviour of rats and men in terms of cerebral anatomy. In the present state of our knowledge, any satisfactory solution of this interesting but immensely difficult problem is obviously unattainable. Nevertheless, it is a fascinating occupation to wander in the borderland between brain and mind and collect stray ideas as to possible points of contact.

The book may be of value to the student of psychology and the general reader. For those who are ignorant of such matters it provides an easily understood introduction to certain aspects of the comparative anatomy of the brain, in particular the cerebral cortex, and the results of an interesting series of experiments on the behaviour of rats, with tentative suggestions as to how and why some of the activities of the brain should express themselves as mental phenomena.

The book is, however, too elusive to be of much use to the serious student. This is due not solely to the fact that the author overuses vague phrases until they become little more than meaningless catchwords, but even more to his neglect of the fundamental conceptions of neural physiology that are associated with the names of Hughlings Jackson, Sherrington, Head, and Magnus, among many others, which represent the essential principles for the interpretation of animal behaviour. The inhibitory influence of the cerebral cortex and the phenomena due to the release of its control, the regulation of posture and the amazing perfection of the automatic mechanisms for controlling the attitude of the body, and in particular the conception of a hierarchy of neural levels upon each of which a different kind of functional result is achieved—these are all matters that are of primary importance for the interpretation of animal behaviour in neurological terms, which are not given due consideration in this book. In particular, however, the chief criticism of Prof. Herrick's fascinating attempt to give a biological explanation of mental phenomena is his failure, when using his terminology, to appreciate the full significance of Sir Charles Sherrington's contribution to the general fund of knowledge of such matters.

Manners and Customs.

Le monde islamique. Par Max Meyerhof. (Bibliothèque générale illustrée, No. 3.) Pp. 80+59 planches. (Paris: F. Rieder et Cie, 1926.) 15 francs.

THIS little book aims at extending among the general public a knowledge of the origin, the character, and the extent of Islam—a civilisation which, as the author says, is composed of the most heterogeneous elements, and yet is not without a certain unity. To this unity has been added since the War an element of hostility towards European control and intervention which is very real, even though its effect as a consolidating force may have been exaggerated in some degree. M. Meyerhof's treatment has necessarily been very summary, and of his sixty-eight pages, nearly half is devoted to an analysis of the recent course of political events. In these, pan-Islamism and the racial movement tend to obscure undercurrents of opinion which have been potent forces in counteracting the movement towards unity. Admirable as is M. Meyerhof's sketch of Moslem religion and culture within the very restricted limit imposed by the nature of the popular series of which his book forms a part, it would have gained still further as a picture of actual conditions had he given a more systematic account of the divisions in the Mohammedan faith which set one sect over against another. Apart from this, it is a clear and lucid introduction to an understanding of one of the grave world problems of the day.

The Southern New Hebrides: an Ethnological Record. By C. B. Humphreys. Pp. xvi+214. (Cambridge: At the University Press, 1926.) 12*s.* 6*d.* net.

Anthropologists will be grateful to Mr. Humphreys for this ethnological record of the Southern New Hebrides for two reasons. Very little systematic work has been done on this interesting little group of five islands, if Speiser's work on the New Hebrides as a whole be excepted; and, as everywhere in the Pacific, changing conditions make it imperative that ethnological investigations should be pushed on before it is too late. Sophisticated as the natives of the New Hebrides are through their contact with Europeans, Mr. Humphreys was fortunate enough to find a few old men who still retained a memory of old customs. How important and how fortunate this was is attested by the intricate and somewhat puzzling character of the culture, especially on the island of Tanna. Mr. Humphreys puts forward a very interesting hypothesis to account for the differences in the form of the chieftainship in that island, the nebulous form of totemism found in the group, the variations in the cephalic index, and other physical characters as well as other peculiarities. It is difficult to suggest an alternative, and Mr. Humphreys' hypothesis must for the present hold the field; but it involves an exceptional history for the island of Tanna for which it is hard to account satisfactorily.

Natural History.

British Spiders: their Haunts and Habits. By Theodore H. Savory. Pp. xxi + 180. (Oxford: Clarendon Press; London: Oxford University Press, 1926.) 6*s.* net.

In recent years, both in England and America, various attempts have been made by writers on the habits of spiders to direct the attention of the budding naturalist to a group of animals little studied, though everywhere abundant. But when interest has been aroused and the reader has been tempted to pursue the matter further and attain to a more intimate acquaintance with these curious creatures, he finds himself at a loss. The would-be student of butterflies or birds has his way made plain before him by a multitude of more or less satisfactory handbooks, but the books which deal in detail with the British spider fauna are either antiquated or unprocurable, or both.

Mr. Savory's book will help the aspiring araneologist at least one step on his way; and we have little doubt that it will be received with the hearty welcome it deserves.

Mr. Savory's main object being 'first aid' in the identification of specimens, he might perhaps have 'cut the cackle and come to the horses' a trifle more quickly. We by no means imply that the 'cackle' is not excellent, or that it is a mere imitation of previous prattlers—Mr. Savory is a keen observer on his own account—but, presumably, his greatest appeal will be to those who already know something of the biological side of the subject and are impatient to get to business. We heartily approve his plan of giving, where possible, the Blackwallian names of species, and thus rendering available Miss Staveley's book with its excellent reproductions of Blackwall's coloured figures—a book which he informs us is still obtainable. Savory plus Staveley should be a real help forward.

The illustrations of the book before us are its chief weakness. The figure of *Segestria senoculata* (Fig. 13) is really too crude, and Fig. 18 gives *Walcknæria acuminata* ten eyes! Then an accurate detailed drawing of the cheliceræ seems absolutely necessary. Without it, how is the student to interpret such terms as "primary fang teeth" and "lower margin of the cheliceræ" used in the dichotomic tables? We venture to direct attention to these slight blemishes in view of future editions, for which we anticipate a demand.

C. W.

Index Kewensis Plantarum Phanerogamarum. Supplementum Sextum: *Nomina et Synonyma Omnium Generum et Specierum ab initio anni MDCCCCXVI usque ad finem anni MDCCCCXX nonnulla etiam antea edita complectens.* Ductu et consilio A. W. Hill. Pp. iii + 222. (Oxford: Clarendon Press; London: Oxford University Press, 1926.) 7o*s.* net.

The appearance of a new supplement to the "Index Kewensis" is matter for rejoicing among botanical taxonomists, on whose behalf we thank the Director and the members of the Herbarium staff who have brought the record of names and synonyms of genera and species of flowering plants up to the end of 1920. The present supplement nominally deals with the years 1916–1920, but also includes many names unavoidably omitted from publications issued in 1914 and 1915, and also earlier names which have been traced since the publication of the original work and its successive supplements. One of the latter, "Stilla," W. Young (1783), followed by the remark 'nomen. Quid?' raises a question as to the desirability of indexing *nomina nuda*. Taxonomically they do not exist; they are neither 'names' nor 'synonyms,' and space would be saved by their omission. A certain French botanist is credited (?) with one or more in almost every other column.

It would be ungrateful, however, to cavil at so trivial a matter in a periodical of such interest; for the "Kew Index" makes as interesting reading as does a good dictionary; at any rate for the taxonomist who takes his work seriously. He may, for example, speculate as to what proportions of the entries in the columns represent genuine botanical work, and what are mere exercises in nomenclature; and as to whether the round-table conference between taxonomists at the recent Botanical Congress at Ithaca will prove a step forward towards the attainment of uniformity in nomenclature. The restoration of names which had been neglected or overlooked by earlier workers is responsible for a large number of entries, especially on behalf of American botanists; these are indicated by citation of the earlier name following the entry.

The "Index" records impartially foibles and follies and the results of honest work, and it brings to the notice of botanists rare and obscure publications. One of the latter (erroneously dated 1889) has yielded two and a half columns of names, credited almost entirely to one individual, under the genus Cinnamomum; a somewhat surprising entry is "*Crucifera*—genus omnia genera *Cruciferarum* amplectens"; while the immortality of a foolish action is illustrated

by the first item in the volume, "AA," under which genus several recent species are recorded. A. B. R.

Goldfish Culture for Amateurs: How to Breed and Rear Goldfish in Aquaria and Ponds. By A. E. Hodge and Arthur Derham. Pp. xi+103+11 plates. (London: H. F. and G. Witherby, 1926.) 5*s.* net.

THIS small book describes a dozen or so of the varieties of goldfish and gives very clear and complete instructions for breeding and rearing them in aquaria. It deserves to be widely read, partly because the goldfish has in the past probably suffered more than any other domesticated creature from neglect, ignorance, and mistaken kindness, and partly because the authors show, in convincing fashion, that their cultivation is of great fascination. Moreover, considerable scientific interest attaches to an animal able to produce such remarkable mutations. This book may well inspire research into the origin and genetic relations of these varieties, with the possibility of results of unexpected value.

Birds in England: an Account of the State of our Bird-Life and a Criticism of Bird Protection. By E. M. Nicholson. Pp. xi+324+8 plates. (London: Chapman and Hall, Ltd., 1926.) 12*s.* 6*d.* net.

UNDER the somewhat vague title of "Birds in England," Mr. E. M. Nicholson has given us a useful and stimulating book: its scope is better indicated by the sub-title, "An Account of the State of our Bird-Life and a Criticism of Bird Protection." The opening chapters discuss losses and gains in our avifauna and the operative causes. The middle portion of the book centres round an account of the lives and work of famous ornithologists. The final chapters deal with the practical problems of protection—sanctuaries, legislation, and the evils of collecting. The last part of the book, especially, is frankly polemic. The author holds decided personal views on questions of protection, and he presents these with force and skill. Not all his conclusions will be generally accepted, but his arguments always deserve serious consideration and often carry conviction.

Mr. Nicholson takes a rather unusual line, for example, on the subject of bird-sanctuaries, but the truth of many of his contentions must be admitted. He draws a useful distinction between sanctuaries in towns and those in solitary places. The object of the former is to attract birds where none lived before. The country sanctuary, on the other hand, is a retort to persecution, and the author regards it as in many ways an unfortunate one, tending to shelve the question of protection on a national scale. He points out how little can be done by scattered sanctuaries for the preservation of rare species other than those which breed in colonies, and he sees the true remedy in the effective prohibition of collecting. Nor does he omit to notice the unfortunate results which sometimes follow from indiscriminate protection.

From a purely scientific point of view, the earlier chapters, dealing with the "Balance of Birds," are the most valuable. These constitute a careful survey of the subject, from which much that is of interest emerges. In dealing with total gains and losses, Mr. Nicholson counts that fifteen breeding species have been lost, as such or altogether, since Tudor times, while seventeen have been gained: the figures include three which have been lost and regained and thus appear on both sides of the account. Of the gains, four are due to artificial introduction and the rest to natural colonisation, all within a century, by former purely visitant species, including seven ducks. The account of the decrease and increase of other birds, which have not been either totally lost or gained as breeding species, is perhaps even more interesting, and the thoughtful discussion of the probable parts played by different factors gives evidence of the author's thorough knowledge of the subject.

A Naturalist's Pilgrimage. By Richard Kearton. Pp. xiii+246+8 plates. (London, New York, Toronto and Melbourne: Cassell and Co., Ltd., 1926.) 7*s.* 6*d.* net.

MR. KEARTON, by his photographs and lectures, has done much to popularise the simpler type of natural history, and he is justly proud of the achievement. This chatty autobiography traces his progress from the fell farm to the study and lecture hall, and with naïveté recounts the experiences, some instructive, many trivial, which he encountered by the way. The naturalist will be interested in the elaborate means sometimes adopted for the delusion of birds, and in the trying adventures of the pioneer days of bird photography; and if the impression is created that the author insists too much on his own cheerfulness and *bonhomie*, it is simply because he realises that here lies one of the secrets of his success.

Insect Studies.

The Fauna of British India, including Ceylon and Burma. Edited by Sir Arthur E. Shipley, assisted by Dr. Hugh Scott. (Published under the Authority of the Secretary of State for India in Council.) *Coleoptera: Chrysomelidæ (Chrysomelinæ and Halticinæ).* By S. Maulik. Pp. xiv+442. (London: Taylor and Francis; Calcutta: Thacker, Spink and Co., Bombay: Thacker and Co., Ltd., 1926.) 25*s.*

THE family Chrysomelidæ, which comprises the leaf-beetles, is one of the largest in the animal kingdom. It includes to-day probably not far short of 20,000 described species which are grouped into sixteen subfamilies. The first eleven of the latter were dealt with in the "Fauna of British India" series in the volume by the late Mr. Martin Jacoby, published in 1908. In 1919 Mr. Maulik wrote the volume on the Hispinæ and Cassidinæ, while the Chrysomelinæ and Halticinæ form the subject of the present contribution. This leaves the Galerucinæ for future treatment, and, it may be added, they are exceedingly numerous in species. Of the subfamily Chrysomelinæ, only 63 species are recorded and are comprised in 18 genera. This paucity is remarkable, considering the richness of the faunal area surveyed, and it is evident that there are still far too few resident entomologists to do the necessary intensive collecting over so wide a region.

In the introduction to the Chrysomelinæ an account is given of the external morphology of the larva and imago, notes on the life-histories, and a list of injurious species found in various parts of the world. In the subfamily Halticinæ 287 species, in 70 genera, are recorded,

and there are similar introductory remarks on structure and habits. It is noteworthy that very many of the members of this subfamily are represented by single records only, and evidently these rather obscure beetles have afforded very little interest to collectors. In this volume, as elsewhere, Mr. Maulik has manufactured many new names from Sanskrit roots—a procedure which he says has saved him time which might have otherwise been used in discovering whether a name is preoccupied or not. The volume is clearly illustrated, although the sex of the examples figured might have been added with advantage. Its type and general arrangement are similar to those of its predecessors, and there appears to be an almost entire freedom from misprints. A. D. I.

Descriptions of new Genera and Species of Lepidoptera Phalænæ of the Subfamily Noctuinæ (Noctuidæ) in the British Museum (Natural History). By Sir George F. Hampson. Pp. iv + 641. (London: British Museum (Natural History), 1926.) 20*s*.

This volume contains the descriptions of more than 200 genera and a still larger number of new species of moths belonging to the subfamily Noctuinæ contained in the British Museum. Its MSS. was left by the author when he retired from the Natural History Department in 1920. Owing to the suspension of the Catalogue of Moths as the result of financial stringency occasioned by the War, a large number of species have remained in the Museum under Sir George Hampson's manuscript names without the necessary published descriptions. In order to obviate this disadvantage it has been deemed necessary to issue the present volume. Apart from bare descriptions, it contains no illustrations or other aid to the identification of this great mass of material.

Rural Science.

Insecticides, Fungicides and Weed Killers. By Dr. E. Bourcart. Translated from the French and adapted to British Standards and Practice. Second English edition, revised and enlarged by T. R. Burton. Pp. xii + 431. (London: Scott, Greenwood and Son, 1925.) 15*s*. net.

Agriculturists and horticulturists alike will welcome the appearance of a new edition of Bourcart's useful work of reference. During the fifteen years since the publication of the original edition of this volume, very considerable advances have been made in the application of chemical methods to agriculture. This has been specially marked in connexion with the suppression of plant pests and diseases, though much of the work is still in the experimental stage and needs applying with caution. In presenting a revised and enlarged English edition the translator has retained the fundamental basis of the original work, while replacing part of the old historical sections by details of modern methods and recipes which have been thoroughly tested and are worthy of recommendation.

Work on insecticides has proceeded rapidly in the United States, where it is aided and supervised by the Government, and in other countries also research is being actively carried on as the regions of cultivation extend, specially in the tropics and warmer temperate zones. This has greatly increased the possibility of dealing effectively with insect and fungus pests, and the volume under review aims at presenting the present state of our knowledge on the subject in so far as it has been sufficiently tested. For the sake of convenience, the entomological glossary, hitherto a separate section, is now incorporated in the body of the book. No bibliography is appended, probably on the score of space or unwieldiness, though recipes are in the majority of cases carefully attributed to their authors. W. E. B.

Rural Scotland during the War. By David T. Jones, Joseph F. Duncan, H. M. Conacher, W. R. Scott. With an Appendix by J. P. Day, and an Introduction by W. R. Scott. (Publications of the Carnegie Endowment for International Peace, Division of Economics and History: Economic and Social History of the World War, British Series.) Pp. xvi + 311. (London: Oxford University Press; New Haven, Conn.: Yale University Press, 1926.) 12*s*. 6*d*. net.

This valuable work embraces a complete survey of the economic and social history of Scotland during the War in its chapters on fisheries, agriculture with special reference to food production, the agricultural labourer and land settlement. There is also an appendix on the jute industry. No occupation suffered more severely, or was forced to undergo more drastic reorganisation, than fishing. The withdrawal of vessels and men, the closure of many fishing-grounds, and the shifting of the fishing ports from the east to the west coast, with the consequent difficulties of transport, are the chief problems discussed in Mr. Jones's survey. In agricultural Scotland, in spite of the heavy enlistments, there was an increased supply of food, especially as regards oats and sheep. Mr. Conacher deals fully with the problem the Scottish farmer successfully solved. Mr. Day's study of the jute industry traces the difficulties this industry had to face in its import of raw material, the rapid soaring of prices for jute goods, and the equally rapid post-War return to normal prices. The book is admirably arranged for easy reference and contains an abundance of statistical matters.

Cornish Geology.

Handbook of Cornish Geology. By E. H. Davison. Pp. 106. (Penzance: Royal Geological Society of Cornwall, 1926.) n.p.

Many excellent books, pamphlets, and papers have been written about the rocks and geological problems of the Cornish peninsula. There are many unsolved riddles in this western land, so that there will always be a number of persons with some geological knowledge ready to turn a portion of their holidays to pleasurable account. The chief drawback of these excellent treatises is that they are too technical and obscure. They describe features in language which is not clear enough to the ordinary layman stranger, who requires to be directed to spots where these particular phenomena are to be seen at once with nothing to obscure the issue. Mr. Davison's book is perhaps scarcely free from the modern vice of multiplying technical terms

and names, which to the older geologist become confusing. The book supplies, however, a long-felt want. It brings the geological knowledge of the county up-to-date in very terse language, and it describes clearly and concisely the places and positions where the keys to various problems may be found. The chapters are short, but to the point; those on "The Granite," the "Lizard Rocks," and the "lodes of Cornwall" are especially good.

On such subjects as "the pneumatolysis [unpleasant word !] of the granite and other rocks" Mr. Davison is, of course, on controversial ground, but it is his own subject, and he steers clear of any points of fierce dispute in his own inimitable way. The chapter on "Geological Localities of Interest" is one which will be appreciated by those who have only a few days to spare in the Duchy. One feels that practically every spot worth visiting has been mentioned. Mr. Davison might perhaps have dealt a little more with the early Pre-Cambrian and Ordovician aspects of the region, in something of the style of Mr. Jukes Brown's excellent "Building of the British Isles"; but, no doubt, many of his readers will find the hints he gives in his little book a substantial basis for building further framework upon. The bibliography is very complete, but why did not Mr. Davison take it back a few years earlier? The period between 1890 and 1906 was a very prolific and useful one in Cornish geology. F. J. S.

Geophysics.

Was lehrt uns die Radioaktivität über die Geschichte der Erde? Von Prof. Dr. O. Hahn. Pp. v+64. (Berlin: Julius Springer, 1926.) 3 gold marks.

In this little book on radioactivity and geology, Prof. Hahn summarises in a form very convenient for German readers the outstanding results that have been achieved in recent years. Radioactivity is of fundamental importance to geologists in two main respects: the constant emission of heat, which is now held to control the surface history of the earth; and the accumulation of end-products in minerals, the analysis of which is making it possible to establish a geological time-scale and to correlate the Pre-Cambrian rocks.

Dealing with the age of the earth, Hahn discusses Joly's reasons for preferring lower estimates than those advocated by Holmes. He rejects the solvent-denudation method as being too uncertain to give trustworthy results, and suggests that the older geological estimates should be multiplied by ten or twenty. The results from thorium minerals are also rejected on account of the unsuitability of the minerals. These he regards either as secondary products or as leached residuals. The argument from pleochroic haloes is thought to be inconclusive, and the opinion is expressed that it is very improbable that uranium disintegrated more rapidly in past ages than now. No mention is made of the possibility of attributing the anomalies of the 'uranium' halo to the actinium series. It is clear that Hahn accepts the straightforward reading of uranium minerals, though it is unfortunate that he does not refer to the geological support given to the longer estimates by the remarkable work of Barrell ten years ago.

In his account of the earth's thermal state, Hahn reviews the work and opinions of Joly, Holmes, and Jeffreys (who, however, is not an American). He goes further than any of these writers in suggesting that life itself depends on the radioactivity of the rocks: without carbon dioxide, no life; without volcanoes, no carbon dioxide; without radio-elements, no volcanoes. A brief résumé is given of the reasons for supposing that uranium and thorium have been concentrated in the outer crust. The book concludes with a discussion of Joly's theory of basaltic cycles and the physical possibility of continental drift.

International Hydrographic Bureau Special Publication No. 12: Investigation of Harmonic Constants, Prediction of Tide and Current, and their Description by Means of these Constants. By Rear-Admiral Phaff. Pp. 80+6 plates. 5 Swiss francs. *Supplement to Special Publication No. 12: Tables for the Calculation of Tides by Means of Harmonic Constants.* Pp. 136. (Monaco: International Hydrographic Bureau, 1926.)

The needs of the seaman are not adequately met by tide tables for a limited number of ports; he cannot always deduce from them the best times for attempting to enter other ports, especially where there is large diurnal inequality in time and height of high water. The simplest solution of his problem is to compute by the harmonic method the tidal variation for a few hours of the required day. He should be provided with a list of the important constants for as many places as possible, with means to facilitate the computations, together with rules which cannot easily be misunderstood. These recent publications of the International Hydrographic Bureau profess to meet his needs; it is regrettable that they appear to have been thrust upon the world with little consideration and with great haste, even if we only judge by the liberal errata and corrigenda pasted in each volume.

The 'Tables' are for use with a method of computation based upon the work of Van de Stok; apart from an unsatisfactory method, the constants are not up-to-date, there is no value of mean sea-level and the phase-lags are given in degrees, local *or* zone time, without any indication as to which is used in any given case. The 'Tables' are not self-contained, lacking simple rules and typical forms for computation; the seaman, therefore, must first read the manual, and that will be fatal, for the language is frequently loose and obscure, and it is difficult to follow some of the processes (p. 53), even for one capable of independent reproduction of the results. The author gives formulæ and symbols without explanation (p. 59), and tables that are neither self-evident nor properly explained in the text (p. 57). In short, the manual appears to be transcribed from the author's notebook. It is incorrect to say that the constituents K_1, K_2 can be reciprocally eliminated in one day, whereas 365 days are required to eliminate K_1 from S_2; also, that 55 days are required to give a negligible contribution from O_1 in the analysis for N_2; less than 55 hours would suffice for that purpose. The objects are indeed laudable, but it is to be regretted that these volumes are unworthy of international acceptance.

Probleme der kosmischen Physik. Herausgegeben von Prof. Dr. Christian Jensen und Prof. Dr. Arnold Schwassmann. Band 7: *Der Massenaustausch in freier Luft und verwandte Erscheinungen.* Von Prof. Dr. Wilhelm Schmidt. Pp. viii+118. (Hamburg-Altrahlstedt: Henri Grand, 1925.) 6 gold marks.

THIS useful little book summarises the literature of the last fifteen years or so relating to transport phenomena in the atmosphere (and also, as a natural extension of the same ideas, similar phenomena in the ocean). The transport of heat and momentum and water vapour by atmospheric eddies is of great importance in meteorology, though the fact has been recognised only in recent years (largely through the work of Prof. G. I. Taylor). The author has himself written widely on these problems.

Modern Physics.

Reflections on the Structure of the Atom. By Florence Langworthy. Pp. xi+260. (London: Watts and Co., 1926.) 12*s.* 6*d.* net.

THIS volume, which covers a wide range, is concerned mainly with an atomic model in which the neutral atom of hydrogen is assumed to be built up of three "atoms of its isotope, ur-hydrogen," and three electrons. On this purely speculative foundation is raised an elaborate superstructure. "In my atom the double-positives (Alpha particles) are massed at the centre, and so I have the single positives free to unite with electrons and form planets that can be neutral, negative, or positive." The author is of opinion that a chemist will find the structure of her atom far more to his mind than that of the Bohr atom, which presents to the world outside negatives (electrons) only. The latter model she holds in scorn, going so far as to say that our knowledge of atomic structure "has been marking time all these years since the Rutherford atom became the Bohr atom"!

In the new wave-theory of matter associated with the name of Schrödinger, a material particle is regarded as a singularity in a wave, but to the author of the present volume even the wave-theory of light is anathema. "Those who have handicapped their intellectual faculties by believing in 'waves' are now engulfed thereby." She claims to be one of the few who have always believed in Newton's corpuscular theory of light. Whatever may be the final solution of the problem of reconciling the quantum theory and the undulatory theory, it will not be reached by turning a blind eye to one side of the questions at issue. Truth is great, and will prevail; but in our view the cause of knowledge will not be advanced by the speculations in this book.

A Numerical Drill Book on Physics. By Prof. L. W. Taylor. Pp. viii + 95. (Boston, New York and London: Ginn and Co., 1926.) 1 dollar.

THIS collection of problems in physics, which should prove useful to teachers, presents some novel features of interest. Nearly every problem is first formulated in algebraic terms; four independent sets of numerical data are provided for each example, these being chosen so as to cause the results to pass through maxima and minima wherever possible; answers are given usually correct to four significant figures. The mathematical tables at the end of the book are clearly printed.

Chemistry and its Borders.

An Introduction to Chemistry. By C. G. Vernon. Pp. 276. (London: George Harrap and Co., 1926.) 4*s.* 6*d.*

MR. VERNON'S book is based on the application of the heuristic method. It proceeds from an account of the beginnings of chemistry, which is cryptically and incorrectly said (p. 177) to have been founded by Jabir, to the work of Dalton. The study of the oxides of nitrogen, 'muriatic' acid and the halogens, sulphur, etc., then follows, and by p. 179 the structure of the atom is attained. The rest of the book deals with practical work, and several interesting experiments are described. There are many excellent illustrations, including portraits of Boyle, Priestley, and Lavoisier.

Even those teachers who do not believe in the rather literary method of introduction to the science here adopted will find Mr. Vernon's book interesting and suggestive. The historical details appear to have been compiled from trustworthy sources, although the judgment passed (on p. 19) on the Alexandrian School is somewhat startling.

A Dictionary of Applied Chemistry. By Sir Edward Thorpe; assisted by eminent contributors. Vol. 6: S. Acid to Tetryl. Revised and enlarged edition. Pp. viii+791. (London: Longmans, Green and Co., Ltd., 1926.) 60*s.* net.

THE characteristic features of the new volume of Thorpe's "Dictionary" are so similar to those of the preceding volumes that very little comment is possible. There has been a considerable expansion, from 572 to 791 pages, in the new edition, but this has been distributed with remarkable uniformity, and the reviewer has been unable to discover any striking novelties in the present volume, except that the 'article' on tetryl, which in the old edition was confined to the single word '= butyl,' now contains an account of an important auxiliary explosive. Articles on sodium, sulphur, sulphuric acid, synthetic drugs, and tartaric acid have been expanded considerably, but again mainly by interlining with new matter rather than by additions in bulk. It, therefore, only remains to express appreciation of the completion of what is presumably the penultimate volume of the "Dictionary."

Photochemical Reactions in Liquids and Gases: a General Discussion held by the Faraday Society, October 1925. Pp. 435-658. (London: Gurney and Jackson, 1926.) 15*s.* 6*d.* net.

WITH the natural growth of the experimental sciences, the gaps between physics and chemistry somewhat unexpectedly expand rather than contract. From time to time, however, from one side or the other, some new point of view is presented, and in a few years a large portion of this 'terra incognita' is explored and mapped out. In support of this thesis

may be mentioned the recent rapid advance in knowledge of the behaviour and properties of interfaces, a subject which until only some ten years ago appeared to be but a sterile flower cultured by pure physics.

The action of radiation in promoting chemical action has long been an interesting experimental field for chemists, but it cannot be said that much real knowledge has been reaped as a result of their labours. During the last few years, however, physical investigation has revealed certain apparently fundamental laws in the interaction between radiation and matter, and has given us a definite concept of the 'active' molecule postulated by Arrhenius. It is in the application of these laws to photochemical action that we may anticipate a revival of interest in photochemistry.

The Faraday Society has since its inception pursued the policy of promoting discussions, international in character, so as to obtain not only a record of the growth of these various physicochemical subjects, but also to apply the necessary stimulus of interest. The contents of this volume certainly fulfil these conditions. In it we find the signs of the revival of photochemistry, for nearly all the contributions deal with the mechanism rather than with the products of reactions. Whilst it is clear that certain reactions which are simple from the chemical point of view are in reality extremely complex, yet hope is offered from the fact that even complex chemical reactions may result from a series of physical actions which are capable of isolation and identification. It is also evident that a very close collaboration of physicist and chemist will be necessary to make real progress in photochemistry, and to prepare the way for the plant biologist. The Society is warmly to be congratulated for the success it has achieved.

E. K. R.

Practical Physiological Chemistry. By Sydney W. Cole. Seventh edition. Pp. xii+481. (Cambridge: W. Heffer and Sons, Ltd.; London: Simpkin, Marshall and Co., Ltd., 1926.) 16*s.* net.

THE fact that this well-known work has reached its seventh edition is its own recommendation. Its usefulness has been enhanced by the inclusion of accounts of electrical methods for the measurement of hydrogen ion concentration, and of chapters on biological oxidations and reductions and on the analysis of the blood. The work itself is more suitable for the advanced student and the research worker than for the ordinary medical student, though by judicious selection of material a course for the latter could be easily arranged. The directions for all practical exercises are given in very full detail, preceded in each case by a short theoretical account of the subject. Among the more recent additions, the following appear to be especially noteworthy: the description of the hydrogen and quinhydrone electrodes, the account of glutathione in the chapter on oxidations, and the description of the Hagedorn-Jensen method of estimating the sugar of the blood. The inclusion of a method may be considered as a guarantee of its trustworthiness, provided that the details are faithfully followed.

Practical and Applied Mathematics.

Advanced Calculus. By Prof. William F. Osgood. Pp. xvi+530. (New York: The Macmillan Co., 1925.) 25*s.* net.

PROF. OSGOOD has here given us a very valuable book on the calculus. It will be useful "not merely to the specialist in mathematics or physics," but "to all who would possess themselves of the calculus as a method for understanding . . . the quantitative relations which follow from the laws of Nature." There are excellent chapters, to mention only a few, on the general methods of integration, with multiple integrals and their transformation; elliptic integrals; vector analysis; the calculus of variations; and finally, a sketch of the theory of functions of a complex variable. The whole is treated with modern rigour and with special reference to physical applications, of which there are many. There are numerous examples for practice together with answers, and the book is excellently produced.

Advanced Calculus: a Course arranged with Special Reference to the Needs of Students of Applied Mathematics. By Prof. Frederick S. Woods. Pp. ix+397. (Boston, New York and London: Ginn and Co., 1926.) 21*s.* net.

THIS book has been written for those students who are "chiefly interested in the applications of the calculus," but are not "primarily concerned with theoretical questions." The author has, however, wisely included some essential theory not only to render the practical rules intelligible, but also "to introduce the students to theoretical questions and possibly to incite in some a desire for more thorough study." The work ranges from a discussion of elementary functions to partial differential equations, Bessel functions, the calculus of variations, and elliptic integrals. There is a good chapter on the functions of a complex variable, and the whole text throughout is well illustrated by practical examples.

Practical Mathematics. By A. Dakin. (Bell's Mathematical Series for Schools and Colleges.) Part 2. Pp. viii+363-629+xxv-xxxiv. (London: G. Bell and Sons, Ltd., 1926.) 4*s.* 6*d.*

MR. DAKIN'S useful little book completes a course specially planned to give practical students a sound knowledge of fundamentals. The treatment is designed to be of real educational value, and the judicious combination of experiment, deduction, and concrete application is a highly commendable feature.

Mechanics and Applied Mathematics: Statics—Dynamics—Hydrostatics. By W. D. Hills. Part 2: *Applied Mathematics.* Pp. xi+248. (London: University of London Press, Ltd., 1926.) 5*s.*

THIS volume completes the course, begun in Part 1, to cover the London Intermediate Science syllabus. The author has well carried out his aim "to temper theory and practice." The numerous worked examples are clearly explained and, with the text, excellently illustrated. The book should prove very useful.

Geometry.

(1) *Practical Geometry: based on the various Geometry Books by Godfrey and Siddons.* By A. W. Siddons and R. T. Hughes. Pp. x+264. (Cambridge: At the University Press, 1926.) 4*s*.

(2) *Theoretical Geometry: based on the various Geometry Books by Godfrey and Siddons.* By A. W. Siddons and R. T. Hughes. Pp. xvi+173. (Cambridge: At the University Press, 1926.) 3*s*.

THESE two books are intended to be used together in order to give a sound course in the methods of geometry.

In the practical geometry, intuition and experiment are skilfully employed to develop the power of intelligent inference.

In the volume on theoretical geometry, the Assistant Masters' Association's sequence of theorems has been followed, the object being to cover the requirements of the non-specialist. The whole treatment is so good that many teachers will regret the omission of the powerful method of limits in its application to tangency.

Analytic Geometry. By Prof. Maria M. Roberts and Prof. Julia T. Colpitts. Second edition. Pp. xii+261. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1926.) 9*s*. net.

THE courses given to students of engineering and science at the Iowa State College form the basis of this book, which embraces Cartesian geometry in two and three dimensions. Special emphasis is placed upon those portions of the subject essential to a working knowledge of the calculus. The treatment is lucid and practical, and there are numerous exercises designed to stimulate independent thought.

Miscellany.

Teaching Science in Schools. By John Brown. Pp. x+170. (London: University of London Press, Ltd., 1925.) 3*s*. 6*d*. net.

THE author of this small book is, as a critical onlooker in the rôle of a London County Council inspector of schools, eminently qualified in taking upon himself the task of a review of the present position of the teaching of science in schools. Much that he has to say is primarily the concern of the elementary-school teacher. Nevertheless, there is much that is common in aims and ideals and methods as between the elementary and the secondary school, and the teaching profession owes its thanks to Mr. Brown for a most valuable contribution to the literature of educational method.

A careful reading of his work impresses one vividly with a sane sense of balance. The swing-swang of the pendulum of method as between too much and too little formal laboratory work rightly has very little sympathy from the author. The pendulum must be damped down to its mean position. At the same time, we are bound to submit that there is no sign of an indifference to a rational realisation of the need for improvement on the part of teachers of science as a whole such as might be inferred to exist from a reading of this book. On the contrary, so far as secondary schools are concerned, there are few 'subject' organisations that compare either in vigour, effect, or for that matter in numerical strength, with, for example, the Science Masters' Association. Most of the points and submissions contained in Mr. Brown's book have been or are being thrashed out by the science teachers of to-day. Nevertheless, this in no way detracts from the value of a book that succeeds admirably in placing before the reader a résumé of the problems that confront teachers of science, and the lines along which a sound solution may be found. I. B. H.

The Journal of the Institute of Metals. Edited by G. Shaw Scott. Vol. 35, No. 1. Pp. xii+988. (London: The Institute of Metals, 1926.) 31*s*. 6*d*. net.

A SUBJECT which is assuming great importance in metallurgical discussions is that of 'creep' at high temperatures, and the new volume contains two papers on this topic. R. W. Bailey reviews the experimental evidence and supplies the first real attempt to provide an explanation, whilst H. J. Tapsell and J. Bradley contribute the results of experiments with an alloy of nickel and copper. The constitution of the alloys of silver and tin, which is of importance for the knowledge of dental alloys, has been determined satisfactorily by A. J. Murphy, previous determinations having been badly in error, and another careful alloy investigation is that of the aluminium-copper-tin alloys rich in copper, by D. Stockdale. W. Hume-Rothery makes a bold and ingenious attempt to apply the Bohr theory of the atom to intermetallic compounds, supporting his theoretical work by interesting experimental data. The speculations have given rise to much discussion, but chemists will follow with interest an effort to find some system in these peculiarly puzzling compounds. Among the more practical papers, a useful account of the die-casting of aluminium alloys, by G. Mortimer, may be mentioned. The May lecture this year was by Prof. Carpenter, who dealt with some of the properties of single crystals. The high standard reached by several of the contributors in their photomicrographs is to be noted with satisfaction. As usual, the volume contains a very extensive and exceptionally valuable collection of abstracts.

A Catalogue of British Scientific and Technical Books. Supplement, 1925. Arranged by Daphne Shaw. Pp. viii+166. (London: British Science Guild, 1926.) 2*s*. 6*d*. net.

BOOK catalogues intended to occupy a permanent place on the reference shelves of libraries must be kept closely up-to-date, if the hopes of their compilers are to be realised. We are, therefore, pleased to note that the British Science Guild has found the means to publish a supplement containing 2258 entries completing its useful Catalogue of 1925, and that it further proposes to print annual supplements early in each year if sufficient support is obtained for these issues. Though the change of system of publication from the class to the dictionary order of headings has advantages, the break in the continuity of system in a serial publication may be resented by its users. The present dictionary headings and references are also not up to the standard of modern library practice. The entries, however, which have been taken from the monthly lists in NATURE, are admirably full, and the allotment of entries to their respective headings is generally satisfactory.

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