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Freedom of Science and Learning

SO much has been said recently upon the subjects of academic freedom and intellectual liberty that there is a tendency for the terms to become catchwords, as in the much-used phrase "Poverty in the midst of plenty". If this were the main result of the reiteration of the principle that scientific inquiry can only develop to its full extent in an atmosphere of political freedom, it might reasonably be suggested that there has been too much talk about liberty but too little done to secure it. Fifty years ago, as Prof. Hogben reminded us in his Conway Memorial Lecture—"The Retreat from Reason"—T. H. Huxley, in an address on technical education, used the pregnant words "The great end of life is not knowledge but action"; and this principle may be applied very appropriately to the reaction that has resulted from a knowledge of conditions deliberately created to restrict scientific work to particular classes, and thus to destroy the international character of the pursuit of scientific truth.

The group of British scholars and scientific workers who, under the leadership of Lord Rutherford, formed the Academic Assistance Council in 1933 wished to defend the principles of university freedom by actions rather than words. As the Council's report*, which has recently been published, says, the Council has relied on the propaganda of practical achievement, not of protest or agitation. The achievement disclosed by the report is remarkable. Of the approximately 800 refugee University teachers from Germany, 465 are permanently re-established and 320 have been provided with temporary positions enabling them

to continue their scientific work. This work has been accomplished during a period of economic depression, which has weakened the absorptive capacities of the universities and increased national protectionist activities in the learned professions of all countries. The report emphasizes that the Council itself is directly responsible for only a part of this achievement; the Council is the institutional expression of a spontaneous activity in the university world to assist the displaced scholars. It is, therefore, the index of a great co-operative achievement by the free universities, the success of which, in contrast to the relatively unsatisfactory progress made towards a solution of the refugee problem in general, proves that it depends chiefly not on motives of compassion but on convictions that the principle of university freedom is involved, and is implicitly defended by assistance for the refugee scholars.

The report is a demonstration of how vigorous is the determination to defend liberty. The work in itself has strengthened that liberty. University teachers, co-operating in the work of academic assistance which the Council has kept consistently on a basis of political neutrality, and associating with the exiles who have suffered by the destruction of liberty, must have learned during the past four years to value more highly the practical advantages of their own freedom. Furthermore, the proof that in a crisis men of science can rely upon the moral and effective support of their colleagues in other countries must have increased that security which is a condition of freedom. It cannot be hoped that the leaders of intolerance and irrationalism will be deterred by the knowledge that their victims will be sheltered in the asylum of liberal countries; but we may hope that

* Third Report of the Academic Assistance Council (Society for the Protection of Science and Learning, 6 Gordon Square, London, W.C.1). Copies may be obtained gratis on application to the General Secretary of the Society.

their opponents will feel slightly more secure in their opposition, and we shall be spared a repetition of what still remains the most tragic feature of the German disaster, the absence of any stubborn resistance by the universities themselves to the restriction of their freedom.

The report makes it clear that university teachers in several countries will need all possible moral encouragement in face of the widening menace to the security of learning. Realizing this, the Academic Assistance Council has converted itself into a more permanent organization, the Society for the Protection of Science and Learning. The dismissal of university teachers in Germany on 'racial' grounds has seen two main phases—that after the original legislation of 1933 and that after the Nuremberg legislation in the autumn of 1935. Information in the last few weeks suggests that a third phase is beginning; for a considerable number of professors have recently been dismissed merely because they have Jewish wives. Parallel with the series of dismissals on 'racial' grounds there has been a continuing process of dismissals on grounds of 'political unreliability'. The law of January 21, 1935, providing for a 'fundamental reconstruction of the universities' has been used for arbitrary dismissals when the other regulations did not provide so convenient a pretext. The report gives details of the displacement of scholars in other countries on grounds of religious or political opinion; for example, in Italy, Portugal and the U.S.S.R., and of the beginnings of a refugee movement from Spain in consequence of the civil war. The Society considers that its services are even more necessary to-day than when the Academic Assistance Council was founded in May 1933.

It may be asked why Great Britain should take a leading part in this work of salvaging scholarship wrecked by the subjection of universities within the new authoritarian States, and whether the work is worth while. On grounds of principle, there can be little doubt that our tradition of toleration imposes on us a special responsibility, and that it is justifiable in defending principles to protect those who have been victimized by the non-recognition of those principles. Doubts arise, however, not on theoretical grounds but on practical considerations. The Society's report describes fully its methods of work and convincingly answers the possible criticism that the sheltering of the refugees in Great Britain has injured the interests of British university teachers by pointing out that its work

has "protected them from the injury that was threatened in the situation in 1933 when an army of wandering scholars invaded the university world, without guidance or directed distribution, and when no new financial resources were available with which the universities could meet the crisis". It is pointed out that, for the future, the efficiency of the work in re-establishing the scholars will make it necessary for almost all to be assisted to re-establishment in over-seas countries without even a period of sojourn here. We must keep a sense of proportion in this matter. There are 228 German *émigré* scholars in Great Britain, and it cannot be seriously claimed that they threaten the professional interests of the 6,000 British university teachers. During the past four years, the Council alone has added a sum of £65,000 to the resources of the universities, which has enabled them to bear the additional strain so unexpectedly imposed.

Hospitality is a two-way process, and it is evident how greatly the universities have profited from their guests. One of the German men of science who had found asylum in the United States was urgently invited by Herr Rust to return to Germany, where his ancestry would be forgiven because his services were required in the rearmament programme. He declined the invitation, expressing the hope that Herr Rust would succeed within ten years in benefiting the German universities as much as he had benefited the American universities within one year. It is rumoured that a certain institution not far from Cambridge has considered the advisability of erecting a tablet in gratitude for the benefactions bestowed on it by the results of the new National Socialist régime. The pages of NATURE itself almost each week show how much of the learning and talent that was threatened with extinction in Germany in 1933 has been preserved through the agency of bodies like this Society.

In the gloomy pages of the history of the German universities in the last four years, this work of the Society for the Protection of Science and Learning stands out in happy relief. The Council asks for continued support for its activities and hopes that many will associate themselves with the work by becoming members of the Society. Few subscriptions to societies can show such good profit as a guinea membership subscription to this Society, which is trying to protect science and learning.

Messianic Radiation

Star-Begotten :

a Biological Fantasia. By H. G. Wells. Pp. vii + 199. (London: Chatto and Windus, 1937.) 6s. net.

IT is always interesting to see what a scientific fact will look like after Mr. Wells's imagination has been let loose on it. The facts on which this book is based are that particles or photons of high energy provoke mutation, and that such particles and possibly photons are reaching our planet from outside. What if some intelligent extra-terrestrial beings, perhaps on Mars, are treating us as we treat *Drosophila*? If these beings are as benevolent as they are powerful, may we not expect that our mutations will be of a desirable character, and that the mutants will reform the world? So Mr. Wells's characters argue. Two thousand years ago Virgil was writing :

"Iam noua progenies coelo demittitur alto"; and it is widely believed that his prophecy was fulfilled. Wells predicts not a single saviour, but millions of messianic mutations.

It is worth while pointing out why such a theory, even if there were some evidence for it, would be unacceptable. First, as Wells himself remarks, the cosmic radiation is undirected. As a theme for his next story, I offer him the radiation of about 15 metres wave-length which Jansky found to be reaching our planet from the hub of the universe, or rather of our galaxy, in Sagittarius. Secondly, spontaneous mutation has a fairly high temperature coefficient, and therefore cannot well be due to radiation. Muller discovered this fact before he showed that X-rays are more effective than heat in provoking mutation. But radiations are news, and temperature coefficients are not, so the discovery is generally ignored. Finally, cosmic radiation obeys (if one may use such a word) the uncertainty principle, so even a superhuman marksman aiming at particular genes in human nuclei could scarcely expect much success. It is interesting that temperature fluctuations are equally uncontrollable, so that at present we have no method which promises anything better than a random provocation of mutations, most of which are harmful.

Why, we may ask, has our author chosen this particular theme? Many of my younger contemporaries, in Flecker's words,

"Take no more solace from the palm-girt Wells".

I think they are wrong. He still represents an

important tradition, he is a great stylist, and the workings of his mind are most instructive. "Star-begotten", like Stapledon's "Last and First Men" and "Odd John", but unlike his recent "Star-Maker", despairs of existing humanity, and demands beings of innate endowments superior to our own to deal with the present crisis of civilization, which it sketches in brilliant phrases. The author is obviously sceptical of the remedies which he and others have propounded. "Haven't all civilised men nowadays the feeling of being dilettantes on a sinking ship?" asks one of his characters. So with unconquered optimism he puts forward a panacea which he knows to be fantastic.

Some of the undercurrents of Wells's thought are indicative. He is strongly anti-communistic, but he cannot help being influenced by communist ideas. Thus he uses the word ideology, and on p. 165 we find a phrase about mad dogs which perhaps owes something to a speech of Vishinsky's at the first trial of Trotskyists in Moscow. Many of his phrases remain apposite if the letter 'x' is substituted for 't' in Martian. Making this substitution, we read "At the onset of a strange way of living we bristle like dogs at the sight of a strange animal. He hated these Marxians as soon as he thought of them. He could not imagine that their interference with our nice world could be anything but devastating". Another character is more tolerant. "And now these new creatures from outside, these creatures called Marxians, are coming on board our drifting system. With their hard clear minds, and their penetrating unrelenting questions stinging our darknesses as the stars sting the sky. Are they going to salvage us? Shall we let them if they can?"

Whether or not the Marxians have correctly diagnosed the cause of our present distresses, it is clear that evolutionary processes, either natural, or directed by terrestrial or celestial eugenicists, are most unlikely to end them. The time-scale of evolution is altogether longer than that of history; and we probably have not many years, let alone generations, to save our civilization from collapse. If this book encourages a single reader to think, even for one moment, that any natural or super-natural process will take the place of human effort and human thought, then it is a bad book. But if it is read as a record of conversations between rather worried intellectuals, it is not only an excellent piece of writing, but also a valuable historical document.

J. B. S. H.

The Dilemma of Contemporary Linguistics

Infant Speech: a Study of the Beginnings of Language

By M. M. Lewis. (International Library of Psychology, Philosophy and Scientific Method.) Pp. xii + 335. (London: Kegan Paul and Co., Ltd., 1936.) 12s. 6d. net.

MR. LEWIS introduces his excellent study of infant speech somewhat dramatically by reminding us how, exactly half a century ago, Max Müller's saying "No thoughts without words" left linguistic studies somewhat in the air. To some, the aphorism went too far; to others not far enough. For the psychologist it was going too far, for obviously symbolic thought without words does occur. Linguistically it did not go far enough, for words mean more than ideas, and in their most important function they are as much a form of human action as any type of bodily behaviour.

To-day, linguists are faced by a similar dilemma. Once we recognize with Mr. Lewis that "language is a form of activity, a mode of human behaviour, perhaps the most important" (p. 5), the question arises: Can we treat language as an independent subject of study? Is there a legitimate science of words alone, of phonetics, grammar and lexicography? Or must all study of speaking lead to sociological investigation, to the treatment of linguistics as a branch of the general science of culture? If the earliest and most fundamental function of speech is pragmatic—to direct, to control and to correlate human activities—then obviously no study of speech except within the "context of situation" is legitimate. The distinction between *language* and *speech*, still supported by such writers as Bühler and Gardiner, but dating back to De Saussure and Wegener, will have to be dropped. Language cannot remain an independent and self-contained subject of study, once we recognize that it is only the general norm of human speech activities. Finally, we shall have to decide whether, with some recent German psychologists, we have to assign three separate functions to speech: the expressive, the evocative, and the representative; or whether we must be satisfied with the admission that speech has only one main function, that of pragmatic control, of co-ordinating human action; while all the other manifold uses and aspects of language are derivative.

The dilemma of contemporary linguistics has important implications. It really means the

decision as to whether the science of language will become primarily an empirical study, carried out on living human beings within the context of their practical activities, or whether it will remain largely confined to deductive arguments, consisting of speculation based on written or printed evidence alone. The first view would insist on drawing the material of linguistics from the observation of infant speech, from the study of pathological phenomena in aphasia, from fieldwork on the actual use of language by the various strata of civilized society, and among so-called primitive peoples.

The grammarian and the lexicologist may have in future to abandon their comfortable, two-dimensional world of parchment and paper, and either go into the field, or else rely on material documented not only by words, but also by those aspects of human life, activity, and social organization by which the use of words is determined. The present reviewer, like most modern anthropologists, would plead for the empirical approach to linguistics, placing living speech in its actual context of situation as the main object of linguistic study.

Mr. Lewis is not too dogmatic in the excellent theoretical introduction to his book. He gives there an impartial summary of most modern theoretical work. He himself, however, takes the empirical view that "the main function of language in human life as the mediator between man and man" must be taken as the guiding principle in any linguistic inquiry.

A cavilling critic might note some omissions in his choice of authorities. The absence of any reference to the work of Philipp Wegener, one of the forerunners of the modern movement; or to the American psychologist, G. H. Mead, who perhaps was the first clearly to formulate the principles of pragmatic symbolism; the relatively small space given to the work of Jespersen and Piaget; and the omission of John Dewey's most important contribution, that is, of Chap. v in "Experience and Nature" (1925), might be remedied in a future edition. On one or two formal matters I should like to suggest also an amendment. Thus to state that "speech is an instrument, a tool" is not, as the author supposes, a useful simile, but, like all analogies, an unnecessary handicap. Speech, obviously, is not a tool, but a habit, a standardized type of activity of the human organism. It is, therefore, not to be classed with the material products of man, but rather with the other modes of active human adjustment to the

environment and to the mechanisms of culture. Again, Mr. Lewis speaks of "language as an institution". Whatever meaning be given the word 'institution', the label again brings language as a fixed product into the realm of material achievements and leads us away from the study of speech customs within the living context of human activities.

But these are minor criticisms, and they are found only in the theoretical preliminaries of Mr. Lewis's treatise. When he comes to work, and enters his empirical laboratory, all the minor misconceptions vanish. Throughout, he studies the child's speech habits within the circumstances in which they occur. He conducts, in fact, all his observations, in the only admissible manner: he investigates *speech* and not *language*; and investigates it, not as a detached, purely linguistic transfusion of meaning, but as a means of action on adults by the child and conversely the influence of speech and other activities of the grown-up on the child.

This makes the author recognize that to regard the child's spontaneous utterance as merely 'expressive' in its function is erroneous. In fact, through the whole range of the author's observation, the distinction between 'expressive', 'evocative' and 'representative' falls to the ground. Mr. Lewis's results show that the only correct treatment is to study the total situation: the vocal

act of the child, which is linked up with the circumstances; and the reactions of the adults which respond to the child's pre-linguistic activity. The meaning of such a vocal act can only be defined as the change produced by the child's utterance in mobilizing its social environment, and making the adults obey its wishes. Obviously, an utterance like this is at the same time expressive, in that it corresponds to the child's feelings of discomfort or anxiety; it is representative, in so far as it is linked up with the situation; and it is evocative in so far as it makes the elders respond to the child's utterance. "Throughout all this the child will tend to use his cries more and more as an aid to the rest of his behaviour, and even as a substitute for it. . . ." In other words, from the very beginning, the human being uses his voice in prearticulate and later on in an articulate sense, in order to achieve, through the assistance given him by others, what he cannot do through his own bodily activity.

The work of Mr. Lewis is in many ways a great advance on all previous experimental studies on child speech and a valuable contribution to the theory of language. In his use of older sources, he is judicious, critical and comprehensive. In the setting of his own observations, he has taken his inspiration from the most scientific, that is, the most empirical point of view in modern linguistics.

B. MALINOWSKI.

Elementary Chemistry and its Presentation

New Practical Chemistry:

Fundamental Principles applied to Modern Life. By Prof. Newton Henry Black and James Bryant Conant. Pp. xi+621. (New York: The Macmillan Co., 1936.) 7s. 6d.

New Laboratory Experiments in Practical Chemistry

To accompany Black and Conant's "New Practical Chemistry". By Prof. Newton Henry Black. Pp. x+193. (New York: The Macmillan Co., 1936.) 5s.

THESE are welcome and important additions to the large number of text-books which deal with the fundamental principles of chemistry and their mode of presentation. Anyone still unconvinced that a knowledge of the fundamental principles of an ever-expanding science and some of their applications may not be a part of a general education might do well to make a detailed study of

these books, one of the authors of which is a distinguished organic chemist, well known in Great Britain, and president of Harvard University.

Much difference of opinion exists among those occupied with the teaching of elementary chemistry concerning the method of presentation. Unlike the authors, some prefer to adhere, so far as possible, to a more or less historical method, and to leave any consideration of the developments of the subject during the last twenty-five or thirty years to a later stage of the student's training. This has the disadvantage that the student who does not continue the more detailed study of the science has little knowledge of the structure of the atom, by which the properties of the elements and the structure and properties of chemical compounds are more adequately explained.

The presentation of the fundamental theories and facts of chemistry by the authors is excellent. Perhaps, at times, it is too didactic, and formulæ

of compounds are stated before any description of the compounds is given. This might cause difficulties for the student who reads without the guidance of a teacher. But the books are not intended for home reading. Even the title of the larger volume, dealing with the more theoretical side of the subject, indicates that chemistry is a practical science, and the companion volume gives a comprehensive series of experiments to be carried out *pari passu* with the theoretical instruction. These not only include qualitative and quantitative exercises of the usual type prescribed for the beginner, but also experiments on soil testing, colloids, textile fibres, blue prints, dyeing, paints, food components of milk and identification of simple compounds. An elementary knowledge of such subjects might be frowned upon as being too technical to form part of general education; but it does provide possible stimuli on which later interest, whether for profit or leisure, may depend. It is no mean achievement to give such information without in any way sacrificing the accurate presentation of the essential facts and theories of chemistry.

It is rare to find elementary text-books so stimulating as these, and they would be unique if they were entirely free from faults. Some chemists would not agree with the authors'

explanation of the apparent dual valency of phosphorus, and perhaps many teachers would hesitate in the first year of a student's training to give so detailed an account of Bohr's theory of spectra. From the teacher's point of view, however, it is important to realize that the authors show it can be introduced without much difficulty.

The authors state that they have "enriched the treatment by exceeding the factual requirements of the College Examination Board". It is to be hoped that this is the case, because the books are so comprehensive in subject-matter. This ranges from the early history of the science to atomic structure, from the "New Periodic Law" to radio-activity and transmutation of the elements, and from coal and oil to dyes, paints and vitamins. All these are apparently to be studied in one year, and presumably the student takes other subjects besides chemistry. Perhaps American students, for whom the books are primarily written, work harder than British students. Even if the user of these books is merely a candidate for a college entrance examination, he is fortunate in having the fundamental theories and facts of chemistry and some of their applications presented to him in so fascinating a manner.

CHARLES S. GIBSON

Operational Symbolism in Mathematical Analysis

The Theory of Linear Operators :
from the Standpoint of Differential Equations of Infinite Order. By Harold T. Davis. (Monograph of the Waterman Institute of Indiana University, Contribution No. 72.) Pp. xiv + 628. (Bloomington, Ind.: The Principia Press; London: Williams and Norgate, Ltd., 1936.) 35s. net.

THE modern philosophy of physical science leans strongly to the view, so well expressed by a recent writer, that the concept is synonymous with the corresponding set of operations. The idea of mechanical imagery advocated by Lord Kelvin is thus being replaced by the notion of an operational process which accordingly presupposes the existence of a law of transformation. To mathematicians, this aspect has long been the subject of profound study, but not until comparatively recently has the idea permeated the theoretical domain of science.

The formal theory of operators is generally considered to have originated with Leibniz and Lagrange, whilst in Great Britain the subject was mainly stimulated by George Boole, who clarified

our fundamental ideas in both logic and mathematics. Then came the generatrix calculus which Laplace made the basic method of his "Théorie analytique des Probabilités". A further stage in the development of operational methods arose from researches in electrical communication, out of which came the once-spurned operational calculus of Oliver Heaviside, a self-taught mathematical man of science. Finally, Volterra and Fredholm laid the foundations of the theory of integral equations and, later, the calculus of forms in infinitely many variables out of which, from the modern study of the quantum mechanics and the properties of electrons, has sprung the matrix calculus.

These main divisions of the theory of operators are all discussed with some detail in Chap. i of the volume under review, which was written, as a result of considerable research, to provide an outline of the theory of linear operators and its manifold applications to general types of linear functional equations. The volume is published as a monograph of the Waterman Institute of Indiana University, and surveys the theory of linear

operators from the point of view of the theory of differential equations of infinite order.

The development centres round the generalized differential operator. Several chapters are devoted to the definition and properties of operators, namely, particular operators, operational multiplication and inversion, grades defined by special operators, etc. Some very interesting examples are given in this section illustrating the application of operational processes. These include such important problems as the development of the disturbing function in planetary motion involving Newcomb operators; the propagation of electromagnetic waves in which Silberstein's elegant operational solution is used, and finally the propagation of population by fission, to which the operational method of Rawles is applied. Chapters vi and vii are devoted to differential equations of infinite order with constant coefficients, and linear systems treated by the Heaviside calculus.

Illuminating chapters then follow on the Laplace type of equation of infinite order, in which

the coefficients are polynomials of bounded degree; the generalized Euler equation of infinite order; Fuchsian operators of infinite order, and the Volterra and Fredholm integral equations of infinite order, in which a full description of Lalesco's theory is given. The closing chapter is devoted to the theory of spectra and, after giving some important theorems on matrices concerning transformations, identities and Hermitian, the author proceeds to discuss the equivalence of the theories of quadratic forms and integral equations and, finally, some general considerations on the continuous spectra of quadratic forms.

Throughout the text, which is very clearly written, many applications to science have been indicated, and an extensive bibliography is provided at the end for further reading. Those interested in the subject will be grateful to have, within one cover, so complete an account of the new operational symbolism which has become one of the important methods of extending the domain of mathematical analysis.

F. G. W. B.

A Text-book of Aerodynamics

Elements of Practical Aerodynamics

By Prof. Bradley Jones. Pp. v + 398. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1936.) 18s. 6d. net.

AS the author claims in the preface, this is a student's text-book of American origin, and as such is an admirable exposition of the subject. It gives worked-out examples in the text and further examples for the student at the end of each division. This is a principle that has always been advocated by educationists, but seldom followed by writers of books on aeronautical subjects up to the present day.

The author states, apparently as a recommendation, that he has avoided the use of the calculus except upon two occasions. It is a little surprising to find fear of this branch of mathematics in any modern scientific book, more especially one expressly written for students, who surely must be beyond the study of such elements of it as would have been necessary in such a book before they even reach the stage of studying aerodynamics.

The first few chapters, dealing with the aerodynamics of the aeroplane, are extremely clear and lucid, but they should have been followed by

the chapters on stability, control, etc., so as to read as one continuous argument. One would like to have seen more on skin friction, laminar and turbulent flow, and such matters, treated as lucidly as the rest of the aerodynamics in these chapters.

The chapter on stability infers that lateral stability is less difficult a subject than longitudinal stability, a statement with which few aeroplane designers will agree. The mathematical consideration of it in theoretically undisturbed air may be, but this is only the introduction to the real practical problem with disturbed motion.

The second half of the book is made up of accurate, but quite inadequate, chapters on subjects such as materials, instruments, meteorology, 'avigation' (American for aerial navigation) and aerostatics. These are good, so far as they go, but are very elementary in character, and out of balance with the treatment of the subject-matter of the earlier chapters.

In general, this is a book that should appeal to students in Great Britain, to be taken as additional reading, giving a rather different American outlook on the subject. Now that we have adopted the same units as used in the United States, it will be less confusing to the beginner.

Death from the Skies:
a Study of Gas and Microbial Warfare. By Heinz Liepmann (with the scientific assistance of Dr. H. C. R. Simons.) Translated from the German by Eden and Cedar Paul. Pp. 286. (London: Martin Secker and Warburg, Ltd., 1937.) 6s. net.

THE author of this sensational book claims to have received information from certain authoritative sources which it would be inexpedient for him to acknowledge; but there seems to be nothing new in his disclosures, and all the probable war gases which he lists as "pre-eminently suitable" can be found in any of the books that have been published on this subject. He believes that "hundreds of millions" will perish from gas in the war that is to come. "Just a minute or two of a hideous struggle for air, and then death—lucky, perhaps, if it is over so quickly. In former days men condemned to death were at least given time for a prayer. Not these, not these. They groan, they scream, they suffocate, they die."

We hear again of the same old gas bomb which, falling in Piccadilly Circus, would destroy all life between Regent's Park and the Thames; and amongst the "authorities" on whom he depends he even includes an entry in a record of the German Patent Office. He comes to the conclusion "that there is no protection against poison gas. Anyone who says such protection is possible is a liar." Similarly, there is no defence against bacteria; and, should war break out within the next few months, Germany will wage bacterial warfare, and we may expect glass flasks filled with cultures and contaminated rats dropped from aircraft by means of small parachutes.

The author is mistaken in saying that the British General Headquarters undertook costly chemical experiments before the outbreak of the Great War in the expectation that poison gas would be used. He is also misinformed in supposing that no known gas mask can protect against blue cross gas; and quite wrong in describing the Chemical Warfare Research Committee as a joint Allied organization, and in stating that (the British) General Thuillier succeeded (the French) General Curmer as head of the French State Commission for Gas Service. His description of the present condition of Germany is quite the most interesting part of the book—"a poverty stricken and dangerous land, a focus of unrest for Europe, in imminent danger of exploding—the explosion being prevented only by a reign of terror unexampled in history". Hitler, he thinks, will inevitably embark on expansionist adventures, and a decisive struggle between Britain and Germany must occur.

C. H. F.

The Journal of the Institute of Metals
Vol. 59. Edited by G. Shaw Scott. Pp. 323+22 plates. (London: Institute of Metals, 1936.) 31s. 6d.

IN September last year, the Institute of Metals held its autumn meeting in Paris, and this volume includes the sixteen papers presented on that occasion, together with the Autumn Lecture on "The Scientific Organisation of Works" by Prof. Pierre Chevenard, scientific director of the Société de Commentry,

Fourchambault et Decazeville. This lecture is a remarkable and convincing account of the successful application of scientific methods throughout a large industrial concern.

A considerable proportion of the papers published in this volume deal with the alloys of aluminium; M. Gauthier describes the effect on the conductivity of super-purity aluminium of additions of those elements which may occur as impurities in commercial aluminium; Mr. N. D. Pullen presents an account of a new treatment for the production of reflecting surfaces on aluminium, while Prof. Portevin and Dr. Bastien treat the property of forgeability in a fundamental manner.

A lengthy paper by Atkinson and Raper provides up-to-date metallurgical information on the six metals of the platinum group, while Northcott discusses veining and sub-boundary structures in metals. Other papers deal with the creep of tin and tin alloys, fluxes for use in soldering, and the constitution of the alloys of cadmium and tin and of indium and lead.

Statistical Year Book, 1937, of the International Tin Research and Development Council
Pp. 206. (London: International Tin Research and Development Council, 1937.) 6s.

THE International Tin Research and Development Council has carried out a useful task in issuing a comprehensive statistical year book, which deals not only with production and trade but also with the varied aspects of consumption. The use of tin in the automobile industry on one hand (8 per cent of the total world consumption) and in the canning industry on the other (50 per cent of the total) are indications of the widespread importance of this key metal. In spite of this, the production is very localized and about 85 per cent of the output comes now under the control scheme. Of the total world output in 1936 of 179,600 long tons, Malaya produced 66,806; the Netherlands East Indies 31,546; Siam 12,678; Bolivia 24,074; Nigeria 9,529 and China 10,664 tons. The greatest consumer, the United States, had a home production (including Alaska) of 87 tons, and the great European users have similarly tiny supplies only.

L. D. S.

The Technology of Aluminium and its Light Alloys
By Prof. Dr. Alfred von Zeerleder. Translated from the second German edition into English by A. J. Field. Pp. x+301. (Amsterdam: Nordemann Publishing Co.; London: Crosby Lockwood and Son, Ltd., 1936.) 21s. net.

THE original German edition of this book was published in 1934, and a second edition was found necessary in less than twelve months. From this second edition Mr. Field has prepared the present translation, and has also brought the text rather more up to date. The book gives in condensed form the essentials of the working of aluminium and its alloys, the object being to bring home the merits and possibilities of aluminium to a wide circle of users and potential users. This purpose it fulfils admirably.

Greenland Culture. (2) The Eskimo*

THREE reports issued recently by the Commission for Scientific Research in Greenland deal with the culture of the Eskimo in East Greenland.

(1) *Kangerdlugssuak District*. An expedition of the Scoresby Sound Committee, of which Einar Mikkelsen was in charge and Magnus Degerbøl responsible for the archæological investigation, examined the coast from Cape Dalton to Kangerdlugssuak, an area of great interest, as it is situated between the Angmagssalik Settlement in the south and the former Eskimo area of settlement in north-eastern Greenland from Scoresby Sound northwards. Before 1932, this region had been traversed only by the Amdrup expedition of 1900, which found a number of deserted Eskimo habitations, graves, tent-rings, etc., at the mouth of Kangerdlugssuak, but no remains from Kangerdlugssuak to Scoresby Sound, nor north of Cape Dalton to Dunholm, where, however, Eskimo remains existed. The present expedition confirmed this result, and it was only at Miki's Fjord, a few kilometres east of Kangerdlugssuak, that it was possible to prove former habitation. An inference that Irminger's Fjord was once the site of a habitation has later (1935) been proved to be correct.

Miki's Fjord is well suited to habitation. Here a ridge runs north-south, with terraces sloping to the south. A firm rocky ledge affords room for movement and building, with easy access to the sea. The only drawback is an absence of fresh water. On this terrace were five sets of house ruins, at different levels, the lowest being the largest and best preserved, though there is reason to believe that the smaller were parts only of houses originally larger. All the houses, with one exception of indeterminate shape, were rectangular. The objects found in the houses were essentially of the same culture period, and belong to the Inugsuk culture. The number of skeletal remains found in the house, together with the secondarily formed small houses, suggests that the population did not emigrate, but perished in their homes, possibly from malnutrition due to a lack of vegetable food. Animal food was evidently plentiful.

* The Scoresby Sound Committee's 2nd East Greenland Expedition in 1932 to King Christian IX's Land—The Former Eskimo Habitation in the Kangerdlugssuak District, East Greenland. By Magnus Degerbøl. (Meddelelser om Grønland, Bind 104, Nr. 10.) Pp. 48 + 1 plate. 2.50 kr.

6 og 7 Thule-Expedition til Sydøstgrønland 1931-33—The Former Eskimo Settlements on Frederik VI's Coast. By Therkel Mathiassen. (Meddelelser om Grønland, Bind 109, Nr. 2.) Pp. 58. 2.50 kr.

The Eskimo Archaeology of Julianehaab District, with a Brief Summary of the Prehistory of the Greenlanders. By Therkel Mathiassen, in collaboration with Erik Holtved. (Meddelelser om Grønland, Bind 118, Nr. 1.) Pp. 141 + 4 plates. 7.00 kr. (København: C. A. Reitzels Forlag, 1936.)

The first article appeared in NATURE of July 10, p. 52.

A woman's grave found on a small headland is one of the largest grave finds in Greenland, and contains several objects not known from other finds. An entirely new element, not previously known in Eskimo culture, is eighty-four beads, small white circular disks of mussel shell, while a needle case containing two needles of walrus ivory is the first example of a bone sewing needle from Greenland. An explanation put forward by Th. Mathiassen of the distinctive character of certain of the cultural objects is that the length of occupation gave rise to independent development.

The character of the remains and deposits shows that the occupation was one of considerable length. Immigration probably took place at the end of the fifteenth, or beginning of the sixteenth, century; and occupation, it is thought, may have lasted until so late as the eighteenth century.

(2) *Frederik VI's Coast*. An expedition in 1931-33, of which Knud Rasmussen was leader, made a study of former Eskimo settlements on this coast between Prince Christian Sound on the south and Ikerssuaq, the boundary of the Angmagssalik district, on the north, with the purpose of determining the number and character of the Eskimo settlements which were known to exist, but of which exact information was lacking. As many settlements as possible were inspected, and a few excavations were made. From all sources, including those already in print, as well as from information received, three hundred and eighty-two settlements were recorded in eleven regions. In 1931 Erik Holtved excavated eleven house sites, producing seventy-two artefacts, and in 1932 Th. Mathiassen excavated twenty-one ruins, producing 526 specimens.

The house types fall into the following categories: (1) small, rounded, and much overgrown and flattened-out houses; (2) small, four-sided, partly flattened-out houses; (3) large, four-sided, partly overgrown houses; (4) houses known to have been inhabited in the nineteenth and twentieth centuries.

The most important site investigated was Ruinnæsset on Skjoldunge Fjord. Here Knud Rasmussen discovered a great house complex. From this site alone 329 specimens were obtained.

In regard to the character and succession of cultures, it would appear that the earliest house ruins on this coast are probably contemporaneous with the earliest houses in Angmagssalik, and belong to the end of the fourteenth, or beginning of the fifteenth, centuries. They are small, round,

and dug down into the ground, with poorly built walls, paved floors, sunk passages and often a cooking extension. Sometimes two or three are built together, forming a clover-leaf shaped complex. Their culture shows evidence of some whaling. There are no glass beads. The culture is of the same type as the Angmagssalik, and belongs to the Inugsuk culture.

The seventeenth-eighteenth century house, of which sixty small, and seventy-seven large, were seen, is distinctly four-sided. At first small; later, in the eighteenth century, it becomes the large common house, which seems to have been introduced by a migration from the west coast, reaching as far as Angmagssalik. Houses of this type were seen at fifty-one settlements. The culture is particularly well displayed in the finds from Ruin-næset. It is derived from the contemporary South-west Greenland culture, but with a special south-east coast stamp. This find is given a special character by the many drilled seal jaws.

Fifty-six houses on this coast are known to have been inhabited in the nineteenth century, or later. Records of this period were made on the voyage by W. A. Graah in 1829-30, when 536 Greenlanders lived here in summer. The movement to the west coast had already begun, the last southeasters moving to the southern part of the west coast in 1900. At the present time, it is visited occasionally only for sealing.

(3) *Julianehaab District.* In the course of an expedition sent out by the Commission in 1934 a comprehensive survey was made of the Julianehaab district, the most southerly part of Greenland's west coast, and its most fertile and thickly populated area. It forms a connecting link between East and West Greenland, and was the site of the principal Norse settlement. The main interest of the expedition was the investigation of early Eskimo settlement, of which very little systematic knowledge was previously available.

It is now known that there are two hundred and forty-six places in the district where there have been Eskimo winter settlements. Of these, one hundred and thirty were visited. Excavation was possible on four sites only. Here fifty-six house ruins, four hundred square metres of midden, and twenty-three graves were examined, producing 1,808 specimens and fifty-seven skeletons. The house types are an early group of round or rounded small houses, sometimes two or three built together with a common passage; two types of the seventeenth-eighteenth century, distinctive, rectangular with a high stone wall and a sunken passage at right angles to the house, large; but the later type small; and fourthly, the nineteenth century house, small, rectangular, with high stone and turf walls and a passage in prolongation of the

longitudinal axis, often with a bend and not sunken, and with a kitchen or storehouse as an offset in the angle. This last is the type now in use, though it is being displaced by wooden houses.

The conditions for the preservation of cultural objects in the Julianehaab district are adverse in the extreme, owing to the succession of frost and thaw and the percolation of water. As a result of this, most of the ruins contained no bones or wood.

In the houses of the earliest type, most of the objects are of the kind known from other sites in Greenland and belonging to the Inugsuk culture. Among the most interesting and important were the lamps, which by their varying form afford a guide to chronology. Those with wick-ledge or knobs are a characteristic type of the culture. A number of objects of Norse origin probably represent spoil from the houses of the Norse settlement, which were deserted when the settlement decayed soon after the first appearance of the Eskimo in 1379. The earliest Eskimo culture of the District may be dated as lying within the period 1350-1650. Early settlement was invariably, so far as observed, half-way up the fjords, the situation most favourable for ice hunting. The principal quarry, as shown by the bones from the sites, was the seal, but the caribou and the whale were of importance.

The finds of cultural objects from the seventeenth-eighteenth century houses do not differ essentially from finds from other parts of Greenland. Glass beads were found in most of the ruins, but in no great numbers. The principal varieties are the large opalescent, the large faceted—blue, yellow and colourless—a large black, a large rather flat dark blue, and a cylindrical bead, red with white longitudinal stripes. Although the culture as a whole compares with that of West Greenland, it has in its harpoon-heads, arrow-heads and lamps an older stamp, as indicative of an out-of-the-way situation. The same old-fashioned types are recognizable at Angmagssalik, the similarity appearing in a relatively large number of objects, such as salmon spear, fish hooks, pendants, etc. The animal bones show that sealing had been the principal occupation; but the inhabitants also hunted whales, caribou, white-whales, bears, foxes and fowl. In certain periods there have been many fish, especially cod. There is also a surprisingly large number of dog bones, but no proof of sledge traction.

The development of the kayak, and the consequent increased utilization of sea locomotion for hunting and fishing, led to a diffusion of settlement, the number of small settlements increasing markedly. In the following period of the nineteenth and twentieth centuries, however, the number of

small settlements declined, and large settlements again prevailed, in order that the population might be near the centres of commerce and industry, which grew up with European settlement. The introduction of wooden houses put a further check on the nomadic habits of the people.

The mummy caves at Querrortut were also investigated. Though much disordered by a previous party of archaeological investigation, remains of desiccated bodies were found, which may be attributed to interment and not to incarceration and death from starvation. The occurrence of grave goods points to the pagan period, and tentatively a sixteenth century date is assigned.

Summarizing his survey of prehistoric Eskimo culture in Greenland, Dr. Mathiassen reconstructs their ethnic history by attributing to them an origin in arctic Canada, whence they came about a thousand years ago, with whale-bone houses and the Thule culture, to settle in the Cape York District. Thence they passed southward over Melville Bay to northern West Greenland, where they remained for several hundred years, encountering the Norsemen travelling northward, and changing the Thule culture into the Inugsuk

culture. In the fourteenth century the growth of population forced them to seek new hunting fields. South Greenland was populated in the course of this century, the Norsemen being overrun. A group of Eskimo wandered around Cape Farewell to the east coast and far to the north along the coast. In the seventeenth century Polar Eskimo migrated north about Greenland and mixed with north-east Greenland's early population. Shortly afterwards, West Greenlanders reached Angmagssalik, while a small remnant of survivors from the first immigration to the east coast at Kangerdingssuaq died out, as also did the inhabitants of north-east Greenland. In West Greenland, however, the population grew rapidly, helped by Danish settlement; while at Cape York there was still a remnant of the old Thule Eskimo, helped by a new immigration from Baffinland.

On the general Eskimo problem, Dr. Mathiassen expresses the opinion that it cannot be solved in Greenland. He is, however, unable to accept K. Birket-Smith's Caribou Eskimo theory, which makes Eskimo culture a link in a circumpolar inland culture, first created in the central parts of arctic Canada. The Thule culture points to Alaska and possibly Siberia.

The Halle Academy, 1652-1937

THE Kaiserlich Deutsche Akademie der Naturforscher at Halle has recently celebrated the two hundred and fiftieth anniversary of the granting of its charter. In 1652, soon after the end of the Thirty Years' War, there was founded by four physicians, in the Reichsstadt of Schweinfurth, a scientific society under the name of *Academia Naturae Curiosorum*. The principal founder and first president, Johann Lorenz Bausch, had studied in Italy and become acquainted with the local academies of that day, and especially with the *Lyncæorum Academia*, now *Accademia Reale dei Lincei*; he was also influenced by the writings of Bacon of Verulam. In 1677 the Emperor Leopold I recognized the society as the Academy of the Holy Roman Empire, and ten years later the same prince bestowed upon it considerable privileges and the title of *Sacri Romani Imperii Academia Cæsareo-Leopoldina Naturæ Curiosorum*. Arms were granted, with the motto: "Nunquam otiosus"; the president and the editor of the ephemerides received golden chains of office; they and their successors became counts palatine of the Holy Roman Empire; as such they could legitimize bastards, confirm the liberation of

slaves and perform other legal functions. They could, moreover, confer the titles of doctor, licentiate, master and bachelor, in the faculties of medicine, philosophy and laws; they could even appoint poets laureate. The doctorates so conferred were to secure the same privileges as those given by the universities. The publications of the Academy were exempted from censorship and protected as to copyright.

The Academy has survived the Empire from which its privileges were derived; these privileges were never abolished, but their exercise fell into abeyance. So did the curious custom, recognized in the imperial charter of 1687, of giving 'symbolic' names to its members; thus the first president was known as Jason I, his successor as Argonauta I. Meetings also fell into abeyance, and the activities of the Academy became restricted to the publication of a scientific periodical and to the administration of its library and museum. The location of the latter at first changed with that of the president, until the Academy became definitely established at Halle. Its natural history collections have been dispersed, but its library remains rich in valuable periodicals, of which a recently

published catalogue enumerates some 3,650 items ("Verzeichnis der periodischen Schriften der Bibliothek der Kaiserlich Leopoldinisch-Carolinisch Deutschen Akademie der Naturforscher, Halle (Saale)", 1937). The most important work of the Leopoldine Academy has been the publication of a journal, *Miscellanea curiosa medico-physica Academicæ naturæ curiosorum sive Ephemerides Germanicæ*, started in 1670 and probably the oldest scientific periodical. In the eighteenth century this valuable journal changed its name to *Acta physico-medica* and then to *Nova acta*; in 1932 a new series, *Nova Acta Leopoldina*, was started.

Various scientific funds have been lost as the result of economic upheaval, but a bequest by Christian Andreas Cothenius, the physician of Frederick the Great, is still operative; in accordance with it, a medal is from time to time awarded for scientific research. A second medal and a research fund was more recently instituted in memory of Auguste Henri Forel, the biologist and sociologist.

It will be seen from the above account that in modern times the Cæsareo-Leopoldina has received no official protection, nor been subject to governmental control. It is one of the oldest of scientific societies; the Royal Society has indeed the older charter, the Lincei Academy the longer history, albeit not so continuous. The present year is the two hundred and fiftieth after the granting of privileges by Leopold I, and this anniversary was celebrated at Halle on May 28-30. The commemoration was attended by representatives of numerous universities, academies and societies, both German and foreign, who were welcomed in the aula of the University by Prof. E. Abder-

halden, the president of the Academy, who has done much to stimulate its activities. His opening address, a historical retrospect, was followed by official congratulations from the rector of the University and the mayor of the city. Then came brief speeches on behalf of the Royal Society of London, the Accademia delle Scienze of Bologna, the Accademia dei Lincei of Rome, the Academies of Vienna, Amsterdam, Copenhagen, Tokyo, the American Academy of Arts and Sciences, at Boston, the Kartell of the German Academies (Berlin, Göttingen, Munich, Leipzig, Heidelberg), etc. It was announced that a sum of 44,000 marks had been collected from numerous donors, to be used henceforth as a research fund.

A very noteworthy lecture was then delivered by Prof. Hans Spemann, of Freiburg, on his recent researches concerning the nature of animal development. Finally, the Cothenius medal, referred to above, was awarded to Profs. Dante de Blasi (Rome), Ostertag (Tübingen), Franz Volhard (Frankfurt), G. Barger (Edinburgh), Max le Blanc (Leipzig), Armin Tschermak-Seysenegg (Prague) and Eugen Fischer (Berlin). In the evening there was a banquet with a few speeches. Next day further lectures were given; there was an admirable performance of an operetta in the municipal theatre, and a pleasantly informal reception by the Oberbürgermeister; the third day, a Sunday, was devoted to an excursion in the country.

In connexion with this very successful celebration, there have been printed the above-quoted catalogue of periodicals in the Academy's library, and a well-illustrated *Festgabe* containing three historical essays and Prof. Spemann's lecture.

International Agreement for the Regulation of Whaling

THE International Agreement for the Regulation of Whaling, which was published on June 23, marks an important stage in the development of whaling regulation. It was the work of a conference at which eleven Governments interested in whaling participated. They met on May 24, and sat almost daily until June 8, when the Agreement was signed. The drastic nature of its provisions are eloquent of the practically world-wide conviction that whaling can be saved from collapse only if it is rationally regulated: while a note under the title "Final Act", which is appended to the Agreement, indicates that the possibility is recognized that actual restriction of

whaling effort may prove necessary if that end is to be achieved.

In the early stages of modern antarctic whaling, the scale on which destruction of the whale stock was wrought made the need of regulation apparent. The Falkland Islands Government, which controlled practically all antarctic land stations, gradually built up a system of regulations and—a feature not yet attempted for whaling as a whole, restriction of the number of whaling vessels—which, while provisional in character owing to lack of information, may be said to have proved adequate until the late 'twenties, when the building of ships capable of working up the whales

on the high seas took the main body of whaling into international waters. The Norwegian Whaling Law of 1929 imposed on Norwegian whaling the provisions of the Falklands regulations except limitation, and added the power to prohibit Norwegian whaling in tropical and subtropical waters.

The Geneva Convention of 1931 followed the lines of the Norwegian law, though without provision for closing areas to whaling. This convention expressed the maximum to which at the time general agreement could be secured. It was recognized that whaling, being mainly outside territorial waters, could be dealt with only by common action, and the inauguration of international treatment was the first object to be attained. The majority of whaling countries adhered to it, and put its provisions into force by legislation which, with the increase of knowledge, tended to go farther and to be more definite than the convention it implemented. Limitation of production was effected by agreements within the industry in several recent seasons: but from various causes these agreements became increasingly difficult to reach, and the International Conference accordingly became necessary.

Space will not permit of any detailed account of the measures taken so far, but it will be useful to summarize the position in the antarctic when the Conference opened, among the countries adhering to the Convention. Only baleen (whalebone) whales were dealt with. Among these Right whales (*Balæna glacialis*), the numbers of which had been reduced almost to disappearance, were protected completely. Protection of other species was partial. It was illegal to kill immature whales, or cow whales with calves, and lengths were laid down below which for the purposes of the regulation Blue (*Balænoptera musculus*) and Fin (*B. physalus*) whales were to be considered immature. The number of whales killed to afford a given quantity of oil was kept as low as possible by requiring the utmost practicable utilization of each carcass. The pay of gunners had not to depend merely on the number of whales shot. Full records had to be kept of the whales killed and the oil produced. Other provisions, such as the partial protection of the Humpback (*Megaptera nodosa*) in the Falkland Islands Dependencies, were to be found in certain cases.

The agreement now reached affords complete protection to the Grey whale, *Rhachianectes glaucus*, as well as to all Right whales. The lengths below which Blue and Fin whales may not be taken is advanced from 60 ft. to 70 ft. and from 50 ft. to 55 ft. respectively. The mean size of these species in the antarctic at first maturity was determined in the "Discovery" Investigations as

74 ft. 2 in. for male and 77 ft. 9 in. for female Blue whales, and 63 ft. 8 in. for male and 65 ft. 7 in. for female Fin whales. The new limit is thus a marked approach towards the actual mean size at maturity. For the first time, minimal size limits were laid down also for Humpback and Sperm whales (*Physeter catodon*); namely, 35 ft. in each case, this length having a similar relation to the size at first maturity of Humpback and male Sperm whales, according to the best available information and protecting female Sperm whales. Those familiar with the sizes of the whales taken in commercial operations will realize the large body of whales these limits will preserve to reproductive size. It may be noted also that the limits will apply to shore stations.

The seasons for whaling are restricted. Antarctic whaling, that is, whaling south of 40° S., will take place only from December 8 until March 7, though there is a short extension for next season only; and no shore station may operate for more than six months in the year.

Lastly, pelagic whaling is prohibited over enormous tracts of sea. The whole Atlantic and Indian Oceans north of lat. 40° S. are closed to it, as is an extensive equatorial belt of the Pacific. The objects of this provision are the protection of calving grounds and the prevention of the destruction of whales when in their least productive condition. It may be possible in the light of further information more narrowly to define these areas, but their present extent guarantees a valuable protection.

The requirements of furnishing statistics and the regulations as to the payment of gunners are as in the previous practice of Norway and Great Britain.

The Agreement is for the coming season only, but there is provision for its year-to-year extension. It has been signed for the Union of South Africa, the United States of America, the Commonwealth of Australia, Germany, the United Kingdom of Great Britain and Northern Ireland and the Dominions, etc., the Irish Free State, New Zealand and Norway. It is to be hoped that other States will adhere to the Agreement: in particular, the adhesion of Japan would make its operation almost world-wide. The "Final Act" appended to the Agreement shows that the possible desirability of changes and extensions of its terms is fully recognized, and it is recommended indeed that next year, after the experience of a season's working, another conference should be convened to consider the Agreement in these respects. A very welcome recommendation is that Governments should take powers to regulate the methods of killing whales. There is reason to think that this would be in the interests of both economic working and humanitarianism.

J. O. B.

Obituary Notices

The Marchese Marconi

THE death of the Marchese Marconi from heart failure on July 20 deprives us of one who had taken the leading part in the development of world-wide communication. It is difficult to exaggerate the importance of his discoveries and the great effects they will have on the future history of the world. For communication purposes, he took the lead in helping to abolish space; and it is to be hoped that this, in the course of time, may result in the abolition of differences in language and even limitations of race. When sound and television are perfected in broadcasting, the outcome of early experiments in radio, life will surely be made easier for the masses, and Marconi's name will be kept green for hastening the advent of this blessing to humanity.

The early history of a great inventor is instructive; and luckily we have many accounts of Marconi's early life. One of the most interesting is the book by R. N. Vyvyan, formerly engineer-in-chief to Marconi's, entitled "Wireless over Thirty Years". For many years, Vyvyan was in close personal touch with Marconi and took a leading part in the great transatlantic transmission experiments.

Guglielmo Marconi was born in Bologna on April 25, 1874, his father being an Italian country gentleman and his mother the daughter of Mr. Andrew Jamieson, of Daphne Castle, County Wexford, Ireland. He was the younger of two brothers and was privately educated at Bologna, Florence and Leghorn. He attended Prof. Rosa's lectures on physics and studied the works of Prof. Righi. He was familiar with researches that had been made on Hertzian waves. While still a student, he was firmly convinced that just as flashes of light can be used to send signals by means of a heliograph, so, in an analogous way, electric waves could be used for signalling.

Marconi's earliest experiments were made in 1894 before he was twenty-one years of age. He used an induction coil as a Hertz emitter, and, at first, used a ball discharger of the type designed by Righi. It consisted of four brass balls separated by small gaps, immersed in 'Vaseline' oil. He connected one terminal of the secondary of the induction coil to a metal cylinder elevated to the top of a pole, and the other to a metal plate laid in the ground. He thus produced an elevated aerial which discharged across the spark gap to earth. At the receiving end he erected a similar capacity at the top of a pole and connected it to earth through a Branly coherer. He improved the design of this coherer, making it much more sensitive than anything previously made. In 1895 he employed metal cubes, the length of an edge being one foot. With this apparatus he was successful in receiving signals up to a distance of thirty metres. Doubling the height of the poles to four metres, he found that he could transmit to a hundred metres

and quadrupling the height to eight metres, he transmitted to a distance of four hundred metres. He next increased the cubes so that their edges were about 3 ft. 3 in. in length. With this new aerial he was able to record Morse signals up to distances of about one and a half miles. He also tried the effect of concentrating the waves by means of large metal parabolic reflectors. This experiment was the forerunner of the beam aeriels which came into use in later days when short electric waves were proved to be practicable.

In 1896, Marconi came to England and took out a patent, the first ever given for radio-telegraphy. In July of that year, Mr. Campbell Swinton introduced Marconi to Sir William Preece, the engineer-in-chief of the British Post Office. Sir William gave him every facility to carry out his experiments and with the help of the Post Office engineers, his system was successfully operated between the General Post Office and the Thames Embankment. The attention of the general public to the importance of Marconi's experiments was first attracted by the experiments carried out on Salisbury Plain, where reception over a distance of eight miles was demonstrated in the presence of officials of the Navy, Army and Post Office. In June 1897, Sir William Preece, in a lecture to the Royal Institution on "Signalling through Space without Wires", said that "Marconi had produced from known means a new electric eye, more delicate than any known instrument, and a new system of telegraphy which will reach places hitherto inaccessible". He also said that for shipping and lighthouse purposes it was a great and valuable acquisition.

In 1897, 'The Wireless Telegraph and Signal Company, Ltd.' was formed to acquire Marconi's patents. Three years later, the name was changed to 'Marconi's Wireless Telegraph Co. Ltd.' Marconi's next step was to erect a station at Alum Bay and another in Bournemouth. For this communication system he elevated his aeriels to a height of about 120 feet and used a ten-inch spark induction coil. The Isle of Wight station was inspected by Lord Tennyson and Lord Kelvin, the latter paying for two radio messages. One of these, dated June 8, 1898, was to Sir William Preece at the G.P.O., London, and the other to Sir George Stokes.

In 1898, Prof. Slaby, of the Technical High School, at Charlottenburg, wrote an article on the 'new telegraphy' in the *Century* magazine. He pointed out that by a simple, but extraordinarily effective, method Marconi had raised the power of radiation a hundredfold. In collaboration with Count Arco, Prof. Slaby developed the Slaby-Arco system, but the German national wireless system—known as the Telefunken System—was not founded until 1903.

In May 1898, at the request of Lloyds' Corporation, apparatus was installed at Ballycastle and Rathlin Island in the north of Ireland. Uninterrupted

communication was obtained, the lighthouse keepers quickly learning how to use the apparatus. About this period, Marconi greatly increased the range of transmission by inserting the primary winding of a small air core transformer in the aerial, the secondary windings being split by a condenser, the outer ends being brought to the terminals of the coherer. These transformers were called 'jiggers', and their efficiency encouraged Marconi to attempt to communicate across the Channel. The French Government gave permission to erect a mast at Wimereux. A corresponding mast was erected at the South Foreland Lighthouse and Marconi successfully transmitted messages on March 27, 1899. The Wireless Co. had established their works at Chelmsford and had erected a mast 150 feet high. Communication was effected between this station and Wimereux—a distance of 85 miles.

In the year 1900, the technical staff that the Wireless Co. had collected numbered only seventeen. Among them were Eccles, Erskine Murray and Andrew Gray, who was afterwards manager. In 1899, Prof. (now Sir Ambrose) Fleming had been appointed scientific adviser to the Company. The rapid increase in the range of radio communications had convinced Marconi that the curvature of the earth presented no obstacle to the extension of radio communication, and he decided to attempt to telegraph by his system across the Atlantic. In consultation with Fleming it was decided that the station for the transatlantic experiments should be built on the west coast of Cornwall. The site chosen was at Poldhu, on the west coast of the Lizard. In 1900, Marconi obtained his very important patent for 'tuned or syntonized telegraphy'. He used this method in his attempts to send signals across the Atlantic. He erected a station similar to Poldhu at Cape Cod in Mass., U.S.A. Unfortunately, the masts and aerial at Poldhu were wrecked by a storm, and a similar mishap at Cape Cod threatened to delay seriously the experiments. To save time when the Poldhu station was restored he went to Newfoundland and used a balloon to support his aerial. But as this was blown away, he used a kite as the support which, with great difficulty owing to a storm, was kept at a height of about 400 feet. He cabled to Poldhu to begin the pre-arranged programme, consisting of sending the Morse letter S (3 dots in succession) from 3 p.m. to 6 p.m. each day. On December 12, 1901, both he and his assistant repeatedly heard in their telephone the three clicks which proved that the electric waves had traversed the 1,800 miles separating St. John's from Poldhu.

In 1902, the site of a power station was chosen at Glace Bay in Canada, and when completed Marconi left England for Canada in an Italian cruiser, arriving on October 31, 1902. During the whole voyage he was receiving from Poldhu in the night time, but in the daytime he heard nothing after the distance was greater than 500 miles. When transmission was started, the early results were very disappointing. Later on, a site for a new station was found at Clifden, Ireland, and aeriels were erected on a new principle Marconi had discovered. The Glace Bay

and Clifden stations were opened for unlimited public service in February 1908. During the Irish rebellion, the Clifden Station was put out of action and a new station at Caernarvon in Wales was used instead.

Prior to 1916 it was generally accepted that for long-distance transmission long waves were essential. But in 1916 Marconi began his wonderful experiments on short-wave transmission, the wave-lengths being only about a hundredth of those usually employed. Erecting a small transmitting station at Poldhu, and fitting a receiver to his yacht *Elettra*, he found in 1923 that with a wave-length of 92 metres excellent reception could be obtained up to about 1,200 miles. The outcome of his work was that the Government accepted the Marconi Company's proposals to use the short-wave beam system for Imperial communications and started building stations capable of working with Canada, South Africa, India and Australia. Later on, in 1931, Marconi turned his attention to the systematic investigation of waves only about one metre in length. Using these waves, a transmission system was put into successful operation between the Vatican City and the papal palace at Castel Gaudolfo.

To the end of his life Marconi retained the vigour of youth. His love for experimenting never waned, and he infected his colleagues with his enthusiasm. He worked hard and was very successful in applying his theories.

Marconi married in 1905 the Hon. Beatrice O'Brien, daughter of Lord Inchiquin, who had been lady-in-waiting to the Queen of Italy. The marriage was dissolved by decree granted at Fiume in 1924. In 1927 he married the Countess Bezzi-Scali of Rome. He had one son and two daughters by his first wife and one daughter by his second.

During his lifetime Marconi's achievements brought him many of the highest honours which nations can bestow. His name is a household word all over the world. The patience and equanimity with which he bore the disappointing results obtained by many of his early laborious experiments will be for all time an encouragement to young engineering physicists.

Dr. H. H. Jeffcott

HENRY HOMAN JEFFCOTT, who died on June 29, was born in Co. Donegal in the year 1877. In 1895 he entered Trinity College, Dublin, from the High School, Dublin, and had a very distinguished career there. In 1897 he obtained a senior exhibition at the final freshman examination, and in 1898 he was first mathematical scholar. In 1899 he graduated with a senior moderatorship in experimental science and a junior moderatorship in mathematics and a moderatorship prize. He spent the next year in London, and in 1900 returned to Trinity College and entered the Engineering School, where he obtained his engineering degree in 1902 with honours in all subjects. In the same year he won the McCullagh Prize for a treatise on the theory of elasticity.

Jeffcott spent the next few years in the shops of Armstrong Whitworth and Co., Ltd., and as assistant

engineer with Siemens Brothers, and in 1905 went to the National Physical Laboratory and there became head of the Metrology Department. In 1910 he returned to Dublin as professor of engineering in the Royal College of Science for Ireland. In 1914 he became Dean of the College. During the Great War years his department was organized most successfully for the manufacture of munitions. In 1922 he received the degree of doctor of science of the University of Dublin. From 1918 until 1921 he was secretary to the Water Power Resources of Ireland Sub-Committee and took an active part in collaboration with Sir John P. Griffith, past president of the Institution of Civil Engineers, in the preparation of a scheme for the development of the water-power of the River Liffey. This scheme, though put on one side while the power resources of the Shannon were being developed, is now beginning to take practical shape under the ægis of the Electricity Supply Board.

In 1922 Jeffcott left Dublin for London on his appointment as secretary to the Institution of Civil Engineers, which position he filled until his death. His charming manner endeared him alike to his staff and the members of the Institution. He was very approachable and welcomed members who called on him, especially those home from abroad. His business ability and tact combined to bring to a successful conclusion many important negotiations with Government departments and public authorities. The recent reorganization of the Institution's activities brought much work to Dr. Jeffcott which the state of his health made very onerous. His early death, on June 29 at the age of sixty years, will prove a severe loss to the Institution and an irreparable one to those who had the good fortune to be his friends.

Though of exceptionally fine physique—Jeffcott was well over six feet in height and broad in proportion—he never took an active part in the athletic life of his college, though he thoroughly enjoyed a good game of tennis.

Jeffcott achieved considerable success as an inventor, being best known in this connexion through the Jeffcott direct-reading tachometer. He was the author of papers on the vibrations of loaded shafts published in the *Proceedings of the Royal Society* and *Philosophical Magazine*, and of papers on water resources and other engineering subjects.

Miss Dorothy Sladden

By the tragic death of Miss Sladden in consequence of a motor accident on Saturday, June 20, a severe blow was struck at the science of experimental zoology. Miss Sladden was one of those rare people on whom Nature has bestowed an inborn love of animals and a marvellous skill amounting to genius in keeping them in good health and in inducing them to breed. She had not had a university education, but she was taken to the Imperial College by her parents as an occasional student, because they saw no other outlet for her peculiar abilities which had manifested themselves since she was quite a young girl.

After passing through the regular undergraduate course, at my suggestion Miss Sladden took up the question of the heritability of acquired habit and carried out with indomitable perseverance a series of experiments on this subject which extended over five years. She showed that the stick-insect (*Carausius morosus*) which is a native of southern India but which has been imported into Great Britain and is readily obtainable from dealers, could be induced by a series of periods of semi-starvation to accept a food (ivy) which was at first repugnant to it, and that the offspring of such insects accepted ivy more readily than did their parents, so that after five or six generations, 100 per cent of the insects accepted ivy at the first opportunity. In this species, males occur only at long intervals and the ordinary female is parthenogenetic, so that the complications involved in crossing different stocks are completely avoided. Two of her papers on this subject had already been published by the Royal Society, and a third in which she dealt successfully with objections which had been made to her first two papers, was nearly ready when a cruel fate snatched her away. Fortunately, this paper will be completed by our mutual friend, Mr. H. R. Hewer, who assisted and advised her in statistical matters.

It may be justly said that Miss Sladden has demonstrated beyond reasonable doubt that functional inheritance is a reality; and this is the cardinal question in zoology, indeed in all biology. Once this conviction has gone home, the whole course of evolution becomes clear and doctrines like the recapitulatory theory of evolution which have been fiercely fought over, follow as a matter of course. That functional inheritance must be true is a conclusion which had already been accepted by leading palæontologists and systematists in the British and other great museums, but the distaste for it felt by a certain modern school of biologists is so great that they refused to accept any but direct experimental evidence in its favour. This has now been provided by Miss Sladden, and it is a feat which will make her name live in the annals of zoology.

E. W. MACBRIDE.

WE regret to announce the following deaths:

Prof. E. B. Elliott, F.R.S., emeritus professor of pure mathematics in the University of Oxford, on July 21, aged eighty-six years.

Prof. W. T. Mather, professor of physics in the University of Texas, on June 14, aged seventy-two years.

Major Paul Murphy, formerly director of experiments, Chemical Warfare Station, Porton, on July 14.

Prof. S. C. B. Pennington, emeritus professor of agriculture in the University of Reading, on July 19, aged sixty-eight years.

Sir Charles E. Saunders, formerly Dominion cerealist, known for his work on the breeding of wheat in Canada, on July 25, aged seventy years.

Prof. Johannes Walther, emeritus professor of geology and palæontology in the University of Halle, on May 3, aged seventy-seven years.

News and Views

Sir Denison Ross, C.I.E.

THE retirement of Sir E. Denison Ross from the office of director of the School of Oriental Studies in the University of London, which he has held since the establishment of the School in 1916, has evoked numerous tributes of appreciation of his work as scholar and administrator, as well as of personal regard, which culminated at the dinner at which he was entertained as guest of honour on July 26. The fact that seven thousand students have passed through the School in the twenty-one years of its existence is sufficiently impressive, when it is remembered that before it came into being there were virtually no facilities for oriental studies in London; but these figures give only a very imperfect idea of the importance of the School as an Imperial asset. By adding Africa and its languages to the Orient in the stricter sense of the term, the School not only covers a broader field of scholarship than any other single institution of its kind, but it has also become a much valued, and indeed an essential agency in the training of officials, missionaries and others, whose life-work is, or will be, among the less advanced races of the Empire. This breadth of outlook and sense of public responsibility in the orientation of academic studies is largely due to the qualities and experience which Sir Denison Ross brought to the task of organizing and developing the work of the School. After a grounding in the study of oriental languages at Paris and Strasbourg, he travelled extensively in the Near, Middle and Far East, and acquired a knowledge of Asiatic languages and cultures no less extensive. This may be seen in his published works, which range from critical works of scholarship to appreciations of art and literature. Perhaps not the least scientifically interesting is a polyglot list of birds in Turki, Manchu and Chinese. No less important, however, than his gift of tongues was his educational and administrative experience during his thirteen years in Calcutta, which had proved and strengthened his ability to arouse enthusiasm for Oriental scholarship in others.

Prof. C. G. Cullis

AT the end of last year, Prof. C. G. Cullis retired from the chair of mining geology which he had held at the Imperial College of Science and Technology, London, since 1930. He became a student demonstrator in the Geological Department of the College so long ago as 1890, and was thus a member of the staff for nearly half a century, having been professor of mineralogy before he was appointed to the chair of mining geology. Prof. Cullis's former colleagues and students, many of whom are scattered over all parts of the world, recently assembled at the College to present an album to him containing their signatures, and to record their appreciation of his work and influence. In this tribute the subscribers say:

"Generations of students will ever remember Professor Cullis as the ideal university lecturer. To few is given the skill to expound with such grace and effect the great truths of geology. We know the labour that is necessary for the attainment of apparent ease and simplicity: and here we see an apt example of *ars est celare artem*. But not only as a teacher will his students remember him: as a wise friend and mentor he was always accessible, and expert alike in directing their studies and in helping them to find their feet in the great world outside the College." In addition to the album, a cheque for the balance of the fund subscribed was presented to Prof. Cullis and a handsome electric clock to Mrs. Cullis and him jointly. Prof. Cullis has presented the cheque to the Governing Body of the College, with the suggestion that the income accruing from it should be used for the benefit of the mining geology department or students at the discretion of the professors of geology and mining geology department with the rector. The Governors have accepted this gift, and have resolved that the name of Prof. Cullis should be associated with the fund.

The Promotion of Peace

A petition to His Majesty's Government has been signed by a large number of distinguished people urging the Government to seek to avert the calamity of war by promoting an international inquiry into the fundamental causes of rivalry and unrest among the nations. The petition urges His Majesty's Ministers to take the initiative in this matter by inviting all other fully self-governing States, Dominions or Colonies to combine with Great Britain on equal terms in setting up expert commissions to ascertain and report upon the basic facts in regard to such questions as access to raw materials, and world markets, colonial development and the problem of surplus populations, foreign loans and credits, trade restrictions and international exchange. The signatories affirm their belief that if Great Britain showed an earnest desire to solve these problems, with full and impartial consideration of all just claims, her example would encourage the establishment of confidence and good will among the peoples of the world.

THE signatories of this petition include many heads of universities and colleges, more than one hundred fellows of the Royal Society, nearly as many distinguished writers as well as the archbishops, bishops and other Church leaders, and a number of members of Parliament. Representatives, individuals of all parties and officials of a large number of important organizations of all kinds throughout the country, have added their signatures, indicating the remarkable and extensive support which a representative body of opinion is prepared to afford the British

Government in the role of world peace-maker. The action already taken by the League of Nations, and approved by the Government, in promoting an inquiry into raw materials is obviously in line with the wishes of the signatories. The first essential step is to establish the facts in these matters beyond dispute, and the wisdom and urgency of this step are the more obvious in view of the refusal of certain countries to participate. If, in spite of such refusal, the British Government resolutely persists in a search for some way of reconciling the conflicting claims of different countries, convincing proof will be afforded of Great Britain's desire to promote peace based on a foundation secure because it is just.

Belfast Meeting of the British Medical Association

THE British Medical Association held its one hundred and fifth annual meeting at Belfast last week under the presidency of Prof. R. J. Johnstone, professor of gynaecology in the Queen's University of Belfast. The main theme of his presidential address, entitled "Some Thoughts on Medical Education", was medical education, undergraduate and post-graduate. As a university teacher and member of the General Medical Council, Prof. Johnstone was able to speak with authority from practical experience. He said that the critic of medical education generally assumes that the teachers should, at the end of the five years curriculum, turn out the general practitioner as a finished product, and blames them if they do not do so, although no one expects a finished surgeon, anatomist or pathologist at the end of this period. The specialist must know almost everything about his subject, the general practitioner must know something about almost every medical subject, and the course the latter has to pursue cannot be less difficult than that needed by the former. Although clinical study must have a considerable place in the education of the undergraduate, it is a fallacy to consider that clinical training is the be-all and end-all of medical education. There must be an adequate background of human anatomy, physiology and pathology provided by medical education. Prof. Johnstone also alluded to the existence of dreary lectures and dull teachers, and suggested that courses of instruction in the art of lecturing might be instituted for those appointed to teaching posts.

Nutritional Requirements of Pregnancy

AT a joint meeting of the Sections of Obstetrics and Gynaecology and Nutrition, a discussion took place on the nutritional requirements of pregnancy. Sir Robert McCarrison said that the food essentials needed by the prospective mother are, in order of precedence: (1) milk and milk products; (2) whole or lightly milled cereals, particularly good wholemeal or standard bread, and oatmeal; (3) green and leafy vegetables; (4) root vegetables, particularly potatoes, carrots and onions; (5) fruit, including the tomato; (6) pulses; (7) eggs; (8) meat, including fish, fowl and glandular organs. To these should be added, in Great Britain, a daily teaspoonful dose of cod liver oil; a portion of yeast extract is a wise

precaution. Dame Louise McIlroy also stressed the value of fresh fruit and vegetables, herrings and wholemeal bread. She suggested that lessons and demonstrations in the preparation and storage of food might well form a part of the work of ante-natal clinics. Other speakers also emphasized the importance of an adequate supply of vitamins during pregnancy. The incidence of puerperal pyrexia seems to be diminished by these means.

Maiden Castle, Dorchester: Excavations in 1937

EXCAVATIONS have now been resumed at Maiden Castle, Dorchester, under the direction of Dr. R. E. Mortimer Wheeler and Colonel C. D. Drew on behalf of the Society of Antiquaries and the Dorset Natural History and Archaeological Society (*The Times*, July 26). Three areas are to be explored in the coming season. At the eastern entrance, the unexpected discoveries made last autumn towards the close of last season's work will be further examined. These earlier fortifications, partly of masonry and dating from the third century B.C., which were found beneath the earthworks screening the entrance, include two outer gateways, which with the inner gateway constitute a complex plan hitherto unknown in prehistoric fortifications. Outside these are areas in which iron was smelted and burials took place. The latter should afford further evidence of the physical characters of the inhabitants, who according to the skeletons found last year were of a small build. Within the fort, investigations will be directed firstly to the Neolithic trenches found last year near the temple, which may have been part of the inner defensive system of the Neolithic partial occupation of c. 2000 B.C.; and secondly to the original western entrance, which was found in December last, but was not then explored. This last is marked by a gap in the rampart, which shows the original western limit of the castle, and should reveal the plan of the earliest gateway known. The first important discovery of the season is that of approach roads diverging in a north-easterly and south-easterly direction, which were superseded and abandoned in the first century B.C. and are thus among the earliest metalled roads known in Britain.

Evidence of Early Man at Bethlehem

To the antiquities from Tell Duweir on view at the Wellcome Research Institution (see *NATURE*, July 17, p. 99) have been added, since the opening of the exhibition, finds from the Bethlehem Bone Beds, which are being excavated by the Wellcome Marston Archaeological Research Expedition to the Near East. The work of investigation is being carried out by Miss D. Bate and Miss E. Gardner. The great pit, from the clays of which these finds are derived, appears to be a swallow hole. Rock has been reached on two sides, while on the third side what appears to be only a thin sheet of sloping deposits remains; but until bottom has been reached the exact form cannot be determined. There are indications that the cavity may fork as deposits are followed further. Among the animal remains found in 1937, the most

striking is the hinder part of the carapace of a gigantic tortoise, together with some detached plates and a bone of the same species. By way of contrast is the fossilized bone of a diminutive species of tortoise. There are also shown part of the tooth of an elephant—the first identification of an elephant in Palestine was from this site—the upper cheek-teeth of a rhinoceros and evidence of a very small form of horse, new to the fauna of Bethlehem. Although there has not yet been opportunity to identify the species with certainty, the indications point to a probably Lower Pleistocene horizon, or even possibly Pliocene. With the animal remains are shown flints selected from a larger number which were found in the bone beds and associated with the fossil fauna. Of these, one is apparently a core, while the others are of characteristic Eolithic or pre-Palaeolithic forms. Both the character of the flaking and the forms would seem to place their human origin beyond question. Their association with the animal remains in a definite geological horizon constitutes them the earliest evidence of man's existence yet discovered in Palestine. The exhibition will close on August 7.

"Caves and Caving"

THE British Speleological Association, which met for its second annual conference at Bristol on July 23–26, may now be regarded as fully established. It has acquired Cragdale House, Settle, Yorks, for its headquarters—a 'shilling fund' to raise £500 has been initiated for its equipment by the women members—and it has issued the first number of a publication under the title "Caves and Caving" (1s., annual subscription 4s. 6d.), in which speleological studies will be treated scientifically, but in popular form. The first issue opens with Sir Arthur Keith's presidential address "History from Caves", delivered at Buxton last year, fronted by an excellent portrait of the author; Prof. L. S. Palmer follows with an account of the objects of the Association and its work up to the present, the latest undertaking to which he refers being the systematic study of the aquatic fauna to be found in cave streams; Mr. E. Simpson reviews the life-work in speleology of the veteran, M. E. A. Martel, honorary member of the British Speleological Association, and honorary president of the Spéléo Club de France at its foundation in 1930. Mr. A. Leslie Armstrong counsels caution in "Cave Exploration as a Science"; and Dr. Franco Anelli gives an account of the recent descent into La Preta Cavern in the Lessini Mountains of the Veronese, Italy, the deepest known cave in the world, when a depth of 637 metres (approximately 2,090 ft.) was reached. At the recent field meeting of the British Speleological Association at Gaping Ghyll Hole, Ingleborough, Yorks, 356 descents were made and half a mile of new passages were explored. This is Britain's largest cave. The history of its exploration is reviewed by Mr. E. Simpson in a contribution, to be continued. Among other articles is a first instalment of the extremely valuable record of cave finds, arranged under caves, which is being compiled through inquiry by Dr. Wilfrid Jackson.

It will, when complete, show the present location, museum or other, of all animal remains and artefacts of archaeological interest found in British caves, so far as can be ascertained.

New Penguin-breeding Record at Edinburgh

THE Scottish National Zoological Park at Edinburgh has long been famous for its penguins—not only for their number and variety and fine condition but also for the manner in which they have bred there. The king penguin bred first in the Park eighteen years ago, and since that time fifteen king penguin chicks have been bred and reared. The ringed penguin and the rockhopper penguin both bred in the Park two years ago. These were the first occasions on which these three species have bred in Britain, and probably the first time they have bred in captivity anywhere. The latest achievement of this kind is the breeding of the gentoo penguin. The gentoo penguin comes next in size to the king penguin. While the king penguin makes no nest but holds its single egg on its feet during incubation, and the rockhopper penguin and ringed penguin make a rough nest of a heap of pebbles, the gentoo penguin prefers something softer, and collects dead grass, twigs and small sticks which it shapes into a symmetrical nest. It was nearly two months after the beginning of the nest building that the first egg was laid, and a second egg was laid five days after the first. Both parents shared in the work of incubation, and took their turns fairly regularly. The first egg hatched after an incubation period of five weeks and four days, but the second was infertile. The chick has a nestling coat of pale grey on the back and white underneath, and it was observed to feed on the day it hatched. It feeds, as do all 'baby' penguins, by taking partially digested fish from the throat of the parent bird.

Acquisitions at the British Museum (Natural History)

MR. J. L. CHAWORTH-MUSTERS has presented to the Department of Zoology 82 birds belonging to 31 species, and a few field mice, which he collected in the High Atlas Mountains, above Marakesh, in the early part of the year. Included among the birds are examples of the rare crimson-winged finch, an alpine accentor, and local forms of the dipper and shore lark. The Entomological Department has received a welcome gift in the letter-book of Dru Drury, a famous collector and describer of insects (1725–1803). He was a goldsmith living in London who had correspondents in Asia, Africa, America, and Australia. This book contains copies, in his own hand, of letters written by him to his friends, his collectors, and his business connexions during the years 1761–1780, and gives a valuable insight into entomological proceedings during that period. Accompanying this volume, and similarly presented by Mr. Charles Dru Drury, are a copy of the auctioneer's catalogue of Dru Drury's collection (1801), and a small collection of letters addressed to him by Carl Linné the younger, by A. R. Lewin (from Australia), and by other well-known contemporary naturalists.

Accessions in the Department of Geology include a collection of nearly 200 fossil fruits and seeds from the Cromer forest bed, all described and figured by Mrs. E. M. Reid and her late husband Dr. Clement Reid, and now generously presented by Mrs. Reid. The Trustees approved the purchase for the Department of Minerals of a nugget of well-crystallized iridosmine (osmiridium), weighing nearly an ounce, from Adamsfield near the source of the Derwent in Tasmania. There is a larger nugget already in the collection weighing nearly two ounces and reputed to be the second largest nugget of pure iridosmine, but it is less well crystallized than the specimen now acquired. Other important purchases are a slice weighing 1,387 grammes of a rare type of meteorite—a pallasite—from Springwater, Saskatchewan, a fine aurichalcite from Utah, and a fine group of laumontite and a large crystal of adularia from northern Italy.

Televisor, Telegraphy, Telephone

THE word 'Televisor' was coined by Mr. J. L. Baird in 1925 to describe apparatus for television and was registered by him as a trade mark. On account, however, of the general adoption of the word in the United States and elsewhere to denote any kind of television apparatus, Baird Television, Ltd., has decided to abandon its registration as a trade mark, so that in future there will be no restriction upon the use of the word in connexion with television. 'Televisor' may thus be used in future as freely as 'telegraph' and 'telephone'. The word telegraph was first applied by Chappe in France, in 1792, to his invention of the semaphore system of transmitting messages to a distance; and the word telephone was used by Sudré in 1828 for a system of signalling by musical sounds. It was employed in 1844 to describe a powerful wind instrument to convey signals at sea during foggy weather. Philipp Reis, in 1861, called his ingenious instrument a telephone, so that he may be regarded as the inventor of the name of the modern instrument. Alexander Graham Bell adopted the word in 1876 for his "Electrical Speaking Telephone".

The Earl's Court Exhibition Centre

THE new Earl's Court Exhibition building, erected on the site of its predecessor, is approaching completion. It will be the largest permanent exhibition and sports centre in the British Isles. The site covers approximately twenty acres, the new buildings enclosing nine acres. The main arena is unique, as it is the largest concrete building in the country. There are no less than six electric railway tracks running underneath the site of this exhibition. These tracks were covered in by tunnels or bridged without interrupting the railway services. The main hall itself is 250 feet by 350 feet without columns, and has seating accommodation for about 25,000 people. A swimming pool having a capacity of 2½ million gallons of water is provided. An account is given in the *Electrical Times* of July 1 of the problems connected with the heating and lighting of the exhibition. Complete designs and estimates were

got out for all reasonable methods of doing this. The first step taken was to prepare designs and costs for a complete generating power station for the Exhibition and alternatively to use boiler-house plant for heating purposes. This was compared with possible tariffs obtained from the Fulham Power Station for an electric service for lighting power and complete heating of the building by electric thermal storage. The estimates were considered by the Company and its consultants, the conclusion being that electricity for all purposes was the best scheme. The Fulham Borough Council has undertaken to carry out the complete installation of all the electrical plant and services required up to the point of low-tension distribution together with the electric thermal storage plant, and the work is now on the point of completion. A permanent form of fire-fighting equipment is installed at every substation. The heating of the whole of the building is carried out by an electric thermal storage hot water plant which is much the largest plant of this kind in the British Isles.

History of Alchemy

THERE are welcome signs of an awakening interest in the history of science, the study of which has until recently received surprisingly little recognition among the increasing body of scientific workers in Great Britain. The appearance last year of *Annals of Science*, a quarterly journal devoted to the history of post-Renaissance science in general, has been quickly followed by another publication entitled *Ambix*, which is to deal with the specialized study of alchemy and early chemistry. *Ambix* is, indeed, the official journal of the newly founded Society for the Study of Alchemy and Early Chemistry. The first issue is dated May 1937; the second number will appear in November 1937; and thereafter it will be published as a quarterly. At first sight, the subject may appear too restricted to afford material for a quarterly periodical, but this impression is corrected by supplementary glances at Sir Robert Mond's introduction and the later contents of this issue. "Alchemy," writes Sir Robert, "records not only Man's groping for the truth and for the enrichment of his experiences, but at the same time the widening of the Human Mind and the accompanying evolution of thought."

ANOTHER point of view is presented by Prof. J. Ruska in his contribution on "Methods of Research in the History of Chemistry". Here he states that "we continually need new texts, we need summaries of contents, translations and commentaries . . . we need also the application of the keenest critical methods." *Ambix* has already begun to supply material of this kind. Thus, Prof. J. R. Partington contributes a fully documented article entitled "Albertus Magnus on Alchemy"; Dr. F. Sherwood Taylor, the editor, writes upon "The Origins of Greek Alchemy"; Mr. Gerard Heym opens a useful "Introduction to the Bibliography of Alchemy", and also discusses the "*Aurea Catena Homeri*". There are,

in addition, a report of a discussion upon chemical and alchemical symbolism; a translation of "The Visions of Zosimos", by Dr. Taylor; and reviews of four recent books, including notably Prof. Partington's "Origins and Development of Applied Chemistry" and Prof. J. Read's "Prelude to Chemistry". The nature of these two works, differing so widely in scope and treatment, conveys some idea of the ambit of *Ambix*.

Public Health in British India during 1934

THE annual report of the Public Health Commissioner with the Government of India (vol. 1), recently issued, surveys the vital statistics, public health and public health services of British India for the year 1934 (Government of India Press, New Delhi, 1936. Rs. 6 As. 2, or 10s.). The mid-year population is estimated to be 275,753,570, the births were 9,288,897, a rate per 1,000 of 34, and the deaths numbered 6,856,244, a rate per 1,000 of 25. The infant mortality per 1,000 live births was 187. Of the causes of death, malaria heads the list with 1,319,026 deaths, and this figure does not include the mortality caused indirectly by malaria. Deaths from respiratory diseases numbered 483,018, those from dysentery and diarrhoea 285,110 and from cholera 199,708. Smallpox, with 83,928 deaths, caused a greater mortality than plague, with 80,131 deaths. At the Research Institute, Kasauli, a number of cases of snake-bite have been treated with anti-venomous serum with a high percentage of recoveries—25 out of 29 cases of cobra bite, and 12 out of 13 cases of bite by Russell's viper. Lieut.-Colonel Jolly, the Commissioner, believes that the intensive public health propaganda carried out during the last ten or twelve years is beginning to bear fruit, and that interest is increasing in such matters as rural reconstruction, nutrition, child welfare and the prevention of epidemics.

Examinations in the United States

EXAMINATION, as a teacher's tool, has undergone remarkable modification in the past sixteen years in the United States. The search for an instrument of precision for the use of teachers in examining their pupils has engaged the ingenuity of a host of investigators, and the resultant devices, the true-false, the completion, the matching, the multiple-choice, the one-word, the problem and other objective-type tests have, to a large extent, supplanted the essay test. The United States Office of Education has recently issued a report (Bulletin 9/1936, Washington: Supt. of Documents. 10 cents) on testing practices of secondary school teachers of 1,600 schools, as described by themselves. It appears that, when constructing tests, about seventy-four per cent of them make use principally of the objective type, only sixteen per cent rely chiefly on the essay test and ten per cent make equal use of both. The report shows that the new style of tests is popular with teachers. Their simplicity appeals to them. But it is clear that their employment calls for watchful control. A principal advantage claimed for them—that a large

number of items can be answered in a short time and the subject-matter can thus be the more thoroughly sampled—has been unrealized in many cases through not using a sufficient number of questions. Of intelligence tests, the report says that few teachers really use the results.

The Swiss Earthquake Service

THE Swiss Seismological Commission, afterwards the Swiss Earthquake Service, is the oldest committee engaged in the study of earthquakes. For its foundation in 1878, we are indebted to the veteran geologist, Prof. Albert Heim. Two years later, it was followed by the British Association Committee on earthquakes in Japan, which, on Prof. Milne's return to Great Britain in 1895, enlarged its scope as the Seismological Committee. In 1883, shortly after the destructive Ischian earthquake of July 28, a geodynamic section was added to the Central Meteorological Office at Rome, which still carries on its useful work of studying Italian and other earthquakes; and, in 1892, the Imperial Earthquake Investigation Committee began its similar, but more extensive, work in Japan. The Swiss Committee, under the direction of Dr. E. Wanner, has recently issued its *Jahresbericht* for 1935, containing three valuable tables, the first on earthquakes sensible in Switzerland, twenty-seven in number, none of which reached destructive intensity; the second, of eighty earthquakes with origins as a rule less than three hundred miles distant; and the third, of a hundred and fifty earthquakes recorded at the five Swiss stations (Zurich, Chur, Neuchâtel, Basel and Sion), the distances of the origins being not less than six hundred miles.

Discussion on Lubrication and Lubricants

THE Council of the Institution of Mechanical Engineers, with the co-operation of other societies and institutions, has decided to hold a general discussion on lubrication and lubricants on October 13-15, when a series of some 140 papers from leading authorities throughout the world will be presented. The opportunity will be taken to review the present state of knowledge by means of a general discussion among those especially interested and qualified to discuss the major problems of the subject, with objects such as to endeavour to establish a correlation between theory and practice and to show how bearing design can be applied, to relate academic research with trade practice, to obtain current views upon bearing metals, and to review the significance of laboratory tests, including wear and friction tests. An exhibition will be held at the Science Museum, South Kensington, to illustrate the subjects under discussion, and will be devoted to lubricants, bearings and bearing materials, as well as to testing and other apparatus. The exhibition will be open for a fortnight from October 13. Support for the discussion has been given by twenty-nine British societies and technical institutions and by ten over-seas societies and technical bodies. The complete proceedings will be issued as a bound volume. Advance copies of the papers will be available for use at the meetings.

Application forms for tickets of admission and for copies of papers, and further information about the discussion may be obtained from the Secretary, Institution of Mechanical Engineers, Storey's Gate, St. James's Park, London, S.W.1.

A Naked-eye Group of Sunspots

A VERY large group of sunspots, that is likely to develop into the largest group so far recorded during the present eleven-year cycle, came into view at the sun's east limb on July 22 in latitude 31° N. The date of central meridian passage is July 28.5; on August 4, the group will reach the sun's west limb. The group comprises a large leader spot and a follower of composite structure; these, with companion spots, covered no less than 2,000 millionths of the sun's hemisphere on July 24. On July 26 (the date of this report) the two chief component spots could be distinguished separately with the naked eye.

The Night Sky in August

THE moon is new on August 6 at 12.6^h and full on August 22^h at 0.8^h U.T. Conjunction with the planet Venus occurs on August 3 at 9^h, and from the northern part of England and in Scotland an occultation can be seen (see NATURE, July 17, p. 103). On August 18 at 23^h, there is a conjunction with Jupiter, and on August 24 at 20^h a conjunction with Saturn. On August 30, the moon occults the 5th magnitude star, α Tauri, the re-appearance at Greenwich taking place at 3^h 20^m at position angle 314° from the moon's north point. From sunset until sunrise during August, four bright planets are visible. Mars sets before midnight; Jupiter is on the meridian at 21^h in the middle of the month, followed by Saturn at 23^h; whilst Venus rises at about 1^h and is a brilliant object in the early morning skies, passing between Procyon and Castor and Pollux towards the end of the month. Uranus is nearly stationary in Aries and may be picked out from the background of stars of similar magnitude (about 6^m) with the help of the map given on p. 57 of the B.A.A. Handbook. At about 21^h the constellations on the meridian offer almost unlimited scope for interesting 'sweeps', which should include double stars such as α Herculis, θ Serpentis, β Cygni, γ Delphini and δ Cephei. The latter star is a notable short-period variable giving its name to a class of variable which, recognizable in the nearer extra-galactic nebulae, enables the distances of these remote systems to be determined. Of the nebulae and star clusters to be viewed with binoculars or a small telescope, the 'ring' nebula in Lyra, the 'dumb-bell' nebula in Vulpecula and the star cluster in Hercules should be easily located by means of a star atlas. The general outline of the Milky Way may also be studied with binoculars, noting the bifurcation near the bright star, Deneb, and the star clouds near the southern horizon. It may be recalled that towards a point at R.A. 18^h 4^m: Dec. $+31^\circ$ the solar system is moving into space with a speed of 12 miles a second. Between August 10 and 12, in particular, the sky may be watched for meteors of the Perseid stream. An ephemeris for the comet

Grigg-Skjellerup is given on p. 32 of the B.A.A. Handbook and also one for the comet Encke, which may possibly be picked up before long on its return to perihelion due next December. The periodicity of this comet, only 3.3 years—the shortest known period for a comet—was first recognized by Encke in 1819.

Announcements

The Earl of Rothes has accepted the appointment of chairman of the governors of Faraday House Electrical Engineering College, in succession to the late Lord Castletown.

DR. L. J. SPENCER, formerly keeper of minerals in the British Museum, has been elected a corresponding member of the Société Géologique de Belgique.

PROF. L. J. WITTS, professor of medicine in the University of London and physician to St. Bartholomew's Hospital and Prof. G. E. Gask, emeritus professor of surgery in the University of London, have been appointed members of the Medical Research Council, in succession to Sir Thomas Lewis and Sir David P. D. Wilkie, who retire on September 30.

THE Trustees have appointed Dr. S. Ochoa of the University of Madrid as Ray Lankester investigator for 1937, and Dr. Ochoa began his researches at the Marine Biological Association's laboratory in Plymouth on July 1, his subject being the experimental relationship of structure to environment in fishes and other animals. This work is a continuation of previous researches at Madrid and Heidelberg on the same subject.

THE first International Congress of Medical Public Health Officers organized by the syndicate of French medical hygienists under the auspices of the Health Section of the League of Nations will be held in Paris on October 20–21 under the presidency of Prof. J. Pariset. Further information can be obtained from Voyages Duchein-Exprinter, 26 Avenue de l'Opéra, Paris 1e.

THE twenty-ninth Annual Autumn Meeting of the Institute of Metals will be held at Sheffield on September 6–9. On September 6, Dr. D. R. Pye, deputy director of scientific research, Air Ministry, will deliver the sixteenth Autumn Lecture entitled, "Metallurgy and the Aero Engine". Further information can be obtained from the Secretary, Institute of Metals, 36 Victoria Street, London, S.W.1.

THE fourteenth annual conference of the Association of Special Libraries and Information Bureaux (ASLIB) will be held at Gonville and Caius College, Cambridge, on September 24–27, under the presidency of Sir Harry Lindsay, director of the Imperial Institute, who will give an address on "The Interrelation between Science, Agriculture and Industry". Further information can be obtained from the General Secretary, ASLIB, 31, Museum Street, London, W.C.1.

Letters to the Editor

The Editor does not hold himself responsible for opinions expressed by his correspondents. He cannot undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. No notice is taken of anonymous communications.

NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 200.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Some New Types of Pleochroic Haloes

EXAMINATION of a large number of biotite specimens from all parts of the world by my students and myself¹ has shown the existence of six distinct types of pleochroic haloes. Two of these, the common type due to uranium and the rarer thorium type, arise from parent radioactive elements of such long periods that α -rays are still being emitted and the darkening of the ring structure is still progressing in these haloes. The remaining four types appear to arise from parents of such short periods that all activity must have long since ceased. The first two types may be referred to as 'active' haloes and the last four as 'extinct' haloes.

To avoid premature implications as to their origin, the extinct types will be designated as *A*, *B*, *C* and *D*. The *A* type is similar to that described by Joly² as "emanation haloes". Types *B*, *C* and *D* are believed to be new. A photomicrograph of a *C* type halo is shown as an example in Fig. 1.

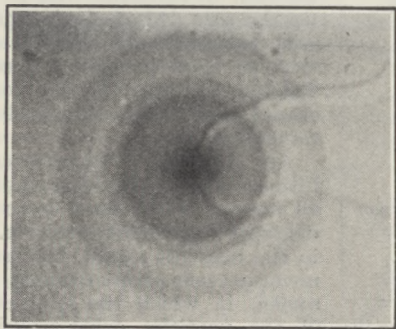


Fig. 1.

The *A* type has one ring, *B* has two rings, *C* three rings and *D* one ring. Certain subsidiary rings, mainly due to the actinium family, are occasionally found. The results of measurements of ring radii with the halo photometer are shown in the accompanying table.

Type	Ring radius in microns	Associated α -particle	Number in group
<i>A</i>	19.80	Po	62
<i>B</i>	34.49	RaC'	24
	20.00	Po	24
<i>C</i>	34.59	RaC'	23
	24.03	RaA	25
	19.85	Po	21
<i>D</i>	16.21	Ra	26

In the third column is shown the α -particle, the range of which agrees with the ring radius within the limit of experimental error and which appears to be the most probable parent of the halo ring in question. The fourth column shows the number of rings actually measured on the photometer records of a limited number of very good haloes mounted on slides and sorted out as to type by visual inspection.

It is to be noted that all six types of haloes may be accounted for by known radioactive elements, and that the ring radii appear to be constant in haloes contained in minerals of all geological ages.

The extinct haloes are fairly common, except type *D*, which is rather rare. All have been observed in more than one biotite specimen. Compound haloes are also found which are due to the superposition of two extinct types, notably *A* and *C*. Extinct haloes are often found arranged along irregular lines the course of which has little relation to the crystal directions. Often a distinct narrow channel is visible, which passes through the centres of the haloes and is sometimes surrounded by a faintly darkened tubulation the radius of which is that of the haloes.

It seems clear that an explanation of the mode of formation of these new types of haloes lies in hydrothermal action, but a detailed consideration is beyond the scope of this letter. A full account of these haloes and a discussion of the mechanism of their formation will be given shortly elsewhere.

G. H. HENDERSON.

Dalhousie University,
Halifax, N.S.
June 12.

¹ *Proc. Roy. Soc., A*, **145**, 563, 582 (1934); **153**, 199 (1937).

² *Phil. Trans.*, **217**, 51 (1917).

Colchicine, 'Phytocarcinomata' and Plant Hormones

COLCHICINE has been shown to produce a bulbous hypertrophy of the root tips and coleoptile of wheat seedlings¹. In these swellings, the appearance of the mitotic figures closely resembles those found in certain organs of animals treated with colchicine, and also in malignant tumours of animals^{2,3}. In this respect, the action of colchicine appears to be similar to that of *B. tumefaciens*, which causes the 'phyto-carcinomata'. On the other hand, A. P. Dustin⁴, Amoroso⁵ and Peyron *et al.*⁶ have claimed that colchicine inhibits the growth of malignant tumours in animals.

I have tested the effect of colchicine on the growth of tumours in plants by the following method. Seventy tomato plants (var. Kondyne red), grown in pots, were inoculated on the same day, with a virulent strain of *B. tumefaciens*, five inoculations being made on the main stem of each plant. The plants were then divided into five groups. One group was used as a control; colchicine was tested on another

group; and the other three groups were used for experiments that I shall mention later.

Colchicine in a 1:10,000 aqueous solution was introduced through a cut in the stem, by a method I have previously described⁷. On the average, 2.5 mgm. of the substance was absorbed by each plant during the period March 18–May 14, 1937. The accompanying table shows that the effect of this treatment was an inhibition of the growth of the tumours in the inoculated plants.

The other three groups of plants were used in control experiments, designed to test the possibility that hormonal changes in plants influence the growth of plant tumours. An attempt was made to influence the plant hormones by the following three methods:

(1) I excluded light from the terminal buds of one group of plants by capping them with a black cloth⁸, on the grounds that the influence of light on the elaboration and circulation of growth hormones in plants is well known.

(2) In another group I removed the flowers, because this also influences the elaboration and circulation of plant hormones.

(3) I administered palmitic acid to the last group of plants, because palmitic acid, administered to animals simultaneously with sex hormones, increases the effect of the hormones⁹. The substance was administered to the plants in two successive doses of 10 ml. of a 5:1,000 solution per plant, and the solution was poured directly on to the soil. The experiments were carried out in ordinary greenhouse conditions (the greenhouse was generously put at my disposal by Madame A. Fester, of Antwerp).

Number of plants	15	10	10	5	30
Treatment	Colchicine	Capped terminal buds	Flowers removed	Palmitic acid	Control
Average weight of tumours per plant	1.173 gm.	1.345 gm.	2.083 gm.	1.510 gm.	3.406 gm.
Average weight of one tumour	0.211 gm.	0.206 gm.	0.277 gm.	0.228 gm.	0.444 gm.
Average number of tumours per plant	5.53	6.50	7.50	6.60	6.85

The table shows that all these three types of treatment produced inhibition of the growth of the plant tumours, and it is therefore suggested that inhibition was produced by a hormonal alteration. The possibility therefore cannot be excluded that colchicine inhibits the growth of plant tumours in a similar way, namely, through the intervention of the plant hormones.

LÁSZLÓ HAVAS.

Institute of Pathological Anatomy,
University, Brussels.
June 20.

¹ Havas, L., *NATURE*, **139**, 371 (Feb. 27, 1937).

² Dustin, A. P., Havas, L., and Lits, F., *Réunion Assoc. Anatomistes, Marseille*, 1937.

³ Dustin, A. P., *Arch. port. sci. biol.*, **5**, 38 (1936).

⁴ Dustin, A. P., *Bull. Acad. roy. méd. de Belgique*, **14**, 487 (1934).

⁵ Amoroso, E. C., *NATURE*, **135**, 266 (Feb. 16, 1935).

⁶ Peyron, A., Lafay and Kobozieff, *Bull. ass. fr. p. étude du Cancer*, **25**, 874 (Déc., 1936).

⁷ Havas, L., *C. R. Ile Congrès intern. lutte sci. contre Cancer, Bruxelles*, 1936.

⁸ Zimmerman, P. W., and Hitchcock, E., *Con. Boyce Thompson Inst.*, **8**, 311 (1936).

⁹ Miescher, K. A., Wettstein, and Tschopp, E., *Schweiz. med. Wochenschr.*, **66**, 1, 310 (1936).

Interaction of Nuclear Particles

FOLLOWING the results of scattering experiments, the hypothesis is now generally favoured¹ that the interaction forces in nuclei do not depend on the charge of the particles concerned. Then the general interaction potential for two particles 1 and 2, either of which may be a proton or a neutron, can be expressed as:

$$U_{12} = [W + \frac{1}{2}B\{1 + (\sigma_1\sigma_2)\} - \frac{1}{2}H\{1 + (\tau_1\tau_2)\} - \frac{1}{4}M\{1 + (\sigma_1\sigma_2)\}\{1 + (\tau_1\tau_2)\}]J(r_{12}) \quad (1)$$

Here σ_i is the spin vector of the particle i and τ_i the formally analogous "isotopic spin vector"²; τ_{iz} has the value +1, if i is a proton, and -1, if i is a neutron; W , B , H and M are four constants. From (1) we obtain $(W + B + H + M)J(r)$ as the potential in the ground state of the deuteron. If $J(r)$ is correspondingly normalized we may put:

$$W + B + H + M = 1 \quad (2)$$

The value of the energy of the singlet state, as derived from scattering experiments, is then accounted for very closely if we put:

$$W - B - H + M = \frac{1}{2} \quad (3)$$

Other relations between the four constants may be obtained from the consideration of heavy nuclei. As Breit and Feenberg³ first showed, the fact that heavy nuclei with extremely large binding energies do not exist is explained if we put:

$$a_1 = 4W + 2B - 2H - M \leq 0 \quad (i)$$

Further, since heavy nuclei of zero charge are experimentally unknown, we must have

$$a_2 = 2W + B - 2H - M \leq 0 \quad (ii)$$

Further considerations by Volz⁴ led him to conclude that a_1 is very nearly zero (which is in agreement with the results of Inglis⁵), and also that a_3 is very nearly equal to 0. Taking $a_1 = a_2 = 0$, the four constants were then completely determined by Volz.

An additional requirement has hitherto apparently been overlooked: all known nuclei show a very large degree of spin-neutralization. Even in the heaviest nuclei, the total spin never exceeds about $10(h/4\pi)$. Heavy nuclei, in which the spin moments

of practically all the particles are parallel, must certainly be unstable. This leads to another condition, namely,

$$a_3 = 2W + 2B - H - M \leq 0 \quad (iii)$$

This inequality can immediately be deduced by analogy with (ii). One has only to note that (1) is invariant if σ , B and τ , $-H$ are interchanged.

Condition (iii) is not satisfied by the values of the four constants derived by Volz. The assumptions $a_1 = a_2 = a_3 = 0$ lead to equal energies for the triplet and the singlet states of the deuteron, in definite disagreement with experiment. One can satisfy all three conditions (i–iii) only by taking $a_1 \leq -\frac{1}{4}$. The limiting value $-\frac{1}{4}$ is, however, outside the limits for a_1 inferred by Volz. A negative value for a_1 would not give better agreement.

Note added in proof.

The manuscript of this note was sent to Dr. Volz, who kindly pointed out that the value $a_2 = -\frac{1}{4}$ may be considered as just within the limits of his

estimate. Dr. Volz, however, agrees that the values of the force constants calculated under the assumption $a_1 = a_2 = 0$ are shown by the above considerations to be improbable; the choice $a_1 = a_3 = 0$ should be more accurate.

N. KEMMER

(Beit Scientific Research Fellow).

Imperial College of Science and Technology,

London, S.W.7.

June 18.

¹ Breit, Condon and Present, *Phys. Rev.*, **50**, 825 (1936).

² Cassen and Condon, *Phys. Rev.*, **50**, 846 (1936).

³ Breit and Feenberg, *Phys. Rev.*, **50**, 850 (1936).

⁴ Volz, *Z. Phys.*, **105**, 537 (1937).

⁵ Inglis, *Phys. Rev.*, **51**, 531 (1937).

Infra-red Spectrum and Molecular Structure of Diketopiperazine and Tetramethyldiketopiperazine

SANBORN¹ has concluded from her work on the chemical properties of glycine anhydride (diketopiperazine), that the molecule exists only in the enol-form (I). In view of the importance of the diketopiperazine configuration for the knowledge of the structure of the proteins, it seemed not without interest to look for further means of investigating the molecular structure of this substance. A very suitable method is the analysis of the infra-red spectrum. The absorption bands of diketopiperazine and its tetramethyl derivative were therefore observed with a quartz spectrometer in the region 2.8-3.6 μ . The effective slit-width was 0.02 μ . Each substance was deposited from a suspension in alcohol or ether, respectively, as a crystalline layer on the quartz window of an absorption cell. Following a suggestion of Dr. W. T. Astbury, the cell was then dried *in vacuo* over phosphorus pentoxide for 38 hours, so as to eliminate all traces of water which might have been adsorbed on the surface of the crystals. The cell was kept dry with phosphorus pentoxide throughout the course of the experiments.

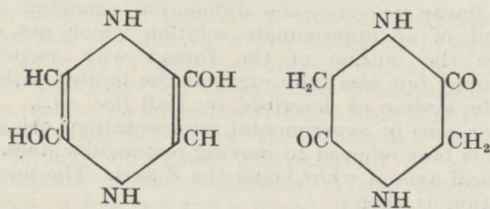


Fig. 1.

The results are given in the accompanying table. The accuracy of the wave-length measurements is $\pm 0.003 \mu$.

ABSORPTION BANDS OF DIKETOPIPERAZINE AND TETRAMETHYLDI-KETOPIPERAZINE

Diketopiperazine (λ in μ)	Tetramethyl- diketopip. (λ in μ)	Assignment of bands to vibra- tions of molecular groups
2.928) 2.953 f	2.964) 2.983 f	Valence vibration of C=O groups, first overtone.
3.008	3.013	Valence vibration of N-H groups, fundamental.
3.478) 3.525 f	3.480) 3.538) 3.569)	Valence vibrations of -CH ₂ (column 1) and -CH ₃ (column 2) groups, fundamental.

The assignment of the bands to the molecular groups given in the table may be understood by

reference to the formulæ, of which I shows the enol-form and II the keto-form of diketopiperazine. The presence of an O—H linkage, required by the former structure, would give a band in the region 2.87-2.97 μ , and =CH vibrations at 3.20-3.30 μ should also appear. (If the O—H group were linked to a C—C instead of a C=C valence, as has been suggested, a band at 3.03 μ would appear instead of that at 2.87-2.97 μ .) With the carefully dried specimen, however, no trace could be found of either the =CH vibrations or of a band at 3.03 μ , so that the bands at 2.928-2.953 μ cannot be ascribed to an O—H vibration associated with the enol-form. They are accordingly assigned to the first overtone of the C=O group, which is consistent with the keto-form of the compound. Additional evidence for this form is the presence of -CH bands between 3.4 μ and 3.6 μ , which shows that the diketopiperazine molecule cannot possess any double bonds between carbon atoms. Furthermore, the similarity of the spectrum of the tetramethyl derivative (where no possibility of a keto-enol tautomerism exists) with the spectrum of diketopiperazine confirms the conclusion that in the crystalline state the diketopiperazine occurs in the keto-form (II), free from mixture with the enol-form. It should be remarked, however, that the observations do not preclude the possibility that a certain amount of each substance exists in the lactim-form, in which the hydrogen is linked with the C=O groups instead of with the nitrogen atoms. The result of this transformation is a double bond between the nitrogen atoms and the carbon of the C(OH) groups. It is clear, however, from the occurrence of the NH bands, that the diketopiperazine and the tetramethyl derivative cannot be wholly in this form. A full account of the experiments and a detailed interpretation of the observed bands will be published elsewhere.

I am very much indebted to Prof. A. C. Chibnall and Dr. W. T. Astbury for providing me with the diketopiperazine and the tetramethyldiketopiperazine.

LOTTE KELLNER.

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Science and Technology,
London, S.W.7.

June 22.

¹ Sanborn, *J. phys. Chem.*, **36**, 1799 (1932).

Radioactive Isotopes of Element 43

PROF. E. O. LAWRENCE, of the University of California, gave us a plate of molybdenum which had been irradiated with deuterons in the Berkeley cyclotron. The plate showed a strong radioactivity due to more than one body. The half-value periods are of the order of magnitude of some months. A chemical investigation of the activity ruled out any radioactive isotopes of zirconium, niobium, molybdenum or ruthenium, and shows most probably that the activity is due to isotopes of atomic number 43 (masurium of I. and W. Noddack).

Since the chemical properties of this element are practically unknown, we investigated the activity in order to collect some information on the chemistry of 43. This element bears the closest resemblance to rhenium, and shows the same reactions as rhenium with sulphuretted hydrogen, nitron, etc., but it can be separated from rhenium by the method used by Geilmann and Weibke¹ for the separation of molybdenum and rhenium.

We wish to express our thanks to the Radiation Laboratory of the University of California for the gift of molybdenum. A more detailed account will be published in the *Rend. Lincei*.

C. PERRIER.
E. SEGRÈ.

Royal University,
Palermo.
June 13.

*Geilmann and Webke, *Z. anorg. allgem. Chemie*, **193**, 120 (1931).

Optical Rotatory Power of Turbid Solutions in an Electric Field

IN a previous note in this journal¹, A. McLean and I published the results of some experiments on the rotation of the plane of polarization of organic compounds dissolved in various solvents under the action of an electric field. These measurements were continued, and the results published in the *Philosophical Magazine*² by J. Kunz and P. H. Babcock.

For some solutions the results could be repeated, but for other solutions the curves obtained were very complicated and could not be repeated, so that the explanation of the phenomenon given became doubtful. These measurements were continued, and we found that the solution of methylester in benzene showed a slight turbidity, due probably to a suspension of naphthalic anhydride; indeed the carefully filtered solution gave no effect, even under the action of alternating fields so high as 15,000 volts per centimetre. Therefore, either some type of compensation is present in this particular solution (such as opposite effects on solvent and ester), or the magnitude of rotation does not depend so much upon the electrical structure as was first assumed. As in the present experiment, the expected effect was not observed, the dipole induced in the given fields may be too small.

When it was found that the rotation was due to a suspension, experiments were carried out using finely grounded calcite, quartz, iron oxide (Fe_2O_3), china clay, sodium chloride, etc., all of which gave an effect. The calcite suspension in benzene was one of particular interest, since it gave rotations from zero to 15° ; in some cases a maximum rotation of 5° was observed at about 3,000 volts per centimetre; then the rotation decreased with increasing fields, reached a minimum and began to increase again. When the field decreased, the curve was either above or below the branch obtained by increasing fields. These features depended upon the platinum electrodes in the polarimeter tube, which were too flexible and were moved upon application of the higher voltages. The difference in the two paths is due to settling or to mixing. The tube was reconstructed by supporting the electrodes in three places, and then the rotation reached a constant value at comparatively low fields.

The optical activity of suspensions is well known; it has received much attention by French and German physicists and chemists³.

J. KUNZ.
R. G. LABAW.

University of Illinois,
Urbana, Illinois.
June 5.

¹ NATURE, **136**, 795 (1935).

² *Phil. Mag.*, (7), **22**, 616 (October 1936).

³ See, for example, Stefan Procopiu, *Ann. Phys.*, **1**, 213 (1924).

WE have been investigating the effect described by Prof. Kunz and R. G. Labaw, first in conjunction with McLean, who, however, had to leave it to take up other work. Although the solutions were apparently quite clear and free from obvious particles, we were led to suspect in some cases that the result might be due to very minute crystals in suspension in the liquid; we have also heard from Prof. Kunz that he has come to the same conclusion. Very careful filtration through selected filter papers removes the optical activity. The conclusion is, then, that the effect is due to dichroism induced in the particles by the electric field, a phenomenon not entirely new, although its accurate quantitative investigation is beset by numerous difficulties.

E. B. LUDLAM.
A. W. PRYDE.
H. GORDON RULE.

Chemistry Department,
University, Edinburgh.
June 16.

Air-drag and the Equilibrium of Whirling Threads

IN the absence of all resistance to motion and assuming perfect flexibility, the differential equations of motion for a thread which carries a small spherical 'bob' and is whirled rapidly about a vertical axis by a horizontal arm give us an approximate solution for small amplitudes a plane sine wave—with reference to moving axes—leading to the well-known formula for plane vibrations¹. This approximate solution throws no light whatever on the stability of whirling threads as observed experimentally in air: these threads show 'necks' of appreciable amplitude in place of point nodes, the necks increasing in diameter the farther they are from the 'bob'. With sufficiently long threads and a large radius of the whirling arm, the sine outline disappears altogether.

I have recently found that if a term be introduced for air-drag—assumed proportional to the square of the linear velocity—the differential equations then admit of an approximate solution which not only gives the outline of the thread with surprising accuracy but also fully explains the limited stability of the system as described by Hall (*loc. cit.*).

For ease in experimental interpretation, the solution is best referred to moving rectangular axes, the vertical axis of whirl being the Z -axis. The form of solution is then:

$$x = R(1 + \frac{1}{3}\mu^2 z^3 + \frac{1}{15}\mu^4 z^5 \dots) \sin \beta z,$$

$$y = R\mu z(1 + \frac{1}{6}\mu^2 z^3 + \frac{1}{35}\mu^4 z^5 \dots) \cos \beta(1 + \frac{1}{4}R^2\beta^2)z;$$

where z is measured from the node of the lowest balloon, R is, effectively, the radius of the lowest balloon, determined by the radius of the whirling arm; β^2 is $m\omega^2/Mg$; m is thread mass per centimetre; ω is angular velocity of whirl; M is mass of 'bob'; g is gravitational constant; μ is $(\gamma/2\beta)(1 - \frac{1}{4}R^2\beta^2)R$; γ is $P\omega^2/Mg$; P is coefficient of air-drag per centimetre of vertical thread.

This solution gives the projection of the spiral thread on two perpendicular vertical planes. The x -values are conveniently referred to as the 'centrifugal wave', the y -values as the 'drag wave'. The period of the drag wave differs from that of the centrifugal wave by the small factor $\frac{1}{4}R^2\beta^2$, so that the positions of minimum amplitude do not coincide exactly with the nodes of the centrifugal wave. This point is clearly shown in photograph *b* of Hall's

note (*loc. cit.*). The accuracy of this solution appears to depend primarily on the magnitude of the expansion coefficient μ and is good, within this limitation, for very large values of the balloon amplitude: we are no longer tied to infinitely small amplitudes.

The value of μ is commonly so small that, with appropriate corrections which will be self-evident from the equations, if r is the radius of the first 'neck' and R is the radius of the first balloon, then

$$\frac{P}{m} = \frac{2r}{\pi R^2}$$

Measurements of this 'drag ratio' are now in progress, using a coincidence method involving a specially constructed prismatic instrument which eliminates the slight sway inseparable from these whirling systems.

Very fine threads are found to give larger values of the drag ratio than coarse ones in approximately the ratio of their diameters, as might be expected. There appears to be a slight decrease in the drag coefficient with increased whirling speed, which is possibly due to increased air swirl in the system or a departure from the square law.

I hope shortly to give elsewhere a full account of these measurements and the derivation of these equations.

E. R. GOSHAWK.

Experimental Department,
Fine Cotton Spinners' and Doublers'
Association Ltd.,
Rock Bank,
Bollington,
Cheshire.
July 3.

¹ Hall, H. W., NATURE, 138, 932 (Nov. 28, 1936).

Maintenance of the Pulsation in Cepheid Variables

THE oscillations induced in the principal modes of vibration of a star by a free oscillation in one of them, generally of the second order in the corresponding free amplitude, are unimportant unless magnified by resonance; so seems the evidence from Miss H. A. Kluyver's analysis¹. Hence, the motion in a Cepheid variable may be closely approximated to by the superposition of the oscillations of two modes of vibration, a free one and a forced one with half the period.

The damping constant of this composite motion is a weighted mean of the constants referring to the components, the weight factors being proportional to the energies of the separate oscillations. As, excepting exact commensurability, the ratio of these weight-factors is proportional to the square of the free amplitude, the dissipation of the energy of the pulsation depends on this amplitude.

As regards the damping constants of the components of the motion, it is to be remarked that each is the sum of positive and negative terms; the positive terms result from the dissipation of energy in the outer part of the star, hence probably are much larger for the mode of vibration corresponding to the forced oscillation; the negative terms, resulting from the generation of energy, probably are of the same order of magnitude in both cases. Hence the possibility arises that the damping constant belonging to the free oscillation is negative and that

belonging to the mode of vibration in forced oscillation is positive.

If the damping constants in actual stellar conditions have values corresponding to the possibility referred to, then the star may adjust its amplitude in such a way that the damping constant of the composite motion is zero: the pulsation may be maintained indefinitely. If a state of affairs is assumed in which the amplitude is very small, then the negative dissipation of energy of the free oscillation intensifies the motion, until the positive dissipation corresponding to the induced vibration restores the balance: a permanent state of pulsation has been reached.

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¹ Bulletin of the Astronomical Institute of the Netherlands, 276.

Photo-decomposition of Aldehydes and Ketones

ALDEHYDES and ketones decompose in the gas phase in two main ways¹. Type I, predominant with short chain compounds, may be represented $RCOR' \rightarrow CO + (RR + RR' + R'R')$. Type II, predominant with long-chain compounds, involves a cracking of the long hydrocarbon chain in a position $\alpha - \beta$ to the carbonyl group, giving a lower carbonyl compound and an olefine.

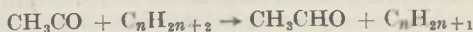
We recently described² certain results obtained in a study of the photo-decompositions of such compounds in paraffinoid solution, in which circumstances both types of decomposition were found to occur, type I being subject to a marked temperature coefficient while type II is not.

These results have now been extended to other carbonyl compounds, and appear to be of general significance. Thus methyl ethyl and diethyl ketones in 10 per cent liquid paraffin solution show no appreciable photolysis at 20° C., but ready decomposition according to type I at 100°.

The products arising from the type I photolysis in all ketones studied in paraffinoid solution are modified in a very simple but profound way, for whereas in the gas phase a mixture of the three hydrocarbons RR , RR' and $R'R'$ together with an approximately equivalent volume of carbon monoxide is obtained, in solution the hydrocarbon products occupy more than double the volume of the carbon monoxide and consist only of the hydrogenated products of the alkyl radicals, RH and $R'H$. None of the RR' and $R'R'$ hydrocarbons, previously found in the gas phase can be detected. It is clear that the free radicals disengaged in the photolysis must mainly react with the molecules of the paraffin solvent rather than combine together, as they do in the vapour. That this is substantially true is shown by the fact that an unsaturation develops in the paraffin solvent which, on removal of the carbonyl compound by distillation *in vacuo*, can be titrated with bromine water, and is equivalent in amount to the unsaturation which would be expected from the volume of the products. This suggests a continuous interchange of hydrogen atoms between paraffinoid free radicals and paraffin molecules, until two such free radicals meeting react to give an olefine and a paraffin by disproportionation.

With methyl ethyl ketone, the ethane produced is in excess of the methane, and this and a deficiency of carbon monoxide with reference to the total hydrocarbon produced has been correlated with the

presence of acetaldehyde which we were able to estimate. These results suggest that the reaction



can occur in paraffinoid solution.

Aldehydes differ from ketones in that photo-decomposition according to type I occurs in solution at room temperatures, and further in that the gaseous products are for the most part the same as those in the gas phase. Thus in the case of acetaldehyde the main products are methane and carbon monoxide, with a slight excess of the former. Butaldehyde and isovaleraldehyde behave similarly giving practically equal volumes of carbon monoxide and saturated hydrocarbon. Both compounds decompose simultaneously according to types I and II, the proportion of each type being approximately the same as in the gas phase, and unchanged in the liquid between 20° and -80° C.

Since with aldehydes less than 2 per cent of hydrogen is found, and but little unsaturation is developed in the solvent, the mode of type I decomposition is strikingly differentiated from that of the ketones. Thus independent evidence is furnished for the conclusion at which we have already arrived², that the hydrocarbon is produced from aldehydes mainly in one act, namely, $\text{RCHO} \rightarrow \text{RH} + \text{CO}$, whereas in ketones free radicals are first formed. This conclusion can also be shown to be in accord with the fact that, with ketones in solution, the type I decomposition is subject to a marked temperature coefficient, while with aldehydes it is not.

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July 13.

¹ Norrish and Appleyard, *J. Chem. Soc.*, 874 (1934). Bamford and Norrish, *J. Chem. Soc.*, 1504 (1935).

² Norrish and Bamford, *NATURE*, 138, 1016 (1936).

³ Norrish and Kirkbride, *J. Chem. Soc.*, 1518 (1932). Norrish, *Trans. Farad. Soc.*, 30, 107 (1934); *Acta Physica Chemica URSS*, 3, 171 (1935).

Elementary Cell and Space Group of Ethyl-chlorophyllide

CHLOROPHYLL itself prepared after Stoll¹ is amorphous, giving in X-ray photographs only one broad ring corresponding to a distance of 4.2 Å. However, by replacing the phytol group by the ethyl group, a crystallizable compound can be obtained. Ethyl-chlorophyllide was prepared from leaves of *Heracleum*, following also the method of Stoll. By evaporation from etheral solutions small crystals, weighing about 2 γ, were obtained in the form of thin equilateral triangles. The crystal form was, as already remarked by Willstätter and Stoll¹, clearly trigonal hemiedric (symmetry class C_3).

X-ray diagrams with copper $K\alpha$ -rays were obtained by oscillation through various angles about the a -axis $[10\bar{1}0]$ and about $[11\bar{2}0]$, the a -axis being parallel to the side of the triangle.

The dimensions of the elementary cell are: $a = 8.90 \pm 0.02$ Å.; $c = 38.4 \pm 0.2$ Å. For the density, the value 1.11 as found for chlorophyll was taken. The number of molecules of $\text{C}_{32}\text{H}_{30}\text{ON}_4\text{Mg} \cdot \text{CO}_2\text{CH}_3 \cdot \text{CO}_2\text{C}_2\text{H}_5 \cdot \text{H}_2\text{O}$ (the crystals were most probably those of the a -component) contained in the

cell was thus found to be 2.7 or approximately 3; so the exact value of the density is 1.24.

The X-ray diagrams confirmed the presence of a threefold axis, with no symmetry plane through the c -axis or at right angles to this axis. So only the symmetry classes C_3 and C_{3i} are possible, the latter being improbable from the external form of the crystals. As only those reflections $000l$ for which $l = 3n$ are found and, further, many of the reflections are inconsistent with a rhombohedral lattice, the space group will be one of the pair of enantiomorphic groups C_3^2 and C_3 . In these space groups the centres of the molecules, that is, the magnesium atoms, will be arranged in spirals around the c -axis.

A discussion of the observed intensities in relation to the shape of the molecules will be given later. We intend to investigate also the compounds derived from ethyl-chlorophyllide by replacing the magnesium atom by other bivalent metals such as copper and zinc.

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¹ Willstätter, R., and Stoll, A., "Untersuchungen über Chlorophyll" (Berlin, 1913).

Oestrous Reactions, including Mating, Produced by Triphenyl Ethylene

DODDS and his co-workers have described a number of synthetic substances with oestrogenic activity.

We have found that 1.0 mgm. of triphenyl ethylene¹, dissolved in oil, produced full vaginal cornification when injected into ovariectomized mice. A dose of 10 mgm. injected in two doses on two successive days produced cornification lasting for some eight to nine weeks, and partial cornification was present for a further period. The injections also caused oestrous distention of the uterus. Ten ovariectomized mice injected with 10 mgm. of the substance were placed with potent males and five of these have mated, as judged by the finding of vaginal plugs; one of these animals mated twice, namely, 5 and 15 days after the injections.

Oestrous changes in the uterus and in the vulva and also mating have been induced in each of two hypophysectomized rabbits.

Although the oestrogenic activity of triphenyl ethylene, as estimated by vaginal cornification, is only about 1/10,000 that of oestrone, yet it can produce effects of remarkable duration, and its power to produce mating is also noteworthy.

The minimum amount of the substance necessary to produce vaginal cornification when given by mouth in solution of oil is approximately the same as when given subcutaneously. Larger doses given by mouth produce cornification lasting for about a week.

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¹ Klages and Heilmann, *Ber. deutsch. chem. Ges.*, 37, 1455 (1904).

Carotenoids of the Chicken Retina

THE cones of many bird and reptile retinas contain brilliantly coloured oil globules. In the chicken they are red, golden and yellow-green^{1,2}. They possess considerable interest, for light must filter through them to enter the sensitive cone outer limbs, and they may serve, therefore, as a mechanism for colour vision³.

Kühne and Ayres² effected a crude separation of chicken retinal pigments into three fractions: purplish red "rhodophane", golden or orange "xanthophane", and yellow-green "chlorophane".

We have crystallized three such pigments from retinal extracts. They are carotenoids, and in suitable solvents reproduce closely the colours of the retinal droplets:

(1) The purplish red pigment, astacene. Epiphasic when shaken with benzene and 90 per cent methanol. Soluble in concentrated caustic potash; precipitates as a red soap on dilution with water. Crystallizes from methanol-acetic acid in thin, curved, purple blades; from pyridine in fine needles. Crystals insoluble in benzene, almost insoluble in methanol, readily soluble in pyridine. The spectrum consists of a single broad band, maximal at 477 m μ in hexane (Fig. 1 a), at 499.5 m μ in pyridine, at 497 m μ in castor oil (used to simulate the retinal oil).

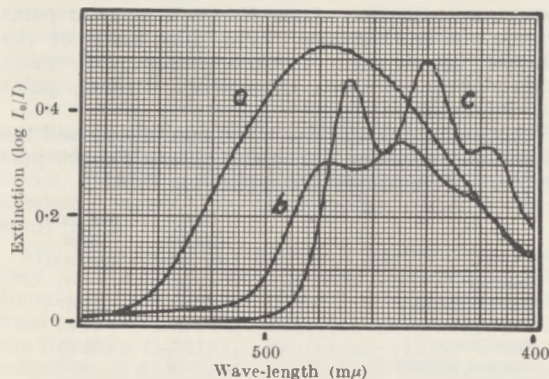


Fig. 1.

(2) A golden or orange xanthophyll. Shaken with benzene and 90 per cent methanol, it is epiphasic before and hypophasic after saponification. This is the typical behaviour of xanthophyll esters. Crystals from methanol solution are orange-red in colour, practically insoluble in benzene, readily soluble in methanol. The spectrum possesses three bands, at (421), 449.5 and 478 m μ in hexane (Fig. 1 b), and at (430), 463 and 490 m μ in castor oil. This is close to the spectrum of lutein (447.5 and 477.5 m μ in benzene).

(3) A yellow or yellow-green hydrocarbon. Epiphasic when shaken with benzene and 90-95 per cent methanol. Crystals from methanol solution are russet in colour, almost completely insoluble in methanol, readily soluble in hexane. The spectrum possesses three sharp maxima, at 418, 440 and 469.5 m μ in hexane (Fig. 1 c), and at 428, 450 and 480.5 m μ in castor oil. This spectrum lies at much lower wave-lengths than that of any known carotene except sarsinene (415, 440, 469 m μ)⁴.

It seems clear from the appearance of the cone globules that one of these pigments predominates in each of them. The fact that one pigment is acidic, one an alcohol and one a hydrocarbon greatly aids their separation *in vitro*. A precisely similar situation

is found in the retina of the turtle, *Clemmys insculpta*⁵. Possibly this chemical differentiation is the basis also of pigment segregation *in vivo*.

Astacene apparently is synthesized by the chicken. We found no trace of it in chicken livers or serum. Though none could be found in the egg yolk, red cone droplets appeared in our chick embryos on the nineteenth day of incubation (37° C.). The hydrocarbon pigment also may be synthesized *in situ*, for it has not been identified either in the egg or in the customary chicken diet.

If the chicken depends upon these pigments for colour discrimination, it should fail to differentiate monochromatic lights between about 600 m μ and 700 m μ , for none of the pigments in castor oil absorbs appreciably in this region. It is significant that the pigeon, which possesses a similar system of cone droplets, is unable to discriminate hue differences between 615 and 700 m μ ⁶.

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¹ Hannover, A., *Arch. Anat.*, 314 (1843); colour plate in Hess, C., "Hdbch. vergl. Physiol.", 4, 555 (1913).

² Kühne, W., and Ayres, W. C., *Unters. physiol. Inst. Heidelbera*, 1, 341 (1878); *J. Physiol.*, 1, 109 (1878-79).

³ Schultze, M., *Arch. mikr. Anat.*, 2, 175 (1866); Roaf, H. E., *Physiol. Rev.*, 13, 43 (1933).

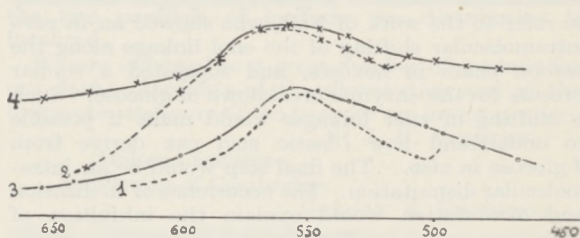
⁴ Chargaff, E., *Naturwiss.*, 20, 872 (1932).

⁵ Wald, G., unpublished observations.

⁶ Hamilton, W. F., and Coleman, T. B., *J. Comp. Psych.*, 15, 183 (1933).

Position of Maximum Optical Sensitivity of Sensitized Photographic Plates

IN one of the first papers¹ on the phenomenon of sensitization of photographic plates to the long-wave rays of the spectrum by dyestuffs, Vogel noted that the maximum sensitivity is often shifted by several hundred Angstrom units towards the red in comparison with the maximum absorption of the dyestuffs in solution. The usually accepted explanation² of this phenomenon is that it is due to the displacement of the maximum of absorption of the dyestuff by its adsorption on the silver halide. But on account of the difficulties connected with measuring the absorption by scattering media, this hypothesis has not yet been confirmed experimentally.



POSITIONS OF MAXIMA OPTICAL SENSITIVITY
Fig. 1.

With the aid of the König-Martens spectrophotometer, we have obtained absorption curves of erythrosin and phloxine sensitizers adsorbed on transparent layers of silver bromide sublimated in vacuum. They were prepared by a method analogous to the method of de Boer³ as described in a series of papers by him on the adsorption of dyestuffs on sublimated layers of alkali earth metals.

In Fig. 1, Curves 1 and 2 represent the curves of the spectral sensitivity of plates sensitized with erythrosin and phloxine, reduced to the same number of incident quanta. Curves 3 and 4 represent the curves of absorption of these dyestuffs adsorbed on layers of silver bromide.

As it is to be seen from the figure, the wave-length of the maxima of sensitivity coincides exactly with the wave-length of the maxima of absorption of adsorbed dyestuffs (erythrosin, 558 μ ; phloxine, 563 μ) whereas the maxima of absorption of the dyestuffs in solution lie at 523 μ for erythrosin and at 524 μ for phloxine.

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¹ Vogel, H., *Ber. deut. chem. Ges.*, 7, 976 (1874).

² Bonhoeffer, K., and Harteck, P., "Grundlagen der Photochemie" (Dresden und Leipzig: Th. Steinkopff, 1933), p. 278.

³ de Boer, J. H., *Z. physik. Chem.*, B, 15, 281 (1932).

Glyceraldehyde and Embryonic Glucolysis

It has already been reported^{1,2} that anaerobic lactic acid production from glucose in the chick embryo is a true case of non-phosphorylating glucolysis, strongly inhibited by *dl*-glyceraldehyde. As possible intermediates, glycerol, glyceric acid, dihydroxyacetone and methylglyoxal were excluded. We are now able to add to the list pyruvic acid and glyceraldehyde.* Of the two stereoisomers, *only l*-glyceraldehyde inhibits glucolysis; this corresponds in its configuration to *l*-lactic acid (sarcolactic acid) which derives from glucose in the body. The inhibitory effect is complete at a concentration of about 2.5×10^{-3} M. The fact that *dl*-glyceraldehyde does not apparently inhibit glucolysis more than about 90 per cent is due to a slow enzymic lactic acid formation from glyceraldehyde itself. This process needs glutathione as co-enzyme and is not based upon a primary condensation of trioses to hexose, as it is not inhibited by amounts of fluoride or iodoacetate which would be enough to poison a secondary glucose breakdown. It is due rather to the non-enzymic formation of methylglyoxal under the experimental conditions, which is then converted to lactic acid by the glyoxalase present.

The exclusion of so many 3-carbon compounds as possible intermediates of glucolysis proper induces us to refer to the work of Nef³, who showed an *in vitro* intramolecular shifting of the enol linkage along the carbon chain in hexoses, and suggested a similar process for the enzymic breakdown of glucose. Such a shifting of enol linkages would make it possible to understand how *l*-lactic acid can derive from *d*-glucose *in vivo*. The final step would be an intramolecular dismutation. The occurrence of enolization and dismutation would explain the inhibition of glucolysis proper by fluoride and iodoacetate, which also poison (though in different concentrations) the enolase and dismutase of hexosediphosphate breakdown.

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* We are greatly indebted to Prof. H. O. L. Fischer and Dr. Baer of Basel, for a gift of *d*-glyceraldehyde.

¹ Needham, Nowinski, Cook and Dixon, *NATURE*, 138, 462 (1936).

² Needham and Lehmann, *NATURE*, 139, 368 (1937).

³ Nef, *Liebigs Annalen*, 376, 1 (1910).

Technique of the Painting Process in the Temple of Vijayalaya Cholisvaram in Pudukottah State

THE ruined temple of Vijayalaya Cholisvaram is situated in the village of Narthamalai (10° 30' N., 78° 45' E.) in Pudukottah State in South India, being about five miles to the north-east of Sittannavasal¹ and about 33 miles, as the crow flies, from Tanjore². The temple was probably built in the ninth century A.D. during the time of Vijayalaya, a king of the Chola Dynasty of South India. The details of the paintings, however, have either faded or disappeared, due to the vicissitudes of time and environment, so that it is very difficult to judge of the art as such. But circumstantial evidences go to show that the paintings were probably executed during the eleventh-twelfth centuries A.D., and at any rate, their date cannot be later than the fourteenth century A.D. If they belong to the eleventh-twelfth centuries A.D., they should have been contemporaneous with the Chola paintings in the Brihadisvara temple³ at Tanjore.

The paintings are executed on the inner walls of the front hall of the temple, which are constructed of large blocks of hornblende-gneiss. The technique adopted is a combination of tempera with fresco. The painted stucco consists of the *Rinzaffo* or the rough coat of lime plaster with a fine lime wash thereon, the latter having been applied while the plaster was still wet. Over this is a layer of paint of appreciable thickness. The thicknesses of the different layers are: painted stucco, 3.3 mm.; rough plaster, 2.3 mm.; lime-wash, 0.4 mm.; paint film, 0.6 mm.

The results of analysis of the rough plaster and the paint film (red paint film being chosen for the purpose) are given in the accompanying table.

	Rough plaster (per cent)	Red paint film (per cent)
Moisture	1.39	1.71
Carbon dioxide	20.95	11.67
Loss on ignition	4.29	11.86
Silica (SiO ₂)	37.83	38.85
Iron and alumina (Fe ₂ O ₃ , Al ₂ O ₃)	1.79	7.63*
Lime (CaO)	31.73	25.09
Sulphuric anhydride (SO ₂)	0.03	0.27
Magnesia (MgO)	0.66	1.68
Undetermined (mostly alkalis)	1.33	1.24
	100.00	100.00

* Al₂O₃ being only 0.73 per cent.

The high value of the loss on ignition of the paint film, amounting to 11.86 per cent, is significant, and goes to show the presence of organic matter in the paint film used as a binding medium.

The only inert material used with the lime is sand.

So far as the pigments are concerned, lime has been used for the white, carbon for black, yellow and red ochres for yellow and red and terre verte for green. There are traces of a light, bluish-green colour, but sufficient quantity of it is not available for identifying the blue pigment.

Full details of the investigation will be published elsewhere.

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¹ *NATURE*, 139, 114 (1937).

² *NATURE*, 137, 867 (1936). *Technical Studies* (Harvard University), 5, 221-240.

Neural Induction by Plant Tissues in the Ectoderm of the Gastrula of *Triton taeniatus*

To investigate the problem concerning the inductive action of plant tissues in the ectoderm of the gastrula, plant tissues rich in nuclear and plasmatic content were used, such as meristem, cambium, ovaries and anthers. Fragments of these tissue, living or dead, were implanted into the blastocoel of an early gastrula of *Triton*.

Four series of experiments were carried out. In the first series, fragments of oat root meristem were inserted either in the fresh condition or after subjection to short boiling in water. Thickenings were formed in the ectoderm at the points in contact with the implant. In the second series, pieces of growing points of potato shoots were used, fresh or boiled. A greater proliferation of the ectodermal cells in the region of contact took place. In the third series, fresh cambium of the birch tree was grated and introduced immediately into the blastocoel of a growing gastrula. Clear instances of inductions of neural plate were obtained, the superficial and deep layers showing a definite differential effect. As might be expected, the cambial layer was the most effective. The reason for this may be that the more tender membranes of the cambium are more easily destroyed by grating. The fourth series forms the control, and shows that the cell membrane is an insurmountable obstacle for inducing substances. Plant subjects such as anthers or whole stamens were implanted with unimpaired cell membranes. In these cases no induction was obtained.

Our results contradict those of Holtfreter's work on plant material (1934, p. 348)¹, but they suggest an explanation of the negative results of his experiments. Holtfreter used plant objects containing much nutritive material (pieces of banana, dough of wheat flour, potato starch).

The unity of plant and animal tissues thus shown may find corroboration in the biochemical field. Butenandt and Jacobi (1933)² extracted folliculin from palm seeds. This folliculin was identical with the folliculin $C_{18}H_{22}O_2$. Skarzynski (1933)³ obtained a hydrate of follicular hormone from flowers, whereas up to that time this substance had only been obtained from the urine of pregnant women and from the placenta.

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¹ Holtfreter, J., *Archiv f. Entwicklungsmech.*, 132, 225 and 302 (1934).

² Butenandt, H., and Jacobi, H., *Z. physiol. Chem.*, 218, 104 (1933).

³ Skarzynski, B., *NATURE*, 131, 766 (1933).

Neural Induction by Fragments of Dead Tissues and Organs of Amphibia and Mammalia in the Ectoderm of the Anuran Gastrula

In the springs of 1934 and 1935, experiments were made on the influence of pieces of dead tissue (killed by means of desiccation, boiling and treatment with alcohol) on the ectoderm of the gastrula of Anura, and tests were carried out in which parts of organs of tadpoles and adult Mammalia were implanted into the blastocoel cavity of the gastrula.

Embryos of *Bufo viridis* proved to be the best test material, but eggs of *Rana esculenta* were also used. All tests gave positive results. Pieces of the upper

lip of the blastopore were desiccated at 60°, others were boiled in water. Some were fixed in 95 per cent alcohol, and later resoftened.

Fragments of muscle, brain and liver were the most effective of all the organs of anuran tadpoles. Fragments of mammalian organs, especially of liver and of kidneys, showed the highest inductive capacity. Our results confirm the work of Holtfreter (1934)¹, who has shown that mammalian tissues are the most effective in inducing axial organs, and add weight to the view that neural induction is chemical in nature.

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¹ Holtfreter, J., *Archiv Entwicklungsmech.*, 132, 225 and 302 (1934).

Distribution of the Biting-louse

THE biting-louse, *Heterodoxus longitarsus* (Piaget), is primarily a parasite of certain didelphian mammals (Macropodidæ), but it has been found also upon non-didelphian hosts. It has been recorded from domestic dogs, a jackal, a coyote, *Oncifelis salinarum*, and a man; also from the passerine bird *Corone australis*. We have examined the original specimens of most of these records and, in addition, have a number of new records from the dog.

This straggling is of interest from two points of view. First, the parasite has become established upon one of these non-didelphian hosts, the domestic dog, and is even the usual dog louse in some localities. Secondly, on this host it appears to have a geographical and local distribution. Of the conditions necessary for the establishment of a louse species on a host other than its 'phylogenetic' host nothing is known; but with the apparent opportunities for transference it is amazing that it has not occurred more often. The earliest date recorded for the occurrence of the parasite on a non-didelphian host is 1902, in Africa.

On examining the locality records, there seems to be a definite geographical distribution such that it occurs only in temperate and tropical areas, roughly confined between lat. 40° N. and lat. 40° S. Thus, we are informed that the parasite is not known from the U.S.S.R., or from Canada; and it does not appear to occur in Europe. The information, from the literature in our records, indicates that within the two parallels of latitude the distribution is localized.

We are indebted to a great number of workers for our data. Accounts of the distribution and of the diagnostic anatomy of the parasite are in preparation.

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"The Handbook of British Birds"

As many ornithologists are already aware, a new edition of "A Practical Handbook of British Birds" has been for some time in preparation. We should be very grateful to any of your readers who would now send us notes of any omissions or errors in the original work, and of any unpublished observations

which would make the work more accurate and complete. Should secrecy in regard to locality be necessary, this will be rigidly respected.

Since the "Handbook" was completed twelve years ago, such a vast amount of matter relating to distribution, migration, breeding-habits and food has been published, both at home and abroad, that the revision made necessary is a very heavy task involving the rewriting of most of these sections.

Moreover, field characters, habitat, song and 'habits' generally, to which very little space was devoted in the original work, will be greatly expanded, and these new sections are being undertaken by Mr. B. W. Tucker (with Mr. Charles Oldham's kind approbation).

The new work will be very fully illustrated in colour, the aim being to show all the birds in so far as possible all their plumages. Such a series of illus-

trations is not now available to British ornithologists, and it is hoped that this new feature will greatly enhance the usefulness of the work, especially to observers in the field.

The original "Practical Handbook" will be in fact so much a new work that we consider an alteration of the title to "The Handbook of British Birds" justified.

As it is proposed to publish in five volumes at six-monthly intervals, beginning next spring, we shall be glad to have now any notes relating to the order Passeres. It would be a convenience if observations concerning breeding habits or food were sent direct to the Rev. F. C. R. Jourdain at Bellevue Road, Southbourne, and all other notes to me at Gracious Pond Farm, Chobham, Surrey.

H. F. WITHERBY.

July 21.

Points from Foregoing Letters

THREE new types of pleochroic haloes have been found by Prof. G. H. Henderson in the course of an extended examination of biotite specimens. Apparently these are due to certain elements of the uranium family, and are of hydrothermal origin.

A table comparing the ability of colchicine to reduce the size of plant tumours (induced in tomato plants by *B. tumefaciens*) with the effect produced by palmitic acid, by removing the flowers, or covering the terminal buds, is given by L. Havas. The author infers that colchicine, like the other factors mentioned, inhibits the growth through the intervention of plant hormones.

Dr. N. Kemmer gives a condition that must be satisfied by nuclear force-constants in order to account for the fact that nuclei with very large spin do not exist. The force constants previously derived by Volz must be altered to fulfil this condition.

Dr. Lotte Kellner concludes, from infra-red absorption spectrum observations, that in the dry crystalline state the molecules of diketopiperazine and tetramethyldiketopiperazine exist in the keto-form free from mixture with the enol-form.

A radioactive element formed in molybdenum irradiated with deuterons has been investigated by C. Perrier and Prof. E. Segrè. They attribute the radioactivity to isotopes of atomic number 43 (masurium), and find that their reactions are similar to those of the element rhenium.

Further experiments by Dr. J. Kunz and others show that the rotation of the plane of polarization attributed by J. Kunz and P. H. Babcock to organic compounds dissolved in various solvents, under the influence of an electric field, is in reality due to the dichroism induced in suspended particles by the electric field, a phenomenon already known.

An approximate solution of the differential equations of motion of loaded, flexible threads whirling about a vertical axis and subject to air-drag has been developed by E. R. Goshawk. The solution accounts for the limited stability of such systems and is not materially affected by the amplitude of whirl. A simple method is indicated for measuring the air resistance to the motion of cylindrical threads—rough or smooth—at high whirling speeds.

Dr. J. Woltjer, jun., points out the possibility of the existence of a self-regulating mechanism which would maintain the pulsation of a star, depending on the superposition of the oscillations of two modes of vibration, a free and a forced one.

Two types of decomposition of the methyl-ethyl and diethyl ketones in 10 per cent liquid paraffin solution, are described by Prof. R. G. W. Norrish and C. H. Bamford. They find that solvent molecules react with the radicals liberated by the photolysis.

An X-ray investigation by Dr. J. A. A. Ketelaar and E. A. Hanson of the ethyl derivative of chlorophyll, said to be the first of the chlorophyll derivatives to be examined by the X-rays, indicates that the molecules are arranged in spirals.

Three crystalline pigments belonging to the group of carotenoids have been obtained by Dr. G. Wald and H. Zussman from extracts of chicken retinas. One is purplish red (astacene), another a golden or orange xanthophyll, and the third a yellow or yellow-green hydrocarbon. None of these absorbs light in the region 600–700 $m\mu$, and the authors suggest that the chicken, like the pigeon, may be unable to discriminate hue differences in this region.

Curves showing that the maximum sensitivity of photographic plates sensitized with dye-stuffs (erythrosin and phloxine) corresponds with maximum absorption by those dyes when absorbed on layers of silver bromide (but not with their maximum absorption when in solution) are submitted by S. Natanson.

Dr. J. Needham and H. Lehmann have investigated the inhibition of embryonic glucolysis by glyceraldehyde—it is due only to *l*-glyceraldehyde. The fact that the inhibition is apparently incomplete is due to lactic acid formation from glyceraldehyde itself. This is brought about by its transformation into methylglyoxal, which is then converted to lactic acid by glyoxalase.

S. Paramasivan reports that the paintings in the temple of Vijayalaya Cholisvaram at Narthamalai in Pudukottah State (South India) have been executed in a technique which is a combination of fresco with tempera. Lime, carbon, yellow and red ochres, and terre verte have been used as pigments.

Research Items

The Quinault Indians, Washington, U.S.A.

THE Indians who speak a Salish dialect lived in a region of the State of Washington, of which the Quinault River, with its valley, was the heart. In addition to the region drained by the river, they also occupied a district along the beach between a point near the mouth of the Raft River and a spot near the present site of the village of Pacific Beach, or the mouth of Joe Creek. In practice, their boundaries were not strictly defined, and the feeling of ownership or exclusive right to this territory was unheard of. The heights above the source of the river were more or less common hunting ground for several neighbouring tribes. The whole region was covered with a luxuriant growth of vegetation. In 1855, they ceded part of their territory to the Government, and since then have lived in the present Quinault Indian Reservation. Between 1925 and 1927 they were visited on three occasions by Mr. Ronald L. Olson under the auspices of the Department of Anthropology, University of Washington, for the purpose of studying the vanishing relics of their tribal culture, of which there has been no systematic description (*Univ. Washington Pub. in Anthropol.*, 6, 1). "Quinault" is a corruption of "kwi'nail", the name of the largest settlement situated at the site of the present village of Taholah. A list of thirty-eight village settlements which had existed along the course of the river was obtained, while some seventy-seven place-names were collected. An approximate estimate for the population at the beginning of the nineteenth century is eight hundred. Their most important economic activity was the taking of salmon, of which the great run began in March or April. During the run, the men virtually lived at the weir, the fish being passed to the women for dressing and curing. After the run, a variety of activities was open. Some might go to the mountains for hunting elk, bear and deer, others might go to the coast to gather clams, while for every household the winter's supply of bark, grass and roots for baskets and clothing had to be gathered.

Daylight Illumination for Clerical Workers

AN interesting investigation into the problem of the daylight illumination which ought to be provided for clerical workers has been described by L. H. McDermott ("Daylight Illumination Necessary for Clerical Work", Dept. Sci. and Indust. Res., Illumination Res. Tech. Paper No. 19. Pp. iv + 14 + 2 plates. London: H.M. Stationery Office, 1937. 6d. net). A mechanical method was devised to ascertain the value of daylight illumination below which workers will make use of artificial light. Briefly, the method employed consisted in photographing a microammeter connected to a photo-electric cell, the motive force for working the camera being derived from the current in the lamp circuit when the subject first switched on the light. The photo-cell was exposed to daylight in a fixed position in one of the office windows, and the reading of the microammeter thus bore a definite relation to the illumination at any particular desk. This relation was determined for each desk occupied by a subject under investi-

gation, and thus it was possible to calculate the daylight illumination at any desk at the moment when the worker made use of the desk light. The results of more than a thousand observations made in a study of seventeen typists are analysed and tabulated. The illuminating value at which the average subject needed artificial light was about 5 foot-candles. Individual subjects varied somewhat in their minimum requirements, but the conclusion that 5 foot-candles is the minimum daylight illumination requirement of the average typist appears to be justified. This result can be applied to determine the average lighting-up time at any season of the year for any given point in a room if the daylight factor for that point is known, and if data concerning the variation of outdoor illumination throughout the day at all times of the year are available. A table is given showing, for positions with various daylight factors, the periods for which natural illumination is sufficient for typists working at desks with specified daylight factors. The figures relate to a non-urban locality in the south of England.

Age and Stock of Blue Whales

THE corpora lutea of whales regress into corpora albicantia, but apparently never become entirely absorbed, so that the ovaries retain a record of the total number of ovulations during the life-history of any female. From material examined in the antarctic, and ovaries extracted and sent to London by whaling factories there, together with date of length, sexual condition, and ankylosis of vertebral epiphyses, Alec H. Laurie has deduced certain important conclusions regarding the antarctic Blue whales (*Discovery Reports*, 15, 223-284, 1937; Camb. Univ. Press, 9s. net). The onset of maturity corresponds with the accumulation of eleven corpora lutea in the ovaries, and a minimum body-length of 86 feet, which is attained at ten to eleven years of age. Breeding may take place every two years at best, and a possible average rate of once in two and a half years is suggested. The oldest females taken, probably about thirty years of age, showed no sign of diminishing fertility. The age distribution of the females points to a progressive fall-off in the rate of recruitment of the stock in recent years, so much so that the author considers it now to be insufficient to compensate for the slaughter of modern intensive whaling. Another suspicious fact bearing upon the same point, is the decrease which (contrary to the analysis made by Hjort, Lie and Ruud) is shown in the average length of females captured. From 82.36 feet in 1930-31, the average length has fallen to 78.99 feet in 1935-36, which means that on an average females are killed before they have even begun to reproduce, and in accordance with this the percentage of immature females captured has risen from 15.16 in 1930-31 to 41.67 in 1935-36. These conclusions point to a serious situation. It would appear that the stock of antarctic Blue whales is steadily being encroached upon, since the annual breeding rate is insufficient to cope with the annual destruction (see also p. 180).

A Pest of the Rhododendron

MR. G. FOX WILSON has directed the attention of gardeners to the appearance in Great Britain of a leaf-hopper, *Graphocephala coccinea*, upon the leaves of species of *Rhododendron* and *Kalmia* (*J. Roy. Hort. Soc.*, 62, Pt. 5, May 1937). The pest normally inhabits the eastern half of the United States. It seems to cause little direct damage to its host, but apparently allows bacteria or fungi to enter the plant tissue, and thus induces secondary infection. Applications of nicotine are recommended where it is necessary to control the activities of the pest.

Chemical Analyses of Rocks and Minerals

BULL. 878 of the Geological Survey of the United States is devoted to a record of analyses of rocks and minerals made in the Laboratory of the U.S. Geological Survey during the years 1914-36. It is supplementary to Bull. 591, which contains the 2,789 analyses made up to January 1, 1914. In the present compilation, for which R. C. Wells, the present chief chemist, is responsible, the details of 1,533 additional analyses are given, including 444 of igneous and crystalline rocks; 303 sedimentary rocks; 115 clays and soils; 156 ores and gangue materials and 515 minerals. Although many of the analyses have already been published, a considerable number have not hitherto been recorded. Moreover, those published are very widely scattered, and some of them would be impossible to find without a great expenditure of time. The Bulletin is therefore likely to be of great value to petrologists and mineralogists. No attempt is made to recalculate the average composition of the earth's crust, but Fersman's figures for the abundance of all the elements—based on the whole of the data available up to 1932—are reproduced from their relatively inaccessible Russian source. Attention is directed to Fersman's new term *clarke* to designate a unit for indicating the relative abundance of an element, either by weight or by number of atoms, in any particular type of rock or in the earth's crust, in honour of F. W. Clarke, who did so much for geochemistry, especially on the statistical side.

Size of Particles Responsible for Ferromagnetism

DIA- and para-magnetism can be explained almost entirely on the basis of the magnetic properties of single atoms; but the phenomena associated with ferromagnetism only appear in aggregates of atoms arranged in a certain manner. These aggregates, it is estimated, should be of ultra-microscopic dimensions. It is therefore to be expected that a study of the structure of aerosols of iron and nickel with the ultra-microscope should yield some information on the size of the elementary magnets of these ferromagnetic substances. Observations by this method are reported by D. Beischer and A. Winkel (*Naturwiss.*, 25, 420; 1937). The nickel and iron aerosols were produced by the thermal decomposition of nickel tetracarbonyl and iron pentacarbonyl, respectively, in nitrogen. Examination of the aerosols under the ultra-microscope showed that the particles were chain-like. This is unusual for this type of sol, which more often forms spherical aggregates, chain-like particles being formed only when some directive force is operative. It is suggested that the force in this case is magnetic. The view is supported by the fact that

the velocity of aggregation is considerably greater than is usual with aerosols, and that if the aggregation takes place at a temperature above the Curie point, no chain-like particles are observed, but aggregation results in the formation of spherical particles. Estimation of the size of the smallest particles of which the chains are composed from the widening of the Debye-Scherrer diagram gives results which are in agreement with the requirements of the Weiss-Heisenberg theory of ferromagnetism. Experiments are also described which indicate that the magnetism of the particles is spontaneous, and not induced by the earth's field.

Polymorphic Changes of the Alkaline-Earth Carbonates

AN interesting application of Hahn's emanation method of investigating changes of structure of solids has been made in the examination of the polymorphic changes of calcium and barium carbonates (K. E. Zimens, *Naturwiss.*, 25, 429; 1937). The curve of amount of emanation evolved against temperature indicates a transition in the case of calcium carbonate from the aragonite to the hexagonal calcite structure at about 500°. The change is monotropic. Barium carbonate shows an enantiotropic change at 800° from the rhombic to the hexagonal form. A further transformation at 982°, which has been reported in the literature, could not be detected.

Mud Fluid for Pressure Drilling Conditions

A HEAVY loaded mud should be used in conjunction with pressure drilling equipment when very high pressures are to be dealt with. Also, it may be convenient to use a mud of this description in circumstances where pressure could be controlled equally effectively either by back pressure or by a loaded mud fluid, for in the event of a formation being encountered where a higher pressure exists such pressure can be immediately controlled by increasing the back pressure applied at surface. Dr. J. T. Evans, in a paper presented to the Burma Branch of the Institution of Petroleum Technologists on May 4, pointed out that the preparation of loaded muds has two stages: mixing clay or shale with water to give an ordinary rotary mud and afterwards mixing barytes with this mud until the desired weight is achieved. It is clear that the desired final characteristics of the mud must determine the type of shale or clay to be used, but the clay best suited for a loaded mud base is not necessarily that best suited for an ordinary mud, since if ordinary mud should become viscous at slightly higher weight it would involve heavy expenditure on barytes to produce the final loaded product. This factor and the properties of weight, stability, viscosity and reaction to chemicals used to reduce viscosity should all be taken into consideration when preparing a specification for loaded mud. Then again, conditions are materially altered when the mud is put into service. Pressure, temperature, etc., are liable to have some effect on the characteristics of the mud, and these factors must be borne in mind when assessing the usefulness of a given loaded mud. Finally, it is quite probable that the admixture of drilling mud with formations penetrated and the phenomenon of thixotropy, whereby alternating gel and sol conditions are produced, will alter the characteristics of the loaded fluid in service.

Science and the Conservation of Food*

AGENCIES AFFECTING FOODS

THERE are many agencies, biological, chemical and physical, which may affect foodstuffs, either by spoiling their appearance or rendering them unfit for consumption. Bacteria are most important among the biological factors, but yeasts and moulds, which may either aid or hinder preservation, have also to be considered; and then there are such animal pests as sugar- and cheese-mites, moths, rats and beetles, all of which may damage the raw material used in food manufacture, or attack the finished products.

Food products have also to be protected from heat, dampness, the oxygen of the air and sometimes from light as well. These last two factors, acting in association, produce the bleaching or discoloration which is sometimes seen in bottled fruit, when pieces of the fruit project beyond the syrup into the space at the top of the bottle. Then again, canned food must be protected from the action of acids and salts which might corrode the tin.

There are also substances contained in the foodstuffs themselves which may have a destructive action, namely, the enzymes. These are present in both vegetable and animal cells, but they can exist independently of them. One enzyme having an important bearing on food preservation in connexion with jam-making is pectase, which, if it is allowed to do so, will destroy the pectin which is responsible for the 'setting' property of jam. Jams, in fact, present a number of problems to the manufacturer, and the way he has been helped to solve these is a good example of the assistance which science has rendered to industry.

JAMS

Substances of importance for the keeping quality of jam are held in solution in the water it contains, for example, sugar, acids and salts. The osmotic pressure of these substances, the sugar in particular, can be responsible for protecting the jam from the growth of moulds, because, for germination, a mould spore must first absorb water. If the osmotic pressure of the jam is equal to or greater than that of any spore which falls upon it, either no water will pass from the jam to the spore or the spore will lose water and so dry up and eventually die, and in both these cases its further development will be arrested. The British Food Manufacturers' Research Association has actually determined the minimum percentage of solids necessary to bring about this condition.

There is, however, still a risk of moulds developing in a jam if the relative humidity of the atmosphere to which it is exposed is above 82 per cent.. Then the jam will absorb moisture and so its osmotic pressure becomes lower than that of the mould spores.

Another defect frequently arising in jams is crystallization or granulation of the sugar. In the jam-making process, sucrose is inverted by the boiling acid, and it is necessary that just the right degree

of inversion should take place if no crystallization is to occur. Thus, if the sugar is under-inverted too much sucrose is left and this crystallizes out. If, on the other hand, it is over-inverted, too much dextrose is formed and this crystallizes out. As fruits vary very much in the amount of acid they contain, the manufacturer must be able to discover the degree of inversion taking place, and modify his process accordingly.

The setting property of jam has already been mentioned, and it is important to remember that unless jam is properly set it cannot be transported and handled. It is therefore necessary to make use of the pectin naturally occurring in fruit cells. Pectin is a complex of different substances, and therefore its properties vary from one fruit to another; for this reason the setting properties of some fruit juices are superior to those of others, for example, gooseberry, red currant and apple are good, while strawberry is poor. Now, pectin must be protected from the naturally occurring enzyme, pectase, which destroys it. So long as the cell structure remains intact, the pectase does not attack the pectin, but in fruit which has become damaged by bruising, the pectase appears to get out of control, and in the case of raspberries all the pectin may disappear in twelve hours. In this fact lies the justification for manufacturers using "added fruit juice" or "pectin" in the making of jam.

Pectin may also lose its jellifying powers by the action of prolonged heat. It is therefore necessary to eliminate any over-heating in the manufacturing process, and this is not always easy when large quantities of liquid have to be dealt with.

MEAT PRODUCTS

The processes of jam-making are more familiar to the public than those of meat preservation. An important difference to bear in mind is that meat has no natural acids to assist the preservation process. Meat, if it is to be kept, must be protected from putrefactive bacteria, which though harmless in themselves feed upon animal and vegetable debris, gradually converting them into ammonia and carbon dioxide, etc.

Refrigeration deprives the bacteria of water which is necessary for their growth, the water in the meat tissues being converted into ice. The bacteria are not necessarily killed, but their development is inhibited. Some of the bacteria can grow at temperatures around freezing point, and for this reason chilled meat cannot be kept so long as meat which is frozen at temperatures well below freezing point. The growth of bacteria can also be restrained by certain concentrations of carbon dioxide in the air.

Although the spores of some bacteria are highly resistant to heat, it has been possible to use heat sterilization as a method for meat preservation. It is, of course, necessary for the manufacturer to know the combinations of time and temperature at which all spores likely to be present will be destroyed.

* Substance of a Friday evening discourse delivered at the Royal Institution on April 16, by Mr. T. Macara, director of research of the British Food Manufacturers' Research Association.

Allowance must be made, when the product is packed in a tin, for the penetration of heat to the deepest parts of the package; and the rate of penetration will vary considerably with the density of the contents, being much slower for meat than for a tin of fluid.

FOOD POISONING

A product canned by correct processes is one of the safest articles of diet it is possible to have, and many complaints made to manufacturers that their products have caused illness, have shown on investigation to have no justification. According to Prof. Tanner of Illinois (speaking at the Congress of Microbiology, 1936), in the past canners and distributors have tried to avoid publicity by settling their claims out of court. Medical practitioners are often unfamiliar with the procedures necessary to establish definitely the causative factors in food poisoning. There is also much prejudice on the part of the public as well as ignorance of the great care generally taken in the manufacture of these products. It has been shown in Great Britain and the United States that by far the largest number of cases of food poisoning are caused by foods which have been prepared in the home or by products sold in a pre-cooked condition, but not sterilized.

TINPLATE CONTAINERS

A difficulty, still not completely solved, is that of producing in commercial quantities the perfect tinplate for the construction of a can, or tin stopper for a glass jar. Then also, the machinery necessary in making the can may break the tin coating and expose the base metal, iron. The iron thus exposed may be attacked by the salt present in meat and

vegetable products. An attempt has been made to produce a lacquer which when applied to the tinplate would prevent this action. Several difficulties have so far prevented the realization of this ideal.

PRESERVATION OF MEAT

The preservation of meat by means of salts has long been practised, but only recently have its scientific principles been studied. The production of colour as well as preservation from putrefaction is brought about by the use of saltpetre. Bacterial action converts the nitrate of the saltpetre into nitrite, which combines with hæmoglobin, and when the meat is boiled the latter is converted into nitro-hæmochromogen, which has the bright red colour characteristic of properly cured silverside. The micrococci responsible for this action can grow in media containing as much as 20 per cent of salt, in which concentrations the putrefactive bacteria cannot exist. Nor can their spores develop in media containing as much as 10 per cent of salt.

CHOCOLATE AND CONFECTIONERY

Changes in atmospheric temperature and humidity are liable to produce changes in chocolate and confectionery. The British Food Manufacturers' Research Association has given manufacturers a great deal of help in determining the conditions necessary for the production and storage of satisfactory chocolate. In the factory, it is generally possible to secure these conditions, but in retail premises it is not so easy. If the manufacturer were able to deliver his goods direct from his warehouse to the consumer, defective products would not be so commonly seen as they are at the present time.

Conduction of Electricity in Solids

CONFERENCE AT BRISTOL

A CONFERENCE on the "Conduction of Electricity in Solids" was held at Bristol on July 13-16 under the joint auspices of the Physical Society and the University of Bristol. The discussions were opened by R. W. Pohl, who gave an account of the fundamental work on electron conductivity and photochemical processes in alkali-halide crystals carried out in his laboratory at Göttingen. The paper was mainly concerned with the properties of crystals which have been coloured either by heating in alkali vapour or in other ways, introducing colour centres called '*F*-centres'. A discussion followed on the exact nature of these *F*-centres, and, although there is as yet no certainty on this point, a hypothesis was proposed which seemed to have a good deal to recommend it, namely that an *F*-centre is an electron localized at a point in the lattice where a negative ion is missing.

Papers on phosphorescence in halide and sulphide crystals were given by R. Hilsch (Göttingen) and J. T. Randall (General Electrical Co., Ltd.) who discussed to what extent this phenomenon is related

to photoconductivity and to the transference of an electron to a large distance from the phosphorescent centre.

J. H. de Boer (Eindhoven) gave a paper by himself and E. J. W. Verwey on semi-conductors with partially filled 3*d*-bands. He pointed out that the electron theory of metals in its present form is not applicable to a substance such as nickel monoxide, in which a 'band' of electron states is incompletely filled, and therefore ought to behave like a metallic conductor, but which has in fact a resistance some 10⁹ times greater than a metal. Both he and R. Peierls gave indications of the way in which the theory would have to be modified to include these substances.

Subsequent papers dealt with conduction in metals. G. Borelius gave an account of the work carried out at his Institute in Stockholm on the resistance of alloys, and especially of alloys in which the atoms can take up an ordered or disordered arrangement. His own pioneer work on the treatment of this problem from the point of view of thermodynamics

is described. W. L. Bragg gave a paper by himself, C. Sykes and A. J. Bradley on the work carried out at Manchester on the same problem.

C. H. Desch (National Physical Laboratory) gave a paper on age hardening alloys with special reference to their resistance. A. J. Bradley also mentioned his recent work on the crystal structure of the permanent magnets in the iron-nickel-aluminium alloy series, and in consequence of this a very definite model was proposed for the age hardening process, the atoms present in solid solution being supposed to collect together in groups still forming part of the crystal lattice of the original alloy. Such a process sets up intense strain, and hence hardens the alloy.

The final day was devoted to a discussion of the resistance of thin metallic films. After an initial paper by G. I. Finch (Imperial College of Science and Technology) on the structure of these films as revealed

by electron diffraction, E. T. S. Appleyard gave a paper on work carried out in Bristol on their resistance, and A. Féry and M. J. Bernamont followed with papers on work done in Paris. A distinction was drawn between metals such as the alkalis which may form a fairly uniform layer over the surface upon which they are deposited, and metals such as mercury which apparently form islands. The mechanism by which the atoms can wander on a surface and form islands was discussed by J. E. Lennard-Jones. A point upon which no agreement was reached was the negative temperature coefficient of resistance of some films, and whether it is due to occluded gases.

Full reports of the principal papers given at this meeting, together with a summary of the discussions and the main conclusions reached, will be published in September in a special number of the *Proceedings of the Physical Society*.

Beginnings of Western Science in Japan

AT the fellows' dinner held at University College, London, on April 30, Prof. Joji Sakurai, emeritus professor in the Imperial University of Tokyo, president of the Imperial Academy and of the National Research Council of Japan, replied to the toast of the new honorary fellow. In the course of his remarks, Prof. Sakurai said:

"If what I have been able to do in my work in Japan is at all creditable, the credit must be traced back to my education in England and, first and most of all, to the scientific training I received in University College during the five years extending from 1876 until 1881. Dr. Alex. W. Williamson, renowned throughout the whole world for his classical investigation on the formation of ethers and renowned also for his remarkably keen insight into the atomic constitution of matter, was then professor of chemistry, and it is needless for me to say how highly I value the scientific training I received from him. I was taught physics by Prof. Carey Foster and Dr. Oliver Lodge, and the knowledge of physics thus acquired was a great help to me in following the remarkably rapid development of physical chemistry which was soon to come.

"It was, however, not the scientific training alone that I received in England. The five years of my student life in England were in the latter half of Queen Victoria's reign, a period which is one of the most glorious in the whole history of England. It was a period in which some of the greatest and most illustrious of men and, also, of women were to be met with in almost every field of human activity. As statesmen and orators, Lord Beaconsfield and the grand old man—Mr. Gladstone—were shining like stars of first magnitude; Tennyson was being adored as poet laureate, Ruskin as a writer and critic and George Eliot as a feminine novelist of unusual talent; Charles Darwin was enjoying to see his life-long labours bearing fruit, Herbert Spencer was laying a scientific foundation of sociology, whilst Henry Irving and Ellen Terry were, night after night, drawing crowds of enthusiastic audiences to the Lyceum.

"Having had the rare fortune of being in England at such a glorious time, I could not, and would not,

confine myself to scientific studies alone, but wishing to look upon England with more widely opened eyes I studied something of English history, of English literature, of English art and, even, of English drama. At the same time, I had the great good fortune of making some very dear and life-long friends and, through them, of knowing something of English homes and of mixing more or less in English society, all of which combined in enabling me to get a fairly accurate idea of English culture, and it was this—the knowledge of English culture—which has proved to me to be of inestimable value throughout the whole of my later life. If, therefore, my work in Japan is worth mentioning, it is to be wholly attributed to the scientific and cultural training I was able to receive during the five years of my student life in England.

"I should like to make a short reference to an important fact in the recent history of Japan, concerning Anglo-Japanese cultural relations. A few years before the Restoration, that is about seventy-five years ago, a group of five young men from Choshu came over to London in one of the sailing vessels owned by Messrs. Jardine, Matheson & Co. of Yokohama, whose correspondents in London were Messrs. Matheson & Co. The object of these young men was to make a general study and observation of Western civilization and when, after a long voyage round the Cape of Good Hope, they arrived in London they were introduced to an elderly gentleman who took every care of them and helped them in every way in their study and observation. This elderly gentleman was no other than Dr. Williamson of University College under whom, as I said before, I was a student for five years. As to what made him particularly interested in these young men and in Japan I can say nothing, but I remember him often telling me that Japan was England of the East, by which, as it appeared to me, he meant something more than mere geographical likeness of the two island empires.

"Returning to the five young men, two of them went back to Japan in the following year in consequence of important developments at home, and

plunged themselves in the great political turmoil which soon led to the Restoration. One of these two men was Shunsuke Ito—later, Prince Hirobumi Ito—who was generally regarded as the founder of modern Japan, and the other was Bunta Inoue—later, Marquis Kaoru Inoue—who was cabinet minister in the Meiji Government on several occasions. The other three also greatly distinguished themselves and occupied important positions in the new Government. Of these, Yasuke Nomura—later, Viscount Masaru Inoue—who, by the way, was living with Dr. Williamson's family for several years, laid and ran the first railways in Japan, Yozo Yamao—later, Viscount Yozo Yamao—greatly contributed towards laying the foundation of technical education, and Kinsuke Endo was, if I remember rightly, the first master of the mint.

"Now, the most important item in the policy of the Meiji Government was the transplantation of Western sciences, the elements of which were taught by missionaries. But as time came for higher scientific education, need was felt for teachers properly equipped with the necessary knowledge and ability, and the Government naturally decided to call these teachers from England. Strange as it may appear to-day, these calls were made through the firm of Messrs Jardine, Matheson & Co. in Yokohama, which transmitted them to their correspondents in London, and the latter invariably consulted with

Dr. Williamson or somebody else named by him. The fact that Dr. Williamson intervened in the transaction of this important business was most fortunate for Japan, for the young scientific men recommended by him, either directly or indirectly, for the Japanese posts all proved themselves to be most capable teachers of science, among whom the names of William Ayrton, Edward Divers, Alfred Ewing, John Milne and John Perry may especially be mentioned as those who, later, all became fellows of the Royal Society of London. These pioneers of science in Japan taught their students to study science for its own sake, themselves setting examples by numerous brilliant researches and thereby greatly stimulating the spirit of original scientific work. I am particularly happy to have been given an opportunity this evening of making reference to this little piece of history, which is almost completely unknown, but which shows how much Japan owes to Dr. Williamson and, through him, University College and England for the valuable help given in the earlier and most important stages of development of modern sciences in Japan.

"Ever since the foundation of Ramsay fellowships in 1920, Japanese Ramsay fellows have, if I remember rightly, without a single exception come to work under Prof. Donnan, with whom the cultural obligations Japan owes University College and England have thus been happily revived".

International Association for European Ethnology and Folklore

CONFERENCE AT EDINBURGH

THE International Association for European Ethnology and Folklore was formed in November, 1935. Its first Congress was held in the New College, Edinburgh, on July 14-21. The Scottish Anthropological and Folklore Society acted as hosts.

Seventy-six delegates registered as members of the Congress, the countries represented being Great Britain and Ireland, Sweden, Norway, Denmark, Finland, Lithuania, Estonia, Holland, Belgium, Switzerland, and the United States.

At the opening of the Congress, the presidential address was delivered by Prof. Herman Geijer, of the University of Uppsala. Thirty-one papers were read. Those dealing with folklore included "Remarks upon Methods of Surveying and Making Distribution Maps in the fields of Dialect and Folklore", by the president; "Scottish and Norwegian Ballads", by Prof. K. Liestøl, Oslo; "Norse and Gaelic Folklore", by Dr. R. Th. Christiansen, Oslo; "The Stars in Eskimo Folklore", by Prof. W. Thalbitzer, Copenhagen; "Rites", by Dr. C. W. von Sydow, Lund; and "The Origins of the Ducking-stool", by Prof. J. W. Spargo, Northwestern University, U.S.A.

Papers of technological and museum interest were "Simple Agricultural Implements of England", by Mr. R. U. Sayce, Manchester; "The Early History of Vehicles in Northern Europe", by Dr. G. Berg, Stockholm; "The Irish House", by Dr. Åke Campbell, Uppsala; and "Scandinavian Folk Museums", by Prof. Sigurd Erixon, Stockholm.

On the linguistic side, Dr. W. Grant, Aberdeen, dealt with "The Scottish National Dictionary"; Mr. J. C. Catford, Edinburgh, with "Scottish Dialects and the Proposed Linguistic Atlas of Scotland"; Dr. G. S. Lowman, Brown University, U.S.A., with "The Linguistic Survey in the U.S.A. and Canada". Dr. R. Nordenstreng, Uppsala, made some helpful suggestions as to the solution of an ethnological problem in his paper on "The Riddle of the Finns, Frisians, and Fair Broad-heads".

Among papers of particularly Scottish interest was that by Mrs. M. Macleod Banks, president of the Folklore Society, on "The Three Marts and the Man with the Withy".

During the Congress, a 'ceilidh', arranged by Miss J. Bruce, secretary of Highland Home Industries, Ltd., was performed by a group of Gaelic-speaking women; and a display of authentic Scottish country dancing was given at Roslin by a team of 'bondagers' under the supervision of Mr. Ion C. B. Jamieson.

Throughout the congress, there was on view an exhibition of ethnological and folkloristic material, of which the outstanding feature was the display of photographs and drawings of house-types and domestic and agricultural implements selected from the collection of the Irish Folklore Commission. Other exhibits were by the Landsmålsarkivet, Uppsala; the Nordic Museum, Stockholm; H.M. Office of Works; and Highland Home Industries, Ltd.

University Events

LONDON.—Sir Robert Pickard, director of the British Cotton Industry Research Association, and a member of the Senate since 1926, has been elected vice-chancellor for the remainder of the year 1936-37 and for the year 1937-38. He succeeds Mr. H. L. Eason, who took up his duties as principal on July 1. Prof. J. C. Philip has been appointed deputy vice-chancellor for the year 1937-38.

Dr. William Wardlaw has been appointed to the University chair of physical chemistry tenable at Birkbeck College as from October 1. Since 1918 he has been on the teaching staff of the University of Birmingham and has held the post of senior lecturer in chemistry since 1926.

The title of professor of morbid anatomy in the University has been conferred on Dr. G. R. Cameron (Melbourne), in respect of the post held by him at University College Hospital Medical School, and that of reader in chemistry in the University on Mr. Henry Terrey, in respect of the post held by him at University College.

The degree of D.Sc. has been conferred on the following: G. P. Crowden, university reader at the London School of Hygiene and Tropical Medicine (applied physiology), G. E. R. Deacon (chemistry), G. S. Hartley (chemistry), H. L. Chhibber (geology), Dr. W. F. Whittard (geology), Marion G. Eggleton (physiology), T. H. C. Taylor (entomology), R. A. Frazer (mathematics) and H. O. Bull (zoology).

MANCHESTER.—Among the numerous appointments announced at the end of this session is one of somewhat unusual interest—that of Mr. A. D. Ritchie, at present lecturer in physiological chemistry, to the Sir Samuel Hall chair of philosophy and public administration in succession to the late Prof. J. L. Stocks. Mr. Ritchie took first-class honours in philosophy at St. Andrew's in 1911, and second-class honours in Part I Natural Sciences Tripos at Cambridge in 1914. He was elected fellow of Trinity College, Cambridge and worked on the philosophy of science, and was Tarned Lecturer in 1935. Though for the last twenty-three years he has been professionally engaged as a teacher of physiology, he has published various philosophical works in this period.

The following further appointments have also been announced: Prof. P. M. S. Blackett, professor of physics in Birkbeck College, University of London, to succeed Prof. W. L. Bragg in the Langworthy chair of physics; H. Davenport, P. Du Val and W. W. Sawyer, assistant lecturers in mathematics; G. D. Rochester, assistant lecturer in physics; D. G. Evans, assistant lecturer in chemistry in the Department of Bacteriology; E. L. Patterson, assistant lecturer in anatomy; and Miss Margaret I. Williams, assistant lecturer in applied physiology.

SHEFFIELD.—The following appointments have recently been made: J. W. Watson to be assistant lecturer in geography; Gilbert Forbes to be lecturer in forensic medicine; J. M. Kennedy to be lecturer in infectious diseases; G. A. de Belin to be assistant lecturer and research assistant in the Department of Metallurgy.

ST. ANDREWS.—A lectureship in political science has been instituted in the United College, St. Andrews, and Mr. J. M. Brown of Glasgow has been appointed to the new post. Mr. B. S. Robertson has been appointed lecturer in regional anatomy in University College, Dundee.

Science News a Century Ago

The Diet of Silkworms

At a meeting of the Paris Academy of Sciences on July 31, 1837, reported in the *Gazette Médicale de Paris* of August 5, MM. Moriset, de Clavaison and Durrand recorded the results of an experiment on the feeding of silkworms by substituting for mulberry leaves those of the Spanish *scorsonera*. The silkworms which had been so fed from the time that they had been hatched did not appear to suffer from this diet, and had produced cocoons which were in no way inferior to those of silkworms which had been given mulberry leaves at the same time. Some of the cocoons had been sent to the Academy, but did not appear to competent judges to be the product of healthy silkworms. Similar trials had previously been made at different times with the leaves of *scorsonera*, and had always been abandoned. In any event, what had encouraged the speakers to pursue the experiment was the fact that the silk industry would never acquire a great development in the south of France so long as silkworms were fed exclusively by mulberry leaves, in view of the fact that cultivation of the mulberry tree did not harmonize with the other principal cultivations in the country; whereas cultivation of *scorsonera* did very well and would yield a double profit, the root forming a wholesome food similar if not preferable to salsify root.

Hospitals in Russia

A PAPER in the *British and Foreign Medical Review* of July 1837 on the present state of medicine and medical institutions in Russia by Dr. George Lefevre, late physician to the British Embassy at St. Petersburg, contains the following account of the hospitals in that country: "Although few countries can boast of finer institutions for the sick and infirm than Russia at the present day, it has nevertheless been the work of nearly two centuries to bring them to their actual state of perfection. Commenced by a private individual, whose example was soon followed by Government, they only began to have a character of importance under Peter the Great. . . . As regards the external appearance of the hospitals in Moscow and St. Petersburg, they are splendid in the extreme, resembling more the palaces of princes than the abodes of the sick. But it is of their discipline we have to speak, and many of the regulations of these institutions are worthy of imitation by similar establishments in other parts of Europe. One great advantage they possess over charitable institutions of a similar kind in England is the *daily* admission of patients, the vacant beds being immediately occupied by the most urgent cases. All applicants are not admitted indiscriminately into the General Hospitals; for there are others devoted to the reception of particular diseases, as eruptive fevers, venereal diseases, etc., and persons labouring under diseases which are considered incurable are not treated in the hospitals but are admitted to almshouses. . . . As regards the internal arrangements there is no cause for complaint. The wards are spacious and lofty, the beds not too much crowded together and cleanliness is carried to a point almost deserving of ridicule. . . . The most decided defect in all these institutions is a thorough disregard of ventilation."

The Botanical Society

At a meeting of the Botanical Society held on August 3, 1837, the secretary read a letter from the Botanical Institution of Brussels requesting it might be admitted into friendly correspondence with the Society. Mr. Dennes then read a paper entitled "Observations on the Structure and Germination of the Reproductive Organs of *Marsilea*". The paper was accompanied by a translation of a memoir on the same subject, made to the Paris Academy of Sciences by MM. Mirbel, Dutrochet and St. Hilaire. In *M. quadrifolia* (which much resembles our common trefoil, excepting in its petals being furnished with an additional leaf) there is apparently a longitudinal membranous partition, containing a number of cells each enclosing an hermaphrodite flower. The stamens of these flowers are stated by Jussieu, who was the first to examine the plant minutely, to be so small, and in such numbers, as to render it impossible to count them: they open transversely, to scatter the grains of the spherical yellow pollen. Convincing proofs were adduced from the researches of Dutrochet and St. Hilaire especially, that germination takes place by the impregnation of the ovules with the antheric dust, although this has been strongly opposed by other botanists, who keep all the species of *Marsilea* in the class Cryptogamia.

The *Athenæum* and Meteorology

In its issues of August 5 and 12, 1837, the *Athenæum* devoted several pages to an essay on meteorology, the subject being suggested by a review of two recently published works. The first of these was by Partick Murphy (1782-1847), and was entitled "Meteorology considered in its Connexion with Astronomy, Climate, and the Geographical Distribution of Animals and Plants". Of the author and this book the *Athenæum* said: "We state our firm conviction, that nothing but loss can be the result of his publishing such books as the one before us". Of the other book, Graham Hutchison's "Treatise on the Causes and Principles of Meteorological Phenomena" the reviewer remarked: "This is a sensible, well-executed compilation, interspersed with some new views and explanations of meteorological facts". The subject was one in which the *Athenæum* took a particular interest and at the beginning of the essay it said: "If there be one branch of science, more than another, which we have endeavoured to place prominently before the public, it has been Meteorology, because it appeared to us of great importance and to have been especially neglected".

The London Electrical Society

As a result of a resolution passed at a general meeting of the Electrical Society held on August 5, 1837, the Committee issued a report stating that the object for which the Society was formed, as stated in a resolution of May 16, 1837, would be fully carried into effect. The publication of papers had been deferred, as members had intimated their intention of presenting communications, after the recess, containing new facts in electrical science. Among the communications which had already been received was one from Andrew Crosse, of Broomfield, near Taunton, describing some results obtained by him in producing crystals by transferring the electrical energy from the zinc and copper plates to other substances not metallic in contact with them.

Societies and Academies

Paris

Academy of Sciences, May 31 (*C.R.*, 204, 1597-1692).

JULES DRACH: The logical integration of linear differential equations: the reduction of the group.

MARCEL DELÉPINE and ALAIN HOREAU: The catalysis of the Cannizzaro reaction by active nickel and platinum. The application to some aldoses. The conversion of an aldehyde into alcohol and acid by alkali (Cannizzaro reaction) is greatly accelerated by the addition of a catalyst, Raney nickel or platinum. Results are given for galactose, glucose and arabinose.

PAUL VINCENSINI: The reconstitution of the ensemble of convex bodies of n dimensional space starting from certain base sub-ensembles.

ARNAUD DENJOY: A theorem of Mandelbrojt.

JOSEPH CHALOM: Reaction pumps with supersonic flow.

ASSÈNE DATZEFF: The solution of Schrödinger's equation.

JEAN LOUIS DESTOUCHES: The relativistic wave mechanics of systems and the interaction of light and matter.

HENRI MINEUR: Clusters of stars in kinetic equilibrium.

PAUL BOURGEOIS and JACQUES COX: The frequency of the concentrations in extra-galactic nebulae detected by Hubble's tests.

LUCIEN D'AZAMBUJA: International co-operation for the continuous observation of the sun, and its first results. A summary of results obtained between July 1, 1935, and December 31, 1936. Study of the connexion between chromospheric eruptions and electrical and magnetic disturbances on the earth.

PIERRE VERNOTTE: How to formulate empirical laws. The exponential development.

HENRI LEMONDE: The interpretation of variations of viscosity with concentration in binary liquid mixtures.

RENÉ LUCAS: The thermal waves of liquids.

RENÉ PLANIOL: The application of molecular jets to the production of light ions.

JEAN P. E. DUCLAUX: The anodic polarization of tungsten. Study of the electrolysis of sulphuric acid with tungsten electrodes. The fall of current with time, due to the formation on the anode of a layer possessing a high resistance, depends on the condition of the surface, and is independent of the current.

VITOMIR H. PAVLOVIĆ: A new method for studying subjectively the mixture of colours.

MAURICE PARODI: Study of the transmission of some oxides in the extreme infra-red. Measurements for the oxides of manganese, strontium, cadmium and barium are given. The wave-lengths of the absorption bands plotted against the atomic number fall on a curve resembling a parabola.

HENRI BIZETTE and BELLING TSAI: The magnetic rotatory power of compressed and of liquefied nitric oxide, NO. The experimental results suggest that the molecules of nitric oxide commence to polymerize under high pressure at -80°C . From the Verdet constant at -163°C ., it is concluded that 93 per cent of the liquid is in the state of double molecules $(\text{NO})_2$, and this agrees with the results of Rice, based on the entropy of vaporization.

P. BONÉT-MAURY: The utilization of photo-elements with semi-conducting layer for radioactive measurements. Selenium or copper photo-cells,

irradiated with α - or β -rays, give rise to a difference of potential, exactly as with photons; the γ -rays have given no appreciable effect. The local variations of sensibility and the effects of fatigue of the element are more marked with α -rays than with photons.

MME. JULIETTE GAVORET: The quantitative study of the adsorption of metallic cations by cellulose. The iso-electric point of cellulose.

MLLE. SUZANNE VEIL: The potential gradient of gelatine under electromotive force.

CASIMIR JAUSERAN: The anomalies of the dispersion of light by colloidal solutions of silver. Although the heterogeneity of the medium studied produces special optical properties, its refractive index can be calculated utilizing for the dispersed metal the same optical constants as those of the metal in the massive state.

MLLE. MARIE THÉODORESCO: The study by the Raman effect of two molybdotartaric complex compounds in water. The results are in agreement with those found by the rotatory polarization, namely, the existence of two complex compounds, $\text{Na}_2(\text{TH}_2, \text{MoO}_3)$ and $\text{Na}_4(2\text{TH}_2, \text{MoO}_3)$.

CH. BEDEL: The determination of the solubility of slightly soluble electrolytes, precipitated and in the presence of their reaction products. Application to silver chloride.

MICHEL CYMBOLISTE: The structure of electrolytic chromium.

PIERRE MASTAGLI: The reducing and condensing action of alkaline benzylates on ketones and aldehydes, and on the α , β unsaturated alcohols.

MLLES. MARTHE MONTAGNE and MARGUERITE GARRY: The action of organo-magnesium compounds on the phenylimino derivatives of benzil.

CHARLES BOUHET: The Raman effect in circularly polarized light in quartz, observed along the optic axis.

LOUIS DUBERTRET: The constitution and genesis of the green Syrian rocks.

DANIEL BARBIER, DANIEL CHALONGE and ETIENNE VASSY: The variations of temperature of atmospheric ozone according to its origin.

JOSUÉ HEILMANN HOFFET: The genus *Trigonoides*, a stable genetic mutation of the genus *Trigonia*.

ANDRÉ EICHHORN: Chromosome enumeration and the study of mitosis in two *Crotalaria*.

JEAN TROCHAIN: A new graphical representation of the results of physical and granular analyses of the soil.

MME. MARGUERITE COMBES: The probable existence of a higher class, not differing in appearance, forming the true workers in the Formica.

TCHOU SU and CHEN-CHAO-HSI: A new Chinese race of *Ascaris megaloccephala* (type *trivalens*).

PIERRE P. GRASSÉ: Aberrant spermiogenesis of the Metatermitides.

JEHAN VELLARD: Geographical variations of the venom of the South American rattlesnake, *Crotalus terrificus*.

HENRI BIERRY: Protein sugar and blood proteins in the normal and pathological states.

V. A. KOSTITZIN: A generalization of the biological equations in the case of a population intoxicated by the products of its chemical activity.

JEAN LAVOLLAY and MME. FRANÇOISE LABOREY: The mathematical expression of the development of *Aspergillus niger* as a function of the concentration of magnesium of the nutritive medium.

MARIUS CHADEFAUD: The organization and the trichocytes of *Gonyostomum semen*.

HENRI SIMONNET, GUSTAVE GUITTONNEAU, GERMAIN MOCQUOT and ANDRÉ EYRARD: The influence of pasteurization in the absence of air on the nutritive value of milk. The experiments described lead to the conclusion that pasteurization in the absence of air is not incompatible with the preservation of the essential nutritive qualities of milk.

Amsterdam

Royal Academy (*Proc.*, 40, No. 6, June 1937).

L. S. ORNSTEIN: Scattering of neutrons in matter (5). A discussion of the distribution of the directions of motion of neutrons scattered by protons.

J. A. SCHOUTEN: The differential geometry of the groups of contact transformations (3). Infinitesimal doubly homogeneous contact transformations and their applications to mechanics and electrodynamics.

F. M. JAEGER, J. A. BOTTEMA and E. ROSENBOHM: Exact measurement of the specific heats of metals at high temperatures (28). The heat capacity and the electrical resistance of didymium between 300° and 600° C.

F. M. JAEGER and J. TER BERG: On pterotactic derivatives of bivalent platinum with optically active cyclic trans-1.2 diamines.

A. G. VAN VEEN and J. K. BAARS: Constitution of toxoflavin. This substance, produced by the action of *Bacterium cocovenenans*, is a di-imine containing the purine skeleton and is isomeric with methyl-xanthine.

O. POSTHUMUS: Some remarks on the vegetation on the sandy soil of the Pandang Loewai (E. Koetai, E. Borneo).

S. W. VISSER: A period of twenty-seven months in the rainfall throughout the world.

W. B. DEYS and M. J. DIJKMAN: Splitting off of gallic acid from tannin, especially from theotannin by *Aspergillus niger*.

M. J. ADRIANI: Transpiration of some halophytes cultivated in various media in comparison with that of some non-halophytes.

H. J. HARDON: Padang soil, an example of podsol in the tropical lowlands.

G. C. HIRSCH and R. F. J. VAN PELT: Rhythm of the glycogen content of the liver of the white mouse.

M. J. L. DOLS, B. C. P. JANSEN, G. J. SZOO and J. DE VRIES: Studies on phosphorus metabolism in normal and rachitic rats with a radioactive phosphorus isotope (see also NATURE, June 19, p. 1068).

J. J. DUYVENÉ DE WIT: Biological evidence of two new hormones by tests on *Rhodeus amarus*.

Cape Town

Royal Society of South Africa, May 19.

K. F. M. BRIGHT: The South African inter-tidal zone and its relation to ocean currents. (2) An area on the southern part of the west coast. (3) An area on the northern part of the west coast.

R. F. LAWRENCE: The odoriferous glands of South African harvest spiders. The external appearance of the odoriferous glands in some South African harvest spiders is described, as well as the colour, volatility, and smell of the secretion of the glands. The activity of the glands is considerably more marked in the large group of Laniatores, some members of which expel the secretion in the form of a fine jet. The ejection of an evil-smelling substance is most probably a defence reflex in this group of Arachnida.

Appointments Vacant

APPLICATIONS are invited for the following appointments, on or before the dates mentioned :

ASSISTANT LECTURER IN ZOOLOGY in the University College of North Wales, Bangor—The Registrar (August 7).

TEACHER OF ENGINEERING in the Oxford Schools of Technology, Art and Commerce—The Chief Education Officer, City Education Office, 77, George Street, Oxford (August 14).

LECTURER IN MECHANICAL ENGINEERING in the Coventry Technical College—The Director of Education, Council House, Coventry (August 23).

JUNIOR METALLURGIST for the British Non-Ferrous Metals Research Association—The Secretary, Regnart Buildings, Euston Street, N.W.1.

Official Publications Received

Great Britain and Ireland

Report on the Progress of the Discovery Committee's Investigations. Pp. 52+11 plates. (London: Colonial Office.) 3s. 6d. net. [116]

Department of Scientific and Industrial Research. Report of the Road Research Board, with the Report of the Director of Road Research, for the Year ended 31st March 1936. Pp. viii+136+9 plates. (London: H.M. Stationery Office.) 2s. 6d. net. [146]

Forestry Commission. Bulletin No. 18: Spring Frosts, with Special Reference to the Frosts of May 1935. Pp. 131+12 plates. (London: H.M. Stationery Office.) 2s. 6d. net. [146]

Carnegie United Kingdom Trust. Twenty-third Annual Report, January-December 1936, approved by the Trustees at their General Meeting held on Friday, March 5th, 1937. Pp. vi+105+18 plates. (Dunfermline: Carnegie United Kingdom Trust.) [146]

Nutrition and Health. (Gabrielle Howard Memorial Lecture.) By Sir Robert McCarrison. Pp. 26. (London and Ashford: Headley Bros.) 6 copies, 1s. [156]

University of Oxford: Committee for Advanced Studies. Abstracts of Dissertations for the Degree of Doctor of Philosophy. Vol. 9 (Dissertations accepted during 1936). Pp. v+272. (Oxford: Clarendon Press; London: Oxford University Press.) 3s. net. [156]

The Animal Year Book. Vol. 4. Edited by Dr. H. E. Bargmann. Pp. vi+174+10 plates. (London: University of London Animal Welfare Society.) 2s. 6d. [166]

Secondary School Examinations and the Curricula of Secondary Schools, with Suggestions for Reform. An Address delivered to the Higher Education Meeting at the Portsmouth Conference of the N.U.T., 1937, by Sir Philip Hartog. Pp. 34. (London: National Union of Teachers.) Free. [166]

Proceedings of the Royal Society of Edinburgh, Session 1936-1937. Vol. 57, Part 2, No. 14: The Genetical and Mechanical Properties of Sex Chromosomes. 3: Man. By Dr. P. C. Koller. Pp. 194-214+2 plates. 2s. 3d. Vol. 57, Part 3, Nos. 15, 16: Quantitative Evolution. 2: Composite Dp-ages in relation to Time; 3: Dp-ages of Gramineæ. By Prof. James Small. Pp. 215-227. 1s. Vol. 57, Part 3, No. 17: Tests for Randomness in a Series of Numerical Observations. By Dr. W. O. Kermack and Lieut.-Col. A. G. McKendrick. Pp. 228-240. 1s. (Edinburgh: Robert Grant and Son, Ltd.; London: Williams and Norgate, Ltd.) [186]

List of 16 mm. Science Films. Pp. 26. 4d. List of 16 mm. Geography Teaching and Travel Films. Pp. 38. 6d. List of 16 mm. History Films. Pp. 6. Free. Supplementary Catalogue of British Medical Films of Technical Interest to Medical Practitioners and Students, Jan. 1936-Jan. 1937. Pp. 16. 6d. (London: British Film Institute.) [17]

Technical Publications of the International Tin Research and Development Council. Series B, No. 4: The Decoration of Tinsplate by Printing and Varnishing. By W. E. Hoare. Pp. 24+3 plates. (London: International Tin Research and Development Council.) Free. [27]

Rubber Growers' Association. Rubber and Agriculture Series, Bulletin No. 7: Modern Equipment for the Poultry Farm. By Alexander Hay and D. F. C. Vosper. Pp. ii+14. (London: Rubber Growers' Association.) Free. [27]

Scientific Proceedings of the Royal Dublin Society. Vol. 21 (N.S.), No. 48: Report of the Irish Radium Committee for the Year 1936; including Reports from St. Anne's Hospital, Dublin, and by Oliver Chance and Oswald J. Murphy. Pp. 541-555. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.) 1s. [57]

Board of Education. Educational Pamphlets, No. 109: Physical Education in Germany. Pp. 80. (London: H.M. Stationery Office.) 1s. net. [67]

The Strangeways Research Laboratory, Cambridge. Report for 1936. Pp. 24. (Cambridge: Strangeways Research Laboratory.) [67]

British Wood Preserving Association. Circular No. 1: The Preservative Treatment of Estate and Farm Timber. By R. C. B. Gardner. Second edition. Pp. 36+2 plates. (London: British Wood Preserving Association.) 6d. [87]

Royal Society for the Protection of Birds. Forty-sixth Annual Report, January 1st to December 31st, 1936; with Proceedings of Annual Meeting, 1937. Pp. 116. (London: Royal Society for the Protection of Birds.) 1s. [87]

Come to Crook. Pp. 16. (Crook: Crook Development Committee.) [87]

Other Countries

Spisy vydávané Pffrodovědeckou Fakultou, Masarykovy University. Čís. 230: Cauchyův problém pro diferenciální rovnice lineární (Le problème de Cauchy pour les équations différentielles linéaires). Napsal B. Hostinský. Pp. 12. Čís. 231: Über zwei neue Phosphatvorkommen in Mähren (Nové nálezy fosforečnanů na Moravě). Von Josef Sekanina. Pp. 9. Čís. 232: Tvorba soli kyseliny 1-amino-anthrachinon-2-karbonové (Salzbildung der 1-amino-anthrachinon-2-karbonové), napsali J. V. Dubský, M. Hrdlička a K. Štěpán; Tvorba soli kyseliny sulfonových R.SO₃H (Salzbildung der Sulfonsäuren R.SO₃H), napsali J. V. Dubský a E. Oravec. Pp. 16. Čís. 233: Contributions à la théorie polaire d'une variété cubique dans l'espace à quatre dimensions, I (Příspěvky k polární teorii kubické variety ve čtyřrozměrném prostoru, I). Par Ladislav Seifert. Pp. 15. Čís. 234: O difusních potenciálech, 3 (On the Diffusion Potentials, 3). Napsal V. Čupr. Pp. 16. Čís. 235: Contributions à la théorie polaire d'une variété cubique dans l'espace à quatre dimensions, 2 (Příspěvky k polární teorii kubické variety ve čtyřrozměrném prostoru, 2). Par Ladislav Seifert. Pp. 9. Čís. 236: La cas discontinu des probabilités en chaîne. Par Wolfgang Doeblin. Pp. 13. Čís. 237: O difusních potenciálech, 4 (On the Diffusion Potentials, 4). Napsal V. Čupr a K. Marek. Pp. 15. Čís. 238: Příspěvek k poznání květeny Československé, 2 (Ad floram Českoslovaciam additamentum, 2). Napsal Vlad. Kríst. Pp. 17. Čís. 239: Eine neue Trissocladusart (Nový druh rodu Trissocladus Kieff.). Von Jan Zavřel. Pp. 12. (Brno: A. Píša.) [226]

Ministry of Commerce and Industry, Egypt: Fisheries Research Directorate. Notes and Memoirs, No. 14: The Tow-Net Plankton of Lake Qarun, Egypt, December 1930 to December 1931. By R. S. Wimpenny and E. Titterton. Pp. ii+57. Notes and Memoirs, No. 18: The Fishery Grounds near Alexandria. 10: Amphipoda Benthonica. By A. Schellenberg. Pp. 27. Notes and Memoirs, No. 19: Les fonds de pêche près d'Alexandrie. 11: Annélides polychètes. Par Prof. Pierre Fauvel. Pp. 60+2 plates. Notes and Memoirs, No. 20: The Fishery Grounds near Alexandria. 12: Insecta, Araneida, Pseudoscorpionidea. By Adolf Steuer. Pp. 9. Notes and Memoirs, No. 22: The Fishery Grounds near Alexandria. 14: Phytoplankton from the Nile. By H. Bachmann. Pp. 2+2 plates. Notes and Memoirs, No. 27: Vitellogenèse chez *Solea vulgaris* (Quensel) et quelques espèces voisines. Par H. Faouzi. Pp. 5+12 plates. Notes and Memoirs, No. 29: A Chemical Study of the Egyptian Sardiniella. 1: Variation in the Fat Content of Whole Fish, Flesh and Gonads. By Dr. M. K. El Saby. Pp. 25. (Cairo: Government Press.) [17]

University of Colorado Studies. Vol. 24, Nos. 3 and 4: The Colorado Labor Market and its relation to Unemployment Compensation. By Edward Robert Livernash. Pp. iii+127-194. (Boulder, Colo.: University of Colorado.) 2 dollars. [27]

The Sixty-fifth Annual Report of the Board of Directors of the Zoological Society of Philadelphia. Pp. 72. (Philadelphia: Zoological Society of Philadelphia.) [27]

Department of Commerce and Industries: Fisheries and Marine Biological Survey Division. Investigational Report No. 7: Black Bass in the Cape Province. Second Report on the Progress of American Large-mouth Black Bass (*Micropterus salmoides*, Lacépède). By A. Cecil Harrison. Pp. 119+3 plates. 2s. 6d. Investigational Report No. 8: Savings-Trawl Investigations in South African Waters during 1935. By J. M. Marchand and W. Taylor. Pp. 31+10 plates. 1s. (Pretoria: Government Printer.) [27]

U.S. Department of Agriculture. Circular No. 422: Biology of the Tobacco Moth and its Control in Closed Storage. By W. D. Reed and E. M. Livingstone. Pp. 39. (Washington, D.C.: Government Printing Office.) 10 cents. [27]

U.S. Department of the Interior: Office of Education. Bulletin, 1937, No. 4: Conservation in the Education Program. By William H. Bristow and Katherine M. Cook. Pp. v+78. 10 cents. Pamphlet No. 74: Crucial Issues in Education. By J. W. Studebaker. Pp. iii+19. 5 cents. (Washington, D.C.: Government Printing Office.) [27]

Conseil Permanent International pour l'Exploration de la Mer. Rapports et procès-verbaux des réunions. Vol. 102: Scientific Report of the Baltic Transition Area Committees; Foreign Guests in the Baltic and Transition Areas. Compiled by K. Andersson and H. Blegvad. Pp. iv+118. 6.00 kr. Vol. 103: Critical Review of the Methods used for determining the Nutrient Salts and related Constituents in Salt Water. By H. Wattenberg. Pp. 33. 2.00 kr. Vol. 104: Rapport Atlantique 1934-1936. Publié avec l'aide de Dr. Ed. Le Danois et Rafsæl De Buen. Pp. 37. 2.00 kr. (Copenhagen: Andr. Fred Hest & fils.) [27]

Bulletin of the Madras Government Museum. New Series, Natural History Section, Vol. 1, No. 2, Part 3: Scyphomedusæ of Krusadai Island. By M. G. K. Menon. Pp. 10+1 plate. 8 annas. New Series, Natural History Section, Vol. 3, No. 5: Decapod Larvæ from the Madras Plankton. By M. Krishna Menon. Pp. 56+9 plates. 1.14 rupees. (Madras: Government Press.) [27]

Ingeniørvidenskabelige Skrifter. Nr. A44: The Metallurgy and Technology of Gold and Platinum among the Pre-Columbian Indians. By Paul Bergsøe. English translation by F. C. Reynolds. Pp. 45+4 plates. (København: G. E. C. Gad.) 2.00 kr. [27]

Report and Accounts of the National Botanic Gardens of South Africa, Kirstenbosch, Newlands, Cape, (and the Karoo Garden, Whitehill, near Matjiesfontein), for the Year ending 31st December 1936. Pp. 28. (Kirstenbosch: National Botanic Gardens of South Africa.) [57]

Indian Central Cotton Committee: Technological Laboratory. Technological Bulletin, Series A, No. 37: Further Tests on Indian Cottons with Different Systems of High Draft Spinning. By R. P. Richardson and Dr. Nazir Ahmad. Pp. ii+23. (Bombay: Indian Central Cotton Committee.) 1 rupee. [57]

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Denjoy, Arnaud. Ensembles et fonctions. 1: Introduction à la théorie des fonctions de variables réelles. Première partie: Aperçu historique, géométrie des ensembles cartésiens fonctions, continuité et convergence, dérivation. Roy. 8vo. Pp. 56. 12 francs. Deuxième partie: Intégration, séries trigonométriques, fonctions quasi-analytiques, fonctionnelles et fonctions d'ensemble. Roy. 8vo. Pp. 58. 12 francs. (Actualités scientifiques et industrielles, 451, 452.) (Paris: Hermann et Cie., 1937.)*

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Dodge, Russell A., and Thompson, Milton J. Fluid Mechanics. Med. 8vo. Pp. xi+495. (New York and London: McGraw-Hill Book Co., Inc., 1937.) 24s.*

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