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Culture and Policy in Basutoland

AMONG the simpler peoples, we are told by members of the functional school of anthropological thought, no element of culture can be studied apart from its social context. This axiom, writ large, is the theme of the report of the Commission* appointed by the Secretary of State for Dominion Affairs to inquire into the financial and economic position of Basutoland, of which Sir Alan Pim was chairman and Mr. S. Milligan, representative in South Africa of the Cotton Growing Corporation, and Mr. H. Lesley Smith were the members (see *NATURE*, June 22, p. 1028). Throughout the report, it is evident that the members of the Commission were deeply impressed by the interlock of social and cultural conditions with those of the financial and economic position, present and future, and by the complete dependence of the political and social advancement of the community as a whole on a harmonious adjustment between such of them as will tend to conflict when faced with change; and in effect, as their final analysis of the situation, the conclusion is stressed that failure to guide the cultural and ethnic characteristics of the Basuto nation into a path which will open the way for a progressive policy, will lead to complete political and cultural breakdown. Basuto society, as at present organised, according to the Commission, is unable to adjust itself to meet the economic strain.

It is a remarkable symptom of the sensitiveness of the modern world as a whole to the influences affecting any one of its parts in any serious degree, that the economic depression which has crippled the more advanced civilisations has not passed by the backward peoples. Over-production

* Financial and Economic Position of Basutoland: Report of the Commission appointed by the Secretary of State for Dominion Affairs, January, 1935. Pp. viii+225. (London: H.M. Stationery Office, 1935.) 3s. 6d. net.

and unemployment find their counterpart in the relatively more primitive communities, though not always recognisable as such when translated into terms of non-European culture. Among the pastoral and semi-pastoral Bantu peoples of Africa, especially in the south of the continent, overstocking of the pastoral lands, made possible by the extra-territorial employment of labour, takes the place of the over-production and maldistribution of commodities, while the social consequences of unemployment find their parallel in the effects of the shortage of cultivable land, which bars an appreciable number of the members of the tribe from full participation in the organisation of the community, owing to the lack of the 'lands', which a man is eligible to hold for cultivation on marriage as an essential concomitant of family life.

It is to be noted, however, that the depression is not entirely responsible for this state of affairs. Rather, it has aggravated a situation which has grown out of certain characteristics of Bantu culture. These tend to give rise to difficulties, which become acute when brought into touch with modern economic conditions, especially the employment of native labour at a remuneration, and the introduction of an effective system of administration, eliminating such checks on over-population and its consequences as warfare and freedom of movement, which mitigated these evils under the old tribal regime.

In all three of the South African Protectorates, the financial and economic outlook is grave. Basutoland, though by no means in such serious straits as Bechuanaland, has almost entirely dissipated its financial reserves, accumulated in a period of prosperity, through the measures of

relief which have been necessitated by the fall in the value of its exports of wool, which now stands at less than a third of what it was a few years ago and will fall still lower, and the effects of a two years' drought. The seriousness of the crisis may be gauged by the fact that not only the holdings of sheep, but also the stocks of cattle, the most essential possession of Bantu culture, have shrunk to one half in this time of distress. This catastrophe, however, is by no means an unmitigated misfortune. It has, to some extent, though not entirely, automatically relieved the over-stocking of the pasture land. A further relief has come with the rains. But neither the rapid recovery of vegetation, notwithstanding the onslaughts of the locust, nor the nearer adjustment of stock to the carrying capacity of the land—possibly temporary and pending the return to individual prosperity—will afford any substantial help towards the solution of the problems of Basutoland's future economic and financial stability. The causes are more deeply rooted.

Basutoland, which is one of the most pleasant, is also in part one of the most thickly populated areas of South Africa. Occupation is, or was, confined almost exclusively to the lowlands, which in the semi-pastoral, semi-agricultural economy of the Basuto are mostly under cultivation. The hill regions are devoted to seasonal grazing. In recent years, however, scattered villages have begun to appear in the uplands, though owing to the consequent reduction of pasture and other evils, these settlements have been forbidden by the Paramount Chief. This veto to a certain extent has been ignored.

In a little less than forty years, the population of Basutoland has more than doubled. It is now estimated to stand at 570,000. This is not entirely a natural increase. There has been a considerable immigration of Tembus from the Union, their accession increasing the prestige of the chief. The Basuto, like a number of other Bantu peoples of South Africa, such as the Matabele, came into independent existence during the troubled times of the beginning of the nineteenth century. Unlike others, however, they were not a single tribe or a homogeneous group, but a congeries of unrelated groups, who gradually came to form a confederation under the Bakwena, or "People of the Crocodile", and were moulded into a nation under the prolonged rule of Moshesh (*reg.* 1815-70). Further, throughout their relations with the whites, they were never subdued, but maintained their in-

dependence. These are crucial facts in determining the character of present problems and the method to be adopted in the approach to their solution. The dominance of the Bakwena has by now, for the most part, eliminated the original tribal chiefs, and through the system of 'planting out' the younger sons of chiefs as subordinate chiefs, each with a court, a chief's holding of land, and a revenue dependent on fines, has produced a complicated and ever-increasing system of chiefs and jurisdictions of which the possibilities of abuse are obvious, especially as these petty chiefs have acquired a taste for the luxuries of modern civilisation, such as the motor-car, which their legitimate financial resources scarcely permit them to gratify. One serious defect of the system is that it has gravely affected the security of land-tenure, as the land, which in theory belongs to the Paramount Chief as trustee for his people and is at his disposal, may be required at any time for the settlement of a new chief.

As a result of their past history, both chiefs and people are acutely conscious of their independence, and although the people are by no means satisfied under the multiplicity of chiefs and fully alive to the defects of character and weaknesses of individual chiefs, they are intensely loyal to the chieftainship as an institution. Any change of custom, however advantageous, would meet with serious resistance, if it were held to be an encroachment on their independence or the prerogative of the chief.

Such interference is clearly foreshadowed in the far-reaching recommendations of the Commission. Although administration as such does not come within its province, the members have accepted the position that custom, social organisation and financial and economic stability are so closely interrelated, that if the reforms which they consider essential are to be carried out with financial assistance from outside, administrative changes and cultural modifications are essential which will necessitate a drastic change in what has hitherto been a policy of non-interference in internal affairs—of protection without control.

The three elements in Basuto culture, which thus insistently demand attention—the position and authority of the chief, the holdings of stock and the system of land tenure—are everywhere among the Bantu crucial problems of administration. In Basutoland these elements in culture, operating without check in certain directions, have reinforced the natural tendency of the

country to surface erosion and thereby added to the difficulty of the social and economic situation. This applies more particularly to overstocking and the consequent overgrazing, and to the breaking up of the upland pastures for cultivation, owing to the shortage of 'lands' in the lowlands. The removal of the natural protection of the surface soil by these agencies destroys fertility and leaves the land a prey to weeds. The evil is progressive; and the elements in culture which have aggravated the trouble are, as indicated, equally an obstruction in the way of remedial measures. Even if the country had the requisite financial resources, the essential reorganisation for reform of practice is beyond the competence of existing authority. The policy of non-interference is plainly no longer in the interest of the Basuto nation or its future as an integral part of South Africa.

Of possible alternatives, the Commission favours the introduction of a real and effective system of 'indirect rule', operating through a reformed chieftainship and based upon the intense loyalty of the people to the institution of the chieftainship.

Only thus, the Commission holds, will it be possible to put into operation measures to check progressive deterioration in the economy of the Basuto and set them on the way to a return to the prosperity which they enjoyed up to a few years ago.

The report of the Commission is neither concerned with nor mentions the question of the future of the Protectorate in its specific relation to the Union of South Africa. On this aspect the recently published White Paper (see *NATURE*, July 20, p. 96) has cleared the air by its insistence on the necessity for a breathing space to allow a policy formulated in the interest of the native to come to fruition. Not only does it reaffirm the obligation of the British Government to consult the native population of Basutoland, as well as of the other Protectorates, before steps are taken to effect their transfer to the Union, but also it invites the co-operation of the Union Government in the next few years in a policy which will convince the native population of "a real and generous desire to improve conditions in the Territories".

Minerals and International Security

The Mineral Sanction as an Aid to International Security

By Sir Thomas H. Holland. Pp. 96. (Edinburgh and London: Oliver and Boyd, 1935.) 2s. net.

THIS interesting little book appears at an opportune moment. Books on international affairs are indeed numerous, and we have plenty of books on minerals; but minerals in relation to international security, and a thesis that the war-like disposition of an aggressor nation can be and should be held in check by a sanction based on mineral supplies, is a fairly new theme, a consideration of which serves to show how vitally necessary for war purposes, as well as for industrial purposes, mineral supplies really are. So long ago as 1929, Sir Thomas Holland discussed the suggestion in his presidential address at the meeting of the British Association in South Africa.

Minerals indeed, as the very stuff of the earth, are fundamental substances. Man has long used the metals, but not until the industrial era did he begin to develop their specialised uses for the purposes that fill so important a place in modern industry. The utilisation of iron and steel at the present day involves the use of a number of alloy

metals, including manganese, chromium, nickel, cobalt, tungsten, molybdenum and vanadium, without access to which the metallurgy of iron as we now know it would not be practicable. Iron and the ferro-alloy metals are essential as munitions of war. So are aluminium, antimony, copper, lead, quicksilver, tin and zinc, and some of the more important non-metals, including fluorspar, graphite, magnesite, mica, petroleum and sulphur. All these minerals are briefly and simply accounted for in Part 3 of this book, in which a short account is given of their importance as war materials.

In Part 2 an account is given of the mineral position in each of the important industrial countries, including the United States, Great Britain, France, Germany, Italy, Japan and Russia, showing with which of the important minerals and metals these countries are well supplied and those in which they are deficient.

The British Empire is well equipped with minerals as a whole, but constituent countries considered separately are seriously deficient. The United States, considered as a geographical unit, is better provided for than any other country as regards war minerals. France, Germany, Italy and Japan each has a long list of war minerals

for supplies of which it is dependent on imports. Russia has large but imperfectly developed resources; and although it is somewhat uncertain how she stands as regards home supplies of many important minerals at present, she has undoubtedly large potentialities.

In an introduction Sir Thomas Holland states his thesis, and in Part I he gives an account of the origin and nature of the scheme for mineral sanctions for war conditions. Briefly, the position is that Article XVI of the League of Nations Covenant has proved unworkable. It is therefore suggested that an agreement among the nations to refuse supplies of war minerals to an aggressor would provide a suitable and practicable means of restraining any industrialised power that might wish to resort to war, as war could not be carried on for long without such supplies, and no country is self-contained in this respect.

Sir Thomas claims for this mineral sanction that it can be put into operation immediately, and that it will be so effective that no refractory nation will run the risk of losing by war what might be obtained without, if its cause be just, in the International Court of Justice.

Such is the mineral sanction, about which no doubt much argument is possible. The pressing

fact before the world to-day, however, is that war is very much in the air and aggressors are on the move. Whether there be any justification for this aggressiveness leaves unaltered the fact that the world cannot be made safe for civilisation and ordered development unless the policy of settling international disputes by resorting to war be abandoned. There lies, therefore, upon the Governments of the world and on the League of Nations, the big responsibility of exploring fully the possibilities of any suggestions that may be made to secure the desired object of seeking a safe basis for world progress, and for that reason no doubt every attention will be given to the consideration of this mineral sanction in order to ascertain its possibilities as a scheme for preventing wars. Certain it is that the days of cheap mineral supplies, as we have hitherto known them, are numbered; and unless Governments plan hard and co-operatively to secure safe conditions for the world's development, without the hindrances and waste that war involves, industrial civilisation as we know it will go to pieces.

As a clearly and simply written account of the bearing of mineral supplies on the problem of international security, this book deserves to be widely read.

Equivalence of the Sexes

Man and Woman:

a Study of Secondary and Tertiary Sexual Characters. By Havelock Ellis. Eighth edition, revised. Pp. vii+469. (London: William Heinemann (Medical Books), Ltd., 1934.) 10s. 6d. net.

MR. ELLIS suggests in his preface that this book, first published in 1894, may be thought by some to have no longer a useful purpose to serve, as it is supporting a conception towards which general opinion has been moving, that of "the entire equivalence of the sexes". The movement has not, however, been sufficiently rapid to make anything but desirable the preparation of this new and considerably modified edition, with its impartial and critical survey of observations made in many different parts of the world. These have confirmed the author's original view that "the sexes are perfectly poised in complete equivalence".

Sex, it is now generally held, is settled at the moment of fertilisation. With its determination comes not only a development of the gonad-containing organs and of the external structures

connected with their functions, but also an interaction of the various endocrine glands which give rise to the distinctive secondary and tertiary sexual characters.

In some directions undoubted differences in these qualities can be established, but even when they are, it is not easy to arrive at the significance of the facts. Readers who look for evidence as to the superiority or inferiority of one of the sexes over the other may not appreciate this book, as very little support is given to either view. In fact, the fallacies inherent in many arguments that have sustained the extremist partisans are clearly and sometimes amusingly exposed.

In the chapter on the head it is shown that many familiar arguments have to give way before a closer and more critical investigation of the evidence. An entertaining illustration of the fitting of fact to theory is met with in the varying statements as to the relative proportions of the frontal and parietal lobes in the female brain. When the frontal lobes were regarded as the seat of the higher mental qualities, evidence accumulated to show that in the female brain the frontal

lobes were small and the parietal large. When further observation gave the parietal lobes pride of place, corrections were soon forthcoming to show that it was the parietal lobes that were smaller. The female brain is certainly on the average absolutely smaller than the male brain, but proportionately to the general body weight it appears to be relatively larger. As for the differences in shape and size of the skull, the author's final summing up is that "It is open to a man in a Pharisaic mood to thank God that his cranial type is far removed from the infantile. It is equally open to a woman to be thankful that her cranial type does not approach the senile."

The difference in muscular strength, now more or less accurately measured as being in the proportion of three to two as between men and women, seems to have been the basis of wages paid to men and women long ago. Records from Suffolk in 1682 give the wages for haymakers as 5*d.* and 3*d.* a day (with meat and drink) for men and women respectively, though for piece work the pay received was generally the same, so that there was no attempt to underpay women as women.

'Affectability', or the quality of responding readily to psychic or physical stimuli, is said to be more highly developed in women than in men, hence also irritability. The neuro-muscular form

of this is, Mr. Ellis thinks, relieved by muscular activities such as dancing. Perhaps in this is seen the reason for the liking many women have for knitting or other forms of handwork. Comparisons of the relative delicacy of the senses give some unexpected results, and consideration of the intellectual and industrial aptitudes also leads to interesting and somewhat unusual conclusions.

There is a wealth of material in this book, so impartially presented that very rarely can a different interpretation of the facts available be suggested. The wisdom, the ripe experience and the humanity of the author are shown throughout the book, which should be widely read. He will carry most of his readers with him in the conclusion that "a cosmic conservatism does not necessarily involve a social conservatism". With regard to changes taking place to-day in the relation of the sexes he says: "An exaggerated anxiety lest natural law be overthrown is misplaced. The world is not so insecurely poised. We may preserve an attitude of entire equanimity in the face of social readjustment." If his scientific attitude of mind towards social conditions could be made to prevail widely, there would be less anxiety and more equity in social life to-day, and the world would be a saner and more tolerant place in which to live.

Physics in Chemistry

Hand- und Jahrbuch der chemischen Physik
Herausgegeben von A. Eucken und K. L. Wolf.
Band 1, Abschnitt 1: Theorien des Aufbaues der Materie. 1: Die Grundlagen der Quantentheorie. Von H. A. Kramers. Pp. 222. 18 gold marks.
Band 6, Abschnitt 2: Elektrische Leitfähigkeit. A: Gase, von W. Hanle; B: Flüssigkeiten und Lösungen, von H. Ulich; C: Nichtmetallische Kristalle, von W. Flechsig. Pp. xii+342+18. 32 gold marks.
Band 6, Abschnitt 3: Positive Korpuskularstrahlen. A: Verhalten von Alpha-Strahlen beim Durchgang durch Materie, von H. Pose; B: Kanalstrahlen und ihre Wechselwirkung mit Materie (einschliesslich Massenspektroskopie), von R. Wierl. Pp. 284+10. 40 gold marks.
Band 9: Die Spektren Entstehung und Zusammenhang mit der Struktur der Materie. Abschnitt 1: Atomspektren. Von H. Kuhn. Pp. vi+266. 26 gold marks. (Leipzig: Akademische Verlagsgesellschaft m.b.H., 1934.)

THE enormous advances in physics and chemistry in the last few years have rendered it imperative that reliable and readable descriptions

of particular aspects of these branches of science should be readily accessible. Consequently, there have recently appeared many treatises on special branches and one or two monumental handbooks dealing with the whole of experimental and theoretical physics. Few of these works, however, attempt to set forth the results of modern physics with what may be termed a chemical bias.

The new "Hand- und Jahrbuch der chemischen Physik", edited by Eucken and Wolf, is an attempt to present the material in a way which makes it appeal more directly to chemists. However, the complete series of important contributions to the literature of physics and physical chemistry which will soon be available, and of which some portions are now under review, will appeal to physicists who wish to study much that is already familiar to them from another point of view.

The first volume, on the theories of the structure of matter, is opened by a very full discussion of the fundamental bases of the quantum theory, contributed by Kramers. Although this rigorous introduction is provided for readers more immediately

concerned with the mathematical aspects of the subject, it must not be assumed that no provision is made for the reader whose mathematical equipment is limited, and a short but fairly complete exposition of the main conceptions and methods of the new quantum theory is provided in Kuhn's book on atomic spectra. Incidentally, the latter also contains a concise introduction to experimental spectroscopy, a very lucid account of spectra and of individual lines, and an unusually clear account of X-ray spectra.

The section by Pose on the passage of α -rays through matter is excellently illustrated, and gives a comprehensive survey of the subject. It will appeal to many who are well acquainted with the excellent English treatises on radioactivity, for it contains much Continental work which is known in England only to the specialist, and the results of experiment are compared with the predictions of modern theory in a very delightful manner.

Hanle's discussion of electrical discharges in gases is remarkable for the way in which the

phenomena of the self-maintained discharge are dissected and described, and the inclusion of an extensive treatment of all the problems of ionisation processes in gases. It would seem, however, that the description of experimental determinations of ionic mobilities has been unduly curtailed.

Ulich's section on the conduction of electricity by liquids will be found most helpful by those who wish to learn as quickly as possible the nature of recent developments, for it contains much information which is not readily accessible elsewhere, and at the end of his section he gives a summary of results and indicates the paragraphs where particular pieces of information may be found. Considerable attention is devoted to solvation numbers, and the results of five different methods of measuring hydration numbers are discussed. Flechsig's section on the conduction of electricity by non-metallic crystals is equally interesting.

All the books under notice clearly indicate how important an addition to the literature of science the new venture is likely to prove.

The Foundations of Mathematics

Grundlagen der Mathematik

Band I. Von D. Hilbert und P. Bernays. (Die Grundlehren der mathematischen Wissenschaften in Einzeldarstellungen mit besonderer Berücksichtigung der Anwendungsgebiete, herausgegeben von R. Courant, Band 40.) Pp. xii + 471. (Berlin: Julius Springer, 1934.) 37.80 gold marks.

THAT the foundations of mathematics are important is a proposition which will find few opponents, for the science of mathematics is commonly regarded as man's securest intellectual possession. What constitutes these foundations is a subject on which agreement has not been reached. There are, however, three main directions into which the body of modern research has branched, namely, the logistic, the intuitionistic and the formalistic theories. Broadly speaking, the logistic theory regards mathematics as a branch of logic, the intuitionistic theory regards the theorems of mathematics as having actual significance, the formalistic theory regards mathematics as devoid of meaning *per se*. The most powerful exponent of the formalistic attitude is Hilbert, and the present volume is the first part of a systematic exposition of mathematical foundations from the point of view of the school of thought which he has founded. This is probably the most important book on mathe-

matical foundations which has appeared since Whitehead and Russell's "Principia Mathematica".

Hilbert gives the name *Beweistheorie* or 'theory of demonstrations' to his method. The term 'Metamathematics' is also used. The fundamental ideas of the *Beweistheorie* are the following.

(1) The subject matter of mathematics consists of concrete symbols (*Zeichen*) which are immediately recognisable, in fact, the marks on paper which the mathematician habitually uses.

(2) The theorems of mathematics are replaced by formulæ by means of the logical symbols

\rightarrow , & , \vee , $-$, (x) , (Ex)
 (implies) (and) (or) (not) (all) (some).

(3) Certain formulæ are set up as axioms.

(4) A demonstration is a 'figure' consisting of inferences made by means of the inference scheme

$$\frac{\begin{array}{c} \mathfrak{S} \\ \mathfrak{S} \rightarrow \mathfrak{I} \end{array}}{\mathfrak{I}}$$

where each of the premisses \mathfrak{S} , $\mathfrak{S} \rightarrow \mathfrak{I}$, must arise (if necessary by substitution) from an axiom or the end-formula of a demonstration.

Axioms and end-formulæ of demonstrations are called 'demonstrable formulæ'.

The procedure just outlined leads to a purely formal mathematics, which contains formal rules of demonstration but is incapable of making significant logical inferences. In particular, that a formula which has the form of a contradiction cannot arise among demonstrable formulæ is incapable of formal proof since formal mathematics does not contain such a significant proposition. That a system of axioms should not lead to contradiction is, however, an essential point, and it is here that the essence of the *Beweistheorie* lies. Hilbert therefore adjoins:

(5) Parallel to mathematics we have metamathematics, which allows significant judgments on mathematics. Such judgments must be intuitive (*anschaulich*), directly evident inferences such as $1 = 1$.

The application of this principle to the proof that a given system of axioms cannot lead to contradiction is as follows. Let P denote the property that each demonstrable formula has *not* the form

$$\mathfrak{A} \ \& \ \bar{\mathfrak{A}}.$$

It must first be proved in full finite detail that each axiom has the property P . It must then be proved that the application of the rules of inference (4) does not destroy the property P . This proof must also be so devised that it can be carried out in full finite detail in every particular case. Assuming that this can be done, it follows that the given system of axioms cannot lead to contradiction. This is, in fact, equivalent to the proof that $1 \neq 1$ cannot be the end-formula of a demonstration. For certain systems of axioms the proof is completely carried out in this volume. Hilbert is convinced that it will ultimately be possible to carry out the proof for a set of axioms on which the whole of analysis can firmly rest.

It cannot be denied that the *Beweistheorie* has serious critics. In fact the publication of the first volume was delayed, and a second volume was required, on account of certain results of Gödel which seemed to point to the impossibility of carrying out the full programme. Another serious difficulty is the meaning of words, which necessitated the recasting of the chapter on the *Aussagenkalkül* to avoid an interpretation put by Scholz on this subject in Hilbert and Ackermann's "Grundzüge der theoretischen Logik", an interpretation other than that intended by the authors.

Nevertheless, the *Beweistheorie* has cleared the ground in many fundamental problems, has produced sharp formulations of some aspects, and has suggested means of tackling the problems thus raised. Even if one were seriously to entertain the idea that Hilbert has reduced mathematics to a game, it would have to be admitted that the

game is certainly not an easy one. Perhaps one quotation may be allowed.

"Die Methoden der Analysis sind in einem Ausmass erprobt, wie wohl sonst kaum eine wissenschaftliche Voraussetzung, und sie haben sich aufs glänzendste bewährt. Wenn wir diese Methoden unter dem Gesichtspunkt der Evidenz kritisieren, so entsteht für uns die Aufgabe, den Grund für ihre Anwendbarkeit aufzuspüren, so wie wir es überall in der Mathematik tun, wo ein erfolgreiches Verfahren auf Grund von Vorstellungen geübt wird, die an Evidenz zu wünschen übriglassen."

L. M. MILNE-THOMSON.

The Electronic Structure and Properties of Matter: an Introductory Study of certain Properties of Matter in the Light of Atomic Numbers. Being Vol. 1 of "A Comprehensive Treatise of Atomic and Molecular Structure". By C. H. Douglas Clark. Pp. xxvi + 374. (London: Chapman and Hall, Ltd., 1934.) 21s. net.

THIS book, written by a chemist for chemists, sets out to review recent progress in atomic and molecular theory and to correlate various properties of matter such as cohesion in terms of the electronic structure of atoms. The first section is devoted mainly to a description of the quantum numbers of electrons in atoms, the principles underlying the electronic structure of atoms and the characteristic features of the Periodic Table. The quantum numbers used in the old orbit theory are described in some detail and then a brief account is given of the modifications found necessary in the new quantum mechanics.

This historical method of approach has its disadvantages, for it necessitates the description of symbols which are afterwards discarded. The description of modern quantum numbers is brief, and there is little indication of the interpretation which can be given to them, so that the reader will have no option but to memorise the list of symbols given. Once the quantum numbers are dealt with, the author proceeds more happily to the discussion of the electronic structure of the transition elements and the rare earths and the explanation of some of their characteristic properties. In the second section of the book, methods are discussed of determining the sizes of atoms, ions and molecules, electric and magnetic properties of the elements and the various types of cohesive forces.

The treatment is light rather than profound, and is apt to be sketchy, and to convey the impression of a series of abstracts of papers. None the less, the book provides an easy introduction to a subject which is likely to become of increasing interest to chemists and is not easily accessible elsewhere. Doubtless many will be stimulated by this broad survey to pursue the subject further, and they will be helped to do so by the excellent list of references at the end of each chapter, a feature which adds considerably to the value of the book.

Das Giftbuch des Šanāq : eine Literaturgeschichtliche Untersuchung

Von Bettina Strauss. (Quellen und Studien zur Geschichte der Naturwissenschaften und der Medizin, Fortsetzung des Archivs für Geschichte der Mathematik, der Naturwissenschaften und der Technik, Herausgegeben vom Institut für Geschichte der Medizin und der Naturwissenschaften, Band 4, Heft 2.) Pp. 64+66. (Berlin: Julius Springer, 1934.) 15 gold marks.

THIS book contains the Arabic text, with an annotated German translation, of the "Book of Poisons" of Šanāq, that is, Cānakya (Chanakya), the minister of King Chandragupta (fourth century B.C.). The Arabic version is not a direct translation of an Indian original, but is rather a compilation from both Indian and Greek sources. It was apparently based on a Persian translation of an Indian "Poison-book of Chanakya" made by an Indian physician, Mankah, of the celebrated hospital at Jundi-Shapur. Mankah also translated other Indian medical books, such as a treatise on the names of drugs, and a medical compendium of Susruta. The Arabic version of the "Poison-book" was made from the Persian by one Abū Hātim of Balkh, about whom we have no information. It was later re-edited by Al-'Abbās ibn Sa'īd al-Jauhārī, who was probably responsible for the introduction of the Greek material.

The book gives a useful picture of early Muslim pharmacology, in which much shrewd and careful observation was diluted with at least as much matter of an unreliable and fanciful character. The Arabic text has been well established and is clearly printed, while the German translation follows the original with close accuracy. It is, however, a great pity that no index of any kind is provided. E. J. H.

Kleine Meteoritenkunde

Von Prof. Fritz Heide. (Verständliche Wissenschaft, Band 23.) Pp. vi+120. (Berlin: Julius Springer, 1934.) 4.80 gold marks.

THE discussion of meteorites in this handy little volume commences with their entry into our atmosphere; the cosmogonical interest has to be found by working back from the chemical analysis of their contents. Even the geophysical phenomena relative to the falls of meteors—the information that they have given as to the highest regions of the atmosphere—are omitted from this book, which is strictly limited to the meteorites that fall to earth. Very full details of these, however, are given and much useful information for the geophysical chemist and mineralogist. The introductory historical chapter is extremely interesting. The number of large crater-fields of meteoritic origin will surprise most readers who come newly to the subject, but it is reassuring to find that there is no certain evidence of any person having been killed by a falling meteorite. Photographs of the devastated country in Siberia surrounding the scene of the great fall of July 30, 1908, show what damage can be done and leave one thankful that so far no densely populated country has been visited by a giant meteorite.

Geologie Südamerikas

Von Prof. Dr. H. Gerth. (Geologie der Erde, herausgegeben von E. Krenkel.) Teil 1. Pp. vii+199+17 plates. (Berlin: Gebrüder Borntraeger, 1932.) 22 gold marks.

THIS volume is one of the series of monographs on the regional geology of the earth published under the general editorship of Prof. Krenkel, and deals with the South American continent from the Pre-Cambrian up to the end of the Palæozoic.

The aim of the author has been to provide, not a detailed regional description but a comprehensive general introduction to South American geology and its problems. At the same time the needs of the reader requiring more precise and detailed information on any particular area or subject have not been lost sight of and each section of the book is provided with an extended bibliography.

Approximately half the book is devoted to a consideration of the Pre-Cambrian basement of the continent, and the structural, petrological and tectonic problems are dealt with rather fully. This is by no means excessive in view of the structural importance of the Pre-Cambrian in South America. Each region is considered separately and then the continent as a whole is dealt with in a concluding section. Much the same method of treatment is adopted throughout the remaining chapters on the Palæozoic systems, and the volume concludes with a chapter on the so-called 'Gondwanides'.

The author has brought together a great mass of information from scattered and often inaccessible sources, and has provided a most useful, up-to-date and well illustrated treatise on South American geology.

Dix leçons d'astronomie

Par Ernest Esclangon. Deuxième édition revue et corrigée. Pp. 116+20 plates. (Paris: Gauthier-Villars, 1934.) 25 francs.

IN this volume of popular lectures, the director of the Paris Observatory has given as simple and clear an account of modern astronomy as can be given in one hundred pages. The style is extremely lucid, as is to be expected in a French book, the facts are accurately given and up-to-date, the illustrations are numerous and the whole volume is very pleasantly readable. In addition to the definitely astronomical chapters, there are two which will be read with much sympathy and interest. The opening chapter gives an account of the importance of astronomy in the past in the development of thought and of civilisation; the final chapter, after dwelling upon the glories of French astronomy in the nineteenth century, emphasises the reasons why France has of late dropped out of a leading position in astronomical research. Modern developments require large instruments, and so far the money has not been forthcoming from Government or private sources to keep France abreast of most other countries. It is to be hoped that Prof. Esclangon's appeal in this volume may fall upon fruitful ground—and if fresh developments in France react favourably upon Great Britain, so much the better.

Fifty Years' Progress in Marine and General Engineering

JUBILEE OF THE NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS

OF the various industrial districts around the coasts of Great Britain, none has a greater variety of industries than that known as the 'North-East Coast'. Here, situated on the banks of the Tyne, the Wear and the Tees are coal-wharves, ship-yards, engine-shops, steel-works and factories by the score. But the outstanding industries are shipbuilding and marine engineering, and ships built or engined at Wallsend, Elswick, Hebburn, Shields, Sunderland or Hartlepool are found all over the world. As compared with the Thames, the Mersey and the Clyde in the early days of steamships, the district occupied a minor position as a shipbuilding centre. About the middle of last century, however, it began to specialise in the building of economical slow cargo ships, and its success in this direction led to developments which perhaps are as remarkable as they were unexpected. In 1850, the depth at low water over the bar at the mouth of the Tyne was only 6 ft. Now the channel of the river is dredged to more than thirty feet, and into the river have been launched such vessels as the *Mauretania* and H.M.S. *Nelson*. To-day, ships of many classes and marine engines of every type are constructed in the district.

In these circumstances, it was but natural that at the jubilee meeting of the North-East Coast Institution of Engineers and Shipbuilders, held at Armstrong College, Newcastle-upon-Tyne, on July 16-19, the principal papers read should have dealt with the progress of ships and their machinery, while the Citizens' Lecture should be "Ships Through the Ages", this being delivered by Sir Westcott Abell.

The three papers dealing with developments in the construction of ships during the past fifty years were on liners, by Mr. J. D. Christie; on cargo ships and tankers, by Mr. J. McGovern; and on coasters, by Mr. F. W. Dugdale. When dealing with the progress of liners, speakers often confine themselves to the vessels of the North Atlantic, where the largest and fastest ships are found. Mr. Christie, however, took a wider view of his subject and sketched the progress in passenger ships not only on the North Atlantic, but also in ships running between Europe and South America, South Africa, India, Japan and Australia, as well as in those crossing the Pacific. The paper is accompanied by seven useful tables dealing with ships on these various routes. As regards

technical problems, he said that, judging by published figures, it does not appear that the latest ships are superior in form to the *Mauretania*, in so far as minimum resistance and propulsive efficiency are concerned. The evidence, too, for the various new forms of bow are conflicting. There is no question of the value of the new tensile steels and of the introduction of welding, while the question of watertight subdivision appears to have reached a certain degree of finality. A great desideratum is the lessening of vibration and the reduction of pitching and rolling, but nothing has yet appeared to show that the Sperry anti-rolling gyroscopes in the *Conte de Savoia* have justified the great cost entailed. In no direction does the passenger liner of to-day present a more marked contrast to the ships of 1885 than in the arrangements for the comfort, safety and enjoyment of passengers.

The carriage of coal, grain, ore, timber, oil, sulphuric acid, molasses and such cargoes present different problems to the naval architect, and in his paper entitled "Cargo Ship and Tanker Development", Mr. J. McGovern described the various types of cargo vessels and their main structural features. The ways in which the plating of a ship may be held together and supported by the internal framing are endless. Special designs of ships developed on the North-East Coast have been the 'Turret' vessels of Doxford's, the 'Trunk' vessels built at Stockton and the Priestman 'Self-Trimmer' type built at Sunderland. One of the landmarks in ship construction was the introduction in 1906 by Sir Joseph Isherwood of the longitudinal system, giving increased strength with less weight of steel. To him also is due the recent radical departure from the orthodox box form of section designated the 'Arcform', wherein he has adopted a midship section shape entirely dispensing with the square bilge long familiar. Extensive model experiments and actual voyage performances of three 'Arcform' vessels have proved them to be the most economical cargo-carrying vessels of their class afloat to-day.

It is acknowledged by all that while many improvements in the structural details of ships have been made during the past fifty years, the improvements in machinery have been still more striking. Half a century ago, the majority of vessels were driven by compound engines using steam at comparatively low pressure. Coal

consumption was high, boilers were heavy, marine auxiliaries were unsatisfactory; the water-tube boiler was in its infancy, oil burning at sea was unknown and the marine steam turbine undreamt of except by Parsons. The triple expansion engine, however, was fast making ground, steel was being used for boilers, forced draught was being introduced, engines were getting more powerful and an era of rapid development was setting in. At the jubilee meeting of the North-East Coast Institution four papers on marine engineering touched upon these matters, and briefly described some of the latest innovations. The paper on turbines was by Mr. R. J. Walker, that on reciprocating steam engines by Mr. S. Hunter, Junr., that on boilers by Mr. T. McPherson and that on marine heavy-oil engines by Mr. H. O. Keller. Like the papers on ships, these are all well-illustrated and together constitute a brief but valuable record of achievements to which scores of men of many countries have contributed.

The last paper read, entitled "Recent Developments in Electrical and General Engineering", was by Mr. M. G. S. Swallow. The 'North-East

Coast' engineers have a right to be proud of the work done by what to-day is the North-Eastern Electric Supply Co., which Mr. Swallow says "was the prototype of the present interlinked electric supply system of the country". But of more interest than the technical information given in this paper were the stimulating remarks on 'North-East Coast' engineering generally. "The history of our Institution," he said, "is a record of men who have led and achieved in the past. . . . To-day the inventive ability, the scientific knowledge, the tenacity and skill which have made us successful are still ours. Some of our industries may decline temporarily or may be lost to us. But this is no reason for despair or lament. Engineering is not only progressive, but is for ever conquering new fields and our activities spread and continually increase." This undoubtedly is the right outlook for a district which has been rendered famous by the labours of the Stephensons, the Hawthorns, the Palmer, Armstrong, Rendel, Morison, Tweedy, Marshall, Noble, Doxford, Laing, Parsons and many other great engineers.

The Economic Importance of the Foraminifera

By Dr. H. Dighton Thomas, Department of Geology, British Museum (Natural History)

PERHAPS the application of science to industry provides no romance equal to that of the smaller Foraminifera. Those earlier research workers, Carpenter, Brady and others, could have had no inkling of the importance that that class of lowly-organised animals was to achieve in the exploitation of oil in various parts of the world.

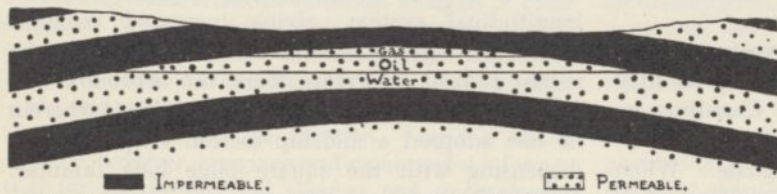


FIG. 1. Diagrammatic section (schematised) of anticlinal fold yielding oil and gas.

It is the object of this article to explain in outline the way in which the Foraminifera are of use economically.

The winning of oil from the reservoir rocks (other than those oil-shales which yield it on distillation) depends very largely on the correct identification of the tectonic structure of the petroliferous areas and the exact location of the fold-axes and fault-lines: for in many fields there is a very close

relation between the geological structure of the area and the sites of the oil accumulation. Thus, anticlinal folds (Fig. 1) frequently act as the reservoirs, the oil, possibly associated with gas, occurring in a permeable stratum at some depth below the surface, and overlain by impermeable beds which act as a cover. Accurate geological mapping provides the solution of the problem of the tectonic structure, but, as with all such mapping, it is dependent on the correct stratigraphical identification of the rocks.

Although petroleum is yielded by rocks of almost all ages, attention here will be focused on

oil-bearing Cretaceous and Tertiary rocks. Many of these beds are often, but not always, rich in small Foraminifera, though other fossils are present also. Although the latter are not neglected by the palaeontologists now attached to most oil companies, yet the Foraminifera have received particular attention, both because they often occur in great numbers in small samples of the rocks, for example, shallow auger-borings, and because

of their frequently widespread distribution. It has been shown from this study that in many oil-fields the Foraminifera, properly used, are excellent stratigraphical markers. Naturally, the methods have been applied to the older fossiliferous formations also, but, even where small Foraminifera are relatively abundant, as in some parts of the Carboniferous, opinions are divided as to their usefulness there. But there are no two opinions on the value of the Cretaceous and Tertiary Foraminifera.

In the technical application of the study of this order of the Protozoa, one of the fundamental considerations is that, for a given period, basins of deposition or embayments may be recognised, and that over a large part of each basin the conditions of sedimentation are similar. In the geological history of such a basin (excluding its margins where facies changes, that is, of lithology*, take place) the changes affecting it usually occur contemporaneously all over the basin, so that the stratigraphical sequence is usually constant throughout it, but different from that of neighbouring basins. These have different geological histories and experience different changes, so that each basin has to be studied separately. In addition, where lateral changes of facies occur, due for example to the approach to shore-line conditions, those areas also have to be treated separately.

The foraminiferal fauna of any area of deposition at any given time is related to the conditions then prevailing, so that the changes affecting the area (changes of salinity, depth, temperature, nature of the sea-bottom, etc.) result in changes in that fauna. Thus, in such a basin there is usually found, throughout all but those parts where lateral facies changes occur, a definite sequence of foraminiferal faunas. Some species, although their geological range considered throughout the world is very long, may be restricted to a small thickness, or to one layer in such an area; others may be very common at one horizon, be absent at another, and then reappear (as conditions changed again) either as a common or a rare form.

Thus the relative abundance of a species at a given horizon, as well as its presence, is a point of great importance. In this way, either by the determination of those species which are found to be restricted to definite horizons, or by the faunal assemblages themselves, the Foraminifera have proved in practice to be of great local zonal importance.

This is the more so in those cases where great thicknesses of similar rock types have been laid down over large areas. Thus in some petroliferous

regions there are great masses of glauconitic sands and clays, and the determination of horizons and geological structures is not an easy matter without palæontological aid. Moreover, the difficulties are not simplified in those areas where the country is swampy and covered with dense vegetation, so that rock exposures are few. The value of the foraminiferal zones in the unravelling of the geology of these areas is very high, and it is not without importance that the crucial evidence can be obtained from a relatively small amount of the rock.

A standard zonal series for that part of the geological column represented in the area is first established either from a number of natural sections which, when pieced together, give a continuous section, or from artificial sections, such as well-sinkings. A detailed analysis of the foraminiferal fauna of successive levels is made, samples of approximately equal weight being used, so that the relative frequencies of the species may be determined. Permanent records of the species of Foraminifera which have been found, their horizons, and their relative abundance at the various horizons, are then tabulated on charts†, so that the zones can be determined. In this, particular attention is paid to those species which have restricted ranges, to the incoming of species, and to the disappearance of species from the succession (in the latter case, this is equivalent to the incoming of the species in a descending series of samples from a well-sinking). Often the oil palæontologist is not concerned with the scientific names of the species, but instead numbers, or letters and numbers (the combination indicating the locality as well as the species), are allocated to them. Ultimately, however, since inter-regional correlation will become a necessity, the correct scientific identification of the species will have to be made.

After the establishment of this zonal series, its application in the field to the determination of the age of the rock exposures or of core-samples is easily made. In order to facilitate matters, various travelling laboratories have been devised, so that the washing of the clays, and the separating, mounting and identification of the Foraminifera can be made on the spot; or samples—often obtained from shallow auger-borings or small trial diggings—are collected continuously by the field-geologist in a traverse, carefully and accurately labelled, and dispatched as quickly as possible to the palæontologist for investigation. To the field-geologist himself, acquaintance with some distinctive and easily recognisable species is of the greatest use for the preliminary identification of

* As, for example, from limestones to clays and shales.

† See Nuttall, W. L. F., *World Petroleum Congress Preprint No. 28*, 1933.

the stratigraphical horizon of a rock seen in a natural or artificial exposure. From the observations and investigations so made, a geological map can be constructed in the usual way, and the geological structure of the region can thus be determined.

Besides this use in mapping and the location of tectonic lines in an area, the Foraminifera are also useful in connexion with the sinking of wells. In boring to the known oil-bearing stratum, samples of the core are taken at frequent and known depth-intervals, and examined for the Foraminifera, so that a continual check is kept on the depth to which the shaft is to be sunk. Such palæontological observations will also indicate quickly when the productive stratum has been passed (for example, in a fault), or when the well is placed too far from the crest of the oil 'trap' so that it will strike water and not oil (see Fig. 1). The saving in expense by the rapid recognition of the futility of further boring on those sites is obvious.

Further, great wastage of oil has occurred in some fields in the past, because 'gushers' have burst out before it was considered necessary for steps to be taken to prevent this loss. But this has been largely obviated by the sampling of the cores, the Foraminifera giving a sure indication of the horizon reached and therefore of the distance above the oil-bearing stratum. In one field, for example, one species makes its appearance (in the descending series) at a relatively short distance above the reservoir rock, so that its recognition in the core-sample gives the indication that the drill has nearly reached the reservoir rock and that precautions must be taken to prevent loss from the oil 'gushing' on further boring.

It will be seen from the above that the smaller Foraminifera can be used to determine the age of the rocks yielding them, and so, by detailed field collecting and investigation, to unravel the geology of an area. When this has been done, then the knowledge so obtained can be used to determine the best sites for drilling for oil, if oil is present in the area. But there is no causal connexion between the Foraminifera and oil—the presence in an area of a given foraminiferal species, or foraminiferal fauna, or foraminiferal zonal series, is no indication of itself that oil is present, though that, however, is a widely-held misconception.

It is knowledge of the detailed geological structure which is of crucial importance in an area known to be petroliferous. But the Foraminifera, if intensively collected and the results from innumerable rock-samples carefully analysed, often supply the key to the problem of the determination of that structure.

A POSTSCRIPT UPON THE "ORIGIN (AND DEVELOPMENT) OF SPECIES"

By Edward Heron-Allen, F.R.S.

In the foregoing article Dr. Dighton Thomas has efficiently dispelled the somewhat widely-spread illusion that Foraminifera, *per se*, especially certain genera and species, indicate the occurrence of mineral oil at a given depth. There are certain ascertained phenomena which indicate the presence of oil in a district, and it is when the 'show' has been observed and noted, that the importance of the Foraminifera to the 'petroleum geologist' becomes apparent. A word of warning to the young geologist, who has now become a necessary official attached to every petroleum company of any importance, should perhaps be added: Let him firmly ignore what Earland has rightly called "the spate of literature" and I have called "the proliferation of nomenclature". The industrious Dr. Hans E. Thalmann has recorded three hundred and eight papers on the Foraminifera published in the years 1931 and 1932, and to these may be added scores of later papers noted in the "Zoological Record" and in the lists periodically published by Dr. Cushman since that date.

What may be called 'the Commercialisation of Protozoology' has, however, had one beneficial effect—a blessing in a deplorable disguise—and that is that there would have been as many papers again published, were it not that the Foraminiferal fauna of a given district have risen—or fallen—to the rank of a trade-secret, and many oil companies jealously guard their zoological records (and even specimens of material from their bores) from the prying eyes of rivals in the trade.

The shattering fact has already been recorded in these pages*, that of recent years the number of genera forced upon protozoology amounts to five hundred and fifty-eight (not counting sub-genera), whilst as regards species the brain simply reels. It is not humanly possible to keep track of them, but anyone who pays any attention to the literature of Foraminifera gradually realises that professional rivalry has something to do with it. Profs. A, B and C are the recognised authorities of as many rival schools of foraminiferal research, which appear to race one another in the recording of new species (and even genera) and each school is ready to swoop, vulture-like, upon the announced discoveries of its rivals, and to pick them to pieces, fondly imagining that students will collect for themselves a new working nomenclature out of the *dissecta membra* left after their attacks upon one another.

I enjoy being 'howled down' by the spokesmen of the advanced schools of petroleum geologists,

* Heron-Allen, NATURE, 134, 43, July 14, 1934.

and I continue to advise the young men, who recurrently visit our collections at the Natural History Museum, to revert boldly to the bygone nomenclatures (condemned by some) of the great *scientific* Foraminiferists, who died in peaceful ignorance of the pending effects of commerce upon their study—Parker, Jones, Brady, Millett, Williamson in our country; d'Orbigny, Berthelin, Schlumberger, Terquem in France; Haeusler, Karrer, Reuss, Schultze in Germany; Costa, Fornasini, Seguenza in Italy—to mention only the names which spring to the memory at once.

The works of these giants will tell them all they need to know. Let them fix this sound *corpus* of genera in their minds, and distinguish the variations of species by numbers, each for himself,

species that they will recognise as their own old friends in every district which they have to examine and report upon.

When their work has been done and borne fruit in the form of adequate remuneration, let them if they like—and are allowed by their board of directors to do so—hand their 'mounts' on to the pupils of Profs. A, B and C, and let them fight it out. *They* need not bother about it any more—taking the Omarian advice of the late Aurelius D. Godley:

"The moving Finger writes; then, having writ,
The Product of your Scholarship and Wit
Deposit in the proper Pigeonhole—
And thank your Stars that there's an End of
It."

Obituary

Prof. Hugo de Vries, For.Mem.R.S.

BY the death of Hugo de Vries, on May 20, at the age of eighty-seven years, biology has lost one of its outstanding figures in the history of the last century. He proved himself a master of plant physiology in the period 1870–85 when that science may be said to have had its modern beginnings; but the problems of evolution held his attention from the time when, as an undergraduate at Leyden, he read a German translation of the "Origin of Species". The transition from experimental physiology to evolutionary theory took place with the publication of his "Intracellular Pangenesis" in 1889, but his earlier work no doubt made it easy for him to introduce experimental methods into the investigation of evolutionary problems.

The range of de Vries's early physiological researches may be indicated by series of papers on such topics as the permeability of protoplasm, the movements of climbing plants, contractile roots, the germination and growth of such crop plants as red clover, potatoes and sugar beets, the reactions of *Spirogyra* and *Drosera*. A series of investigations on food plants were done for the Prussian Ministry of Agriculture while a student with Sachs at Würzburg.

In his classical researches on the mechanical causes of cell stretching in plants (1877), de Vries introduced the plasmolytic method, determining the osmotic pressures of cells and developing the conception of isotonic coefficients. In 1884, by comparing the plasmolytic effects of many isosmotic solutions, he was able to show that the osmotic pressure depends on the number of molecules in solution. He also used these methods to determine the molecular weight of raffinose. This work formed the basis for the laws of dissociation in dilute solutions, with which the names

of the physical chemists Van 't Hoff and Arrhenius are connected.

The intracellular pangenesis was an important development of Darwin's earlier theory of pangenesis. In it de Vries related theories of heredity and development to the increasing knowledge of cells, and put forward the view which modern work has proved to be correct, that every nucleus of the organism contains a full representation of the hereditary materials. In that work is clearly stated the conclusion that "hereditary qualities are independent units, from the numerous and various groupings of which specific characters originate", and for these units he adopted the term 'pangen'. This anticipation of the modern theory of the gene in all its essentials was a masterly triumph of clear thinking—especially when we remember its date, 1889.

In the same work de Vries criticised the views of Weismann, especially as regards his theory of the idioplasm and his idea that a sorting out of germinal materials takes place in different types of somatic nuclei. The influence of these erroneous views would have been avoided had contemporary zoologists been able to recognise that Weismann's elaborate architecture of the germplasm held less truth than de Vries's simpler but better founded theory. The two authors agreed, however, in denying the inheritance of acquired characters.

In the same year (1889) the publications with what we would now call a genetical bearing were begun, with papers on sterile maize plants and on the inheritance of twisted stems. This was followed during the next decade by a stream of papers on similar subjects. From now onwards, heredity and variation claimed the whole of de Vries's interest, yet the problems were viewed from the first with an experimental background.

The turn of the century marked the well-known triple rediscovery of Mendel's principle of segregation in hybrids, which de Vries had confirmed in several plants before publishing his account in 1900. In the meantime, in searching for mutable plants in accordance with his theoretical views, he had begun so early as 1886 the cultivation of *Oenothera Lamarckiana* and the investigation of its variability. His first paper on *Oenothera* appears to have been in 1895, on the introduction of *O. Lamarckiana* into the Low Countries. The "Mutation Theory", first published in 1901-3, and afterwards translated into English, will remain a classic as the earliest example of the pedigree method applied to evolutionary problems, and as a statement of the broad biological distinction between mutations and fluctuations which has gained general acceptance in modern biology. It may safely be said that no work since the "Origin of Species" has had so profound an effect on evolutionary thought. The early years of this century were epoch-making, and progress has gone on with increasing rapidity since de Vries and Bateson led the way with the conception of discontinuity, or better, definiteness in variation.

Oenothera became classical material for the investigation of the more complicated problems of genetics and cytology. No other genus of plants has been subjected to such prolonged and extensive genetical investigations. By 1915 the mutations had been analysed in terms of change in chromosome numbers. The succeeding twenty years has disclosed new conditions in the genus, many species have been recognised as heterozygous, with two complexes yet breeding true owing to balanced lethals and fixed chromosome catenations. While the mass of evidence has necessitated many developments and re-orientations in points of view, yet the general conception of mutation which de Vries founded has remained the basis of genetical work, although views still differ as to the value to be attached to mutations as the raw materials of evolution.

De Vries continued his breeding work with evening primroses until the end. In 1909 was published "Species and Varieties: their Origin by Mutation", as a result of an American lecture tour, and in 1913 "Gruppenweise Artbildung", which is entirely devoted to analytical breeding experiments with *Oenothera*. In 1918-20 six volumes of his collected early papers were published, a seventh volume, of *Oenothera* papers (1915-25), being added in 1927.

De Vries was born in Haarlem on February 16, 1848, the son of a former Prime Minister of Holland. After study in various German universities, he occupied the chair of botany at Amsterdam from about 1878 to 1918, and was not tempted away by flattering offers from Berlin, Columbia and other universities. In Holland his name became a household word and in scientific circles his fame spread throughout the world. When he retired at seventy years of age, he went to live in the village of Lunteren. Here he continued his experiments with evening primroses in a private garden and laboratory attached

to his residence. Among the numerous scientific honours conferred upon him was the foreign membership of the Royal Society (1905), the Darwin Medal of the Royal Society (1906), and the gold medal of the Linnean Society (1929).

The genius of Hugo de Vries resulted from the combination of an acute, sagacious and clear-reasoning mind with a power of accurate observation which is rarely equalled. Every biologist would gain from a re-reading of "Intracellular Pangenesis", which was translated into English in 1910. It shows how unerringly his reasoning from the few known facts guided him to views which require extraordinarily little alteration in the light of modern detailed knowledge.

R. RUGGLES GATES.

Miss Ida M. Roper

MISS I. M. ROPER, who died at a nursing home in Bristol on June 8, in her seventieth year, was known widely for her devoted work as a field botanist, and as a contributor of well selected dried specimens to both the British Botanical Exchange Clubs. She had been honorary secretary and librarian of the Bristol Naturalists' Society for nineteen years, and was the only woman to become president (1913-16); also the first woman to serve on the Council of the Bristol and Gloucestershire Archaeological Society. Her presidential address on mistletoe showed wide research on the host trees of that parasite; and her second annual address was appropriately entitled "Some Historical Associations of Flowers". Her power of organisation was remarkable. In 1920 she joined the Somersetshire Archaeological and Natural History Society, and was also a useful committee member of the Botanical Section.

Miss Roper gave great help to the late J. W. White in the compilation of his excellent "Flora of Bristol", 1912, "not only for field work, but for assistance in literary research and in revision and correction for the press". More remarkable is the fact that for thirteen years she made the collecting and exhibition of local wild plants at the Bristol Museum and Art Gallery a labour of love, both in summer and winter. Her own herbarium of British Phanerogams and ferns, good and beautifully arranged, was recently given to the University of Leeds.

Miss Roper had a particularly good knowledge of British violets. Mosses also interested her, and the British Bryological Society excursions were among the numerous scientific or antiquarian meetings which she enjoyed attending. These included many British Association meetings; hence her cheerful and energetic personality was known to many.

In 1928 Miss Roper rediscovered *Erodium Ballii* in Ireland. Jordan had named it in 1852 from Irish specimens gathered by John Ball, F.R.S. In 1920 she found *Euphorbia platyphyllos* at Keynsham, near Bristol, Ray having noticed it in 1670 as a first record for Britain. Other notes and short articles on British flowering plants appeared in the *Journal of Botany* and in the *Proceedings of the Bristol Naturalists' Society*.

During most of her life, Miss Roper had been interested in monumental effigies, and had visited nearly every church in Gloucestershire and Bristol and many in Somerset to collect information. This culminated in 1930 in the publication of a handsome volume on "Monumental Effigies of Gloucestershire and Bristol".

H. S. T.

WE regret to announce the following deaths:

Dr. Arthur Bramley, head of the Department of Pure and Applied Science at Loughborough College, on July 19, aged fifty-six years.

Sir John MacFarland, Chancellor of the University

of Melbourne since 1918, a member of the Royal Commission (1899) on Technical Education, Victoria, and of the Government Board (1908) for the Protection of Aborigines, on July 22, aged eighty-four years.

Mr. L. M. Nesbitt, who was awarded the Murchison Grant in 1931 of the Royal Geographical Society for "his difficult journey through the Danakil country of Abyssinia", on July 20, as the result of an aeroplane disaster near the San Bernino Pass, Switzerland.

Sir James Watt, a well-known stock-breeder and forester, formerly chairman of the Forest Tree Growers under the Forestry Commission, on July 1, aged ninety-three years.

News and Views

International Folk Dance Conference

IN another column of this issue of NATURE (see p. 154) there appears a brief account of the conference, which formed part of the International Folk Dance Festival held in London last week. Lack of space for fuller reference does less than justice to a kaleidoscopic spectacle, of which the interest to students of the development of social custom and religious belief, more particularly in Europe, was profound. In its general results, the conference on the scientific aspect of the folk dance has made a very appreciable contribution to the advancement of this branch of the study of the art and life of the 'primitive' element in European populations, both of to-day and in the past. In its effect on future development, it should stimulate the application of that study to the revival and extension of the practice of folk dancing, as well as, possibly, lead to restoration of forgotten or neglected elements where traditional dances and customs are still a living factor in peasant life, as has already happened in certain of the dances which appeared at the festival. On the other hand, the references of many speakers to the obsolescence of traditional customs and dances among the folk and the contrast in the spirit of such dances as those of eastern Europe—for example, the hobby horse dance of the Calușari from Rumania—when the dance is a living functioning element, integral in rural life, argues that the folk dance as a revived art can become a factor in communal life once more only as an attenuated and, to a considerable degree, sophisticated form of expression. Its essential meaning vanishes with the fading away of its economic and magical background.

African Problems

SIR MALCOLM HAILEY, lately Governor of the United Provinces, India, and now director of the African Research Survey, accompanied by Mr. Donald Malcolm, formerly of East Africa, will leave England on August 15 for the purpose of a prolonged

journey of investigation on the African continent. During an absence which is expected to extend over a period of eight or nine months, Sir Malcolm Hailey will be engaged in testing and amplifying material which has been collected for a survey of African problems in a report to be published, if possible, in 1937. The survey has been undertaken by a Committee, of which Lord Lothian is chairman, as the result of a suggestion, made by General Smuts in his Rhodes lecture at Oxford in 1929, that it was time to consider how far the resources of modern knowledge were being applied to the problems of Africa, and how far it was possible to co-ordinate the experience of the different territories. The scope of the survey has been limited to Africa south of the Sahara. It will deal with the problems of each territory in the administrative, economic and scientific fields, and will estimate the character and amount of the material available for their study, as well as suggest the lines on which further research and extended study might prove profitable. The aim of the report will be to state facts rather than to criticise methods and results. Dr. E. B. Worthington, of the Department of Zoology, University of Cambridge, has been engaged for some time in digesting the facts relating to research bearing on Africa in all the physical sciences, and a similar digest is being prepared in the economic field. Funds for the cost of the survey have been provided by the Carnegie Corporation of New York.

Academic Assistance Council

THE second annual report of the Academic Assistance Council, published on July 20, contains a statistical summary of the present position of the 1,300 German university teachers dismissed as 'non-Aryans' or for political reasons. Approximately 650 emigrated from Germany; of these, 287 are already re-established in permanent positions and 336 of the others are being temporarily assisted to continue their research. The importance of organised academic

assistance is shown by the fact that of the 287 scholars who have been re-established, 202 are still within the university world. The Council has played an important part in this work, not only within Great Britain by raising during the past year £24,000 for temporary maintenance grants, but also on an international basis by organising a central information bureau. The Council announces that it hopes to continue its information service as long as possible, although it proposes to end its emergency financial grants by July, 1936. It hopes during the coming year to raise funds to create a limited number of research fellowships to retain in Great Britain the services of some of the most distinguished of the displaced scholars. The need for the continuation of the Council's work is evident. During the past two months, 50 more university teachers have been dismissed in Germany, and, as the report points out, "it is impossible for the exiled scholars to regard return to Germany as a possible alternative to further exile". We hope that the Council will receive sufficient financial support to continue its patient work, for it is making a historic contribution to the cause of free learning. Copies of the report may be obtained free on application to the General Secretary, Academic Assistance Council, Rooms of the Royal Society, Burlington House, London, W.1.

Flight Experiments with Compression-Ignition Engines

THE Air Ministry has ordered a number of "Culverin" 720 horse-power heavy oil engines from Messrs. D. Napier and Son, Ltd. It is understood that these are to be used for complete operational tests in large flying boats. Imperial Airways is also interested in the same problem for civil aircraft, and will doubtless be watching these results. The Napier engine is a horizontal water-cooled engine, built under licence from the German Junkers company. The Bristol Aeroplane Co., Ltd., has also developed a compression-ignition engine of the radial air-cooled type, which has actually gained the world's altitude record for aircraft powered with that type of engine. The Diesel type engine has a definite advantage in long-distance flight owing to its smaller oil consumption, but as it is structurally heavier than the petrol engine this advantage is outweighed on short flights. With modern design and performance of heavier-than-aircraft, there is no gain in using it for a flight of less than about eight hours duration. Another major point in its favour is the lessened risk of fire after a crash. Although the fuel oil used is not non-inflammable, its flash point is much lower than that of petrol, and the risk of ignition from flame or hot parts is less. A minor trouble to be dealt with is the lack of facilities for the distribution of this fuel oil at the present time. The oil distributing companies will need considerable additions to their plant before fuel oil will be available upon as world-wide a scale as is petrol.

Polarising Light Filters

THE Eastman Kodak Company, at the ninth International Congress of Photography recently held

in Paris, demonstrated a new kind of light polariser, known as the 'Pola filter'. This is made in sheets and may be used to produce effects similar to those obtained with a Nicol prism. Thus when used in pairs, any desired degree of extinction may be obtained by rotating one filter in relation to the other. In photography alone there are many very useful applications for these filters, such as the elimination of surface reflections from glass windows, water, coloured objects (with consequent increased saturation of the colours), the modulation of blue sky brightness without alteration of hue, etc. The comparative cheapness of these filters, and the possibility of manufacturing them in large sizes, opens up a great vista of applications, in which has been suggested their use to combat headlight glare with motor-cars.

Prehistoric India

A DISCOVERY which, if substantiated, holds out promise of great moment for prehistoric archaeology in the Near and Middle East, is announced from India. According to a dispatch from Karachi, which appears in *The Times* of July 19, remains of a city of an earlier date than Mohenjo-daro have been discovered alongside the bed of the Indus River at a site known as Kol Deja or Narujadaro in Khaipur State, Bombay. The discovery was made by Mr. Ūtam Thakur, a research scholar, in the course of survey work. It is stated that shell and earthenware bangles, decorated images and decorative pottery were found. If further investigation should afford ground for accepting the claim that this material represents an earlier stage of civilisation than that already known from the Indus valley, where the earliest city at Mohenjo-daro is dated at about 3300 B.C., it will have a crucial bearing on the problem of the relations of the early civilisations of Sumeria and India. The authorities of Khaipur State have taken measures for guarding the site, and Mr. Thakur is now engaged in seeking financial aid for carrying out systematic excavation in the coming season.

Equipment of a Photo-Elastic Laboratory

A PAPER of the greatest interest to all who contemplate the design and equipment of a photo-elastic laboratory, and indeed of interest to engineers generally, was read to the Junior Institution of Engineers by Prof. E. G. Coker and appears in full, with many illustrations, in the *Journal* of the Institution of April 1935. It was prepared with the view of giving an outline of the essential requirements of a photo-elastic laboratory when a start is being made from the beginning of things and not merely an adjunct to a larger laboratory already well supplied with much of the experimental apparatus and machinery, which can be utilised for photo-elastic work. For this purpose, the paper opens with a concise statement of the elements of photo-elasticity, a subject which might with advantage be taken up much more widely and at an earlier stage than at present, as the elastic properties of materials are of more or less importance to all engaged in technical

work, though of course in a much greater degree to engineers. By its means a considerable advance has been made in our knowledge of the distribution of stress intensities at discontinuities, where very little exact information was previously available. It is particularly useful in the stress analysis of fusion joints, in which it is, as a rule, a fallacy to assume that stress distributions can be determined by applying elementary methods. In this paper, Dr. Coker takes the connexion of two steel plates in line by means of a V fusion weld as a typical example of the incalculable stresses which can be determined by photo-elastic analysis. He describes the apparatus required and concludes with a description of a detached photo-elastic laboratory made by a small addition to a medium-sized house.

The World's Greatest Highway

THE Inter-American Highway from Alaska and Canada in the north to Chile, the Argentine and Brazil in the south, is now, according to an article in *Roads and Road Construction* of February, having its gaps filled in on the maps and plans of engineers. At present, 4,500 miles of its length are passable by motor-cars in all weathers. The finished sections are in Canada, the United States, Mexico and Panama, and parts of all-weather roads are completed in Alaska, Costa Rica, Salvador, Guatemala, Colombia and Brazil. Highways passable in dry weather cover the greater part of the international highway route. The South American portion of the highway offers a great variety of scenery. There are the jungles of Colombia and Brazil, the sea coasts of Peru and Chile, the magnificent heights of the Andes and the broad expanse of the Argentine pampas. A thousand miles of this highway will be at elevations of 5,000-10,000 ft. The international project is to open up a through route for the highway tourist between North and South America. It will be of special value to citizens of the United States living in the Panama zone. The 250 miles of improved road in Panama have already been largely patronised by the residents of the Canal Zone for recreational travel, and a through highway to the north would be very attractive to them. The Central American section makes it possible to open up large areas for agricultural and commercial development and so promote their economic welfare. At present, access is mainly by steamer to the ports and thence by rail, highway or aeroplane. Pan-American Airways provides a service throughout the length of Central America, paralleling the future line of the Inter-American Highway on the Pacific slope of the divide.

Post Office Publicity

THE present-day policy of the Post Office is based on a recognition of the fact that the Post Office is not only a Government Department, but is also one of the largest businesses in Great Britain. In pursuance of this recognition, recent developments have included the establishment of a Public Relations Department, with an organisation for employing all the most modern methods of publicity at its

disposal. An interesting account of the policy being followed by this department is given in a recently published pamphlet entitled, "Post Office Publicity". This pamphlet is the eighth of a series of Post Office Green Papers (London: H.M. Stationery Office. 6d. net), previous issues of which have dealt with the air mail service and with various aspects of telegraph and telephone communication. The text of the pamphlet has been adapted from a lecture recently given by Sir Stephen Tallents, Public Relations Officer of the General Post Office, and it is illustrated by a selection of photographs and reproductions of posters and pamphlets already issued by the Post Office. This pamphlet shows how recent advances in the arts of press advertising and exhibition display and the arrival of new forms of communication in films and broadcasting have coincided with the growth of the new need of correctly-balanced publicity. The methods by which the Post Office is pursuing these purposes are clearly described. These include press advertising, the supply of posters of high artistic quality for public display and for use in schools, and the participation in public exhibitions of various kinds, and the temporary leasing of shops in important centres for the display of Post Office activities and equipment. Finally, the G.P.O. Film Unit produces and circulates films which illustrate vividly the great variety of Post Office work.

Canalisation of the Upper Mississippi

AN article in the *Scientific American* of February by Mr. S. G. Roberts describes the important work now being done under the United States Army engineers for the improvement of the navigation of the Upper Mississippi River. Some years back it was considered that a channel six feet deep at low water could be maintained by dredging and contraction works, but this proved to be impracticable. In 1931, therefore, it was decided to canalise the whole length of the river between St. Louis and the 'twin-cities' of Minneapolis and St. Paul, a distance of about 650 miles, so as to give a minimum depth of 9 feet. For this purpose, 27 dams are being built, each having locks 110 feet wide and 600 feet long. The dams are provided with spillways and roller gates suitable for contending with fields or floes of ice, which sometimes attain a thickness of 2 feet. The object of the scheme is to provide for the direct shipment of cargoes from Minneapolis and other places direct to New Orleans by means of flotillas of barges which will carry as much as 14,000 tons, and will be towed through the locks without changing formation. The work was begun about three years ago and is expected to be completed in 1938 at a cost of 124,000,000 dollars. "There is every reason to believe," says Mr. Roberts, "that the work now under way will give to the Mississippi valley a trunk-line water route that will mean to the vast region served by it what the Rhine has long been to Central Europe. From Minneapolis to the sea, the Mississippi has a length of 1,950 miles; and the run from Minneapolis to New Orleans is 1,840 miles.

From the head of navigation on the Rhine to the sea, the distance is 445 miles. Therefore the Mississippi offers a water outlet to a far more extensive region than does the Rhine; and the potential wealth of the American domain is infinitely greater and in some respects more varied."

Cold-Storage Plant in Madrid

WITH the aid of cold-storage plant it is possible to regulate the supply of perishable foodstuffs to a city so that, whatever the season, the supply may be sufficient. A privately owned cold-storage building has been erected in Madrid with this end in view. O. Rhunke gives a description of the plant used in this building in the *Escher-Wyss News* of April. A five-storied building was constructed in the immediate vicinity of the principal markets, with the railway track on one side and the Calle de Toledo on the other. The level of the railway is 23 ft. above the level of the street, so that goods are unloaded from the railway into a chute and delivered into the street from the ground floor. Ten thousand cubic metres are provided for storage for eggs, fruit and fish. The main cooling is by conditioned air with brine-circulated cooling in addition. The temperature and humidity of all the cooling rooms have to be kept within prescribed limits. The used air is cleared out several times every day and ozonising is employed. Special care has to be taken to prevent any interruption of the cooling process taking place. A cooling capacity of thirteen million British thermal units per day is required. It was at first thought that such a spacious building would considerably exceed the needs of the city, but three months after the opening practically all the space was utilised.

East Malling Research Station

THE twenty-second annual report, for the year 1934, of the East Malling Research Station, has just been published (pp. 241. 4s. net. May 1935). The Station is maintained by the Kent Incorporated Society for Promoting Experiments in Horticulture, with various grants from the Ministry of Agriculture and Fisheries. A 22-page supplement describes the more administrative side of the Station, and leaves the main volume free to set forth the research findings during the past year. These are, perhaps, even more numerous than usual, for a determined effort has been made to elucidate more fully the problems of insecticides and fungicides. Section 1 of the report describes the experimental farm, and is contributed by Messrs. J. Amos, F. H. Beard, M. H. Moore and A. C. Painter, with a foreword by the director, Mr. R. G. Hatton. Section 2 is a general review of research work, with summaries of papers published during the year. It is compiled by numerous members of the staff. The third section, on preliminary research reports, occupies most of the volume. Truly is the East Malling Research Station justifying its comparison, voiced by H.R.H. the Duke of York, to a standard apple tree, which, once established on good soil, would "continue to flourish and yield excellent fruit".

Farm Machinery

THE favourable reception that attended the publication of the first volume of "Farm and Machine" issued by the Institute for Research in Agricultural Engineering, Oxford, last year, has led to the decision that an annual issue would be justified. Vol. 2, which has recently appeared (2s. 6d.), contains like its predecessor the report of the Institute for the year under review and also a collection of miscellaneous papers on agricultural engineering. The chief event of the year has been the removal of the Institute into its new quarters in Parks Road, a building well suited for the indoor work and provided with excellent workshop and stores accommodation. The testing of various new types of agricultural machinery naturally takes a prominent place in the work of the Institute, but research on the theoretical side is also carried out, from which important advances have already been made. The titles of some of the miscellaneous articles such as market garden tractors, farm electricity tariffs, the mode of action of mole drains, sugar beet harvesting, implements for regenerating grassland need only be quoted to show that the volume is likely to be of help and interest to a wide section of the farming community.

Rare Developmental Condition in a Boy

A NOTE by Science Service, of Washington, D.C., states that a 'dog-boy' four years old is living in Kharkov, U.S.S.R. His face and body are entirely covered with long blond hair, coarse and a little wavy. The child is otherwise normal mentally and physically except for rickets, which is being treated in the hospital. The relatives are all normal so far as known. This very rare condition is known as hypertrichosis universalis. Some thirty such families have been recorded, most of them from Russia. In certain cases reported from India, the hair was dark. The condition is a developmental defect, in which the prenatal lanugo is not shed. It may be accompanied by faulty teeth and nails. Once the condition has appeared, it is likely to recur in the next generation. An effort should be made to determine whether the family producing this child is related in any way to the previously recorded Russian families.

Bibliography of Seismology

IN a recent issue of NATURE (135, 1070; June 29), a brief notice was given of the "Bibliography of Seismology" for the year 1934 prepared by the Dominion Observatory of Ottawa. In that note, it was pointed out that Great Britain is not represented in the list of collaborators. We have received a letter from Dr. F. J. W. Whipple, Kew Observatory, in which he suggests that this omission may be taken to imply that the works of British seismologists are ignored in the Bibliography, and he states that in the last quarterly number there are seven references to such publications. On the other hand, in the United States, there are eleven collaborators, who refer to forty memoirs written in that country. The test as regards completeness is not, however, the actual number of memoirs noticed, so much as the

percentage of the total number published that are entered in the Bibliography, and this percentage obviously depends on the number of contributors. In the absence of collaborators, memoirs are, of course, likely to be overlooked.

World Power Conference

THE annual report for 1934 of the World Power Conference, 36 Kingsway, London, W.C.2, records that the transactions of the Scandinavian meeting held in 1933 have been published in seven volumes. The subjects discussed centre round the power problems of large-scale industry and of land and sea transport. The Chemical Engineering Congress will be held in London on June 22-27, 1936, and will be a sectional meeting of the World Power Conference. After preparatory work extending over seven years, it is hoped that tables of international statistics on a strictly comparative basis will be published this year.

Conference of Empire Survey Officers

THE Third Conference of Empire Survey Officers opened in London on July 23 and will continue in session until August 2. The Conference is not open to the public, but an official report of its proceedings will be published in due course. Representatives of Canada, the Commonwealth of Australia, the Union of South Africa, the Irish Free State, India and Northern Ireland, and of about twenty Colonial dependencies, as well as by representatives of various interested departments, societies and institutions in Great Britain, are attending the Conference. The principal object of these gatherings, of which the two earlier ones were held in 1928 and 1931 respectively, is to afford opportunities for surveyors from overseas to obtain and exchange up-to-date information as to the progress made in survey matters, and for discussions on questions of general interest to surveyors.

IN opening the Empire Survey Conference on July 23, Mr. Malcolm MacDonald, the Secretary of State for the Colonies, expressed his pleasure at being able to welcome at the Conference not only representatives of the various Colonies, Protectorates and Mandated Territories, but also representatives of the majority of the self-governing Dominions, of India, and of Northern Ireland. He referred to some of the subjects to be discussed, such, for example, as trigonometrical and topographical surveying, and various aspects of air survey work. Continuing, Mr. MacDonald said, "Another question which appears on your agenda is that of the co-ordination of African surveys. I need hardly emphasise the importance of this, but I should like to express the hope that this Conference will be able to work out an agreed plan for co-ordination in the future. Closely allied with this is the question of the completion of the Arc of the 30th meridian. The possibility of completing this important work at the earliest possible moment is kept continually in mind." Brigadier MacLeod, the Director General of the Ordnance Survey, who was asked by Mr. MacDonald to preside over the Conference, then thanked the Secretary of State on behalf of the delegates for coming to open the

Conference and emphasised the value of periodical Conferences of this nature.

ASLIB

THE twelfth annual conference of the Association of Special Libraries and Information Bureaux is to be held on September 20-23 at St. John's College, Cambridge. According to the preliminary programme, Sir Richard Gregory will deliver his presidential address on September 20 and will speak on the "Interpretation of Science". Mr. J. D. Cowley, director of the University of London School of Librarianship, and others will deal in a symposium with special librarians and their problems, Sir Stephen Gaselee, of the Foreign Office Library, will describe libraries and special sources of information in Government departments, and Mr. B. M. Headicar, of the British Library of Political and Economic Science, will deal with the use of reference books. "What Industry expects from Public Libraries" is the title of a paper by Mr. R. Brightman, of Imperial Chemical Industries, Ltd., while Miss E. W. Parker, of the Mond Nickel Co., Ltd., inquires into the use that industry and commerce make of the public libraries in the London area. Further particulars about the meeting can be obtained from the Secretary, ASLIB, 16 Russell Square, London, W.C.1.

The Third International Congress of Soil Science

SOME four hundred delegates, from twenty-five foreign and twenty British countries, will assemble at Oxford for the Third International Congress of Soil Science on July 30-August 7. The delegates will be welcomed by the Vice-Chancellor of the University at the opening session, and will be entertained by the Government at a dinner in Christ Church Hall on July 31. The meetings have been arranged so that questions of wide interest will be discussed in the mornings at plenary sessions, and more specialised ones in the afternoons at Commission sessions. Sir John Russell will deliver the presidential address on "The Place of Soil Science in Agriculture", and Prof. G. W. Robinson will present a general survey of British soils. The plenary session of Commission IV—Soil Fertility—promises to be of particular interest. Prof. E. A. Mitscherlich will describe the co-operative work developed and organised by him in Germany to test his physiological methods of determining fertility, Prof. R. A. Fisher will outline the principles of his well-known methods of field experimentation as used in England, and Prof. O. de Vries will describe fertility measurements in the tropics with special reference to work in the Netherlands Indies. Other papers likely to attract attention are by Prof. F. Hardy on tropical soil types, by Dr. Brüne on the cultivation of moorland, and by Prof. Lowdermilk on the measures now being adopted in the United States for the control of soil erosion. The programme covers the whole field of pure and applied soil science, and includes a number of excursions of both scientific and scenic interest in the neighbourhood of Oxford.

Beit Fellowships for Scientific Research

THE Trustees of the Beit Fellowships have awarded the following fellowships for research at the Imperial

College of Science and Technology, during the academic year 1935-36: Extensions of fellowships already satisfactorily held for one year to:—Dr. J. Bell, for research in fuel technology—"A spectrographic investigation of hydrocarbon combustion"; Dr. H. I. Stonehill, for research in chemistry—"The applicability of the modern theories of strong electrolytes due to Debye, La Mer, Bjerrum, Davies, etc., and the measurement of the E.M.F. of certain cells"; and Mr. J. R. Tillman, for research in physics on "Electron diffraction". New fellowships for one year, renewable for a second year, to:—Mr. R. Walls, of the University of Liverpool, for an investigation of the metamorphic rocks of north-east Scotland, under Prof. P. G. H. Boswell; Mr. E. W. Hewson, of the Mount Allison University, Sackville, Canada, and the University of Toronto, for research in meteorology, more especially the detailed structure of discontinuities between air masses as occurring in England and Canada, under Prof. D. Brunt; Mr. J. E. Carruthers, of Emmanuel College, Cambridge, for the study of primary photochemical processes and oxidation, applied to kinetics of gas reactions in general, under Prof. W. A. Bone.

The Sky in August

MERCURY passes through superior conjunction on August 10, after which date the planet is once more an evening object. Venus attains its greatest brilliance on August 3, the stellar magnitude then being -4.2 . The planet is now moving towards the sun, and will be difficult to pick up with the naked eye at the end of the month. Mars is still conspicuous in the evening sky, but is decreasing in brilliance, from $+0.6^m$ to $+0.8^m$ during the month. This planet is moving towards Jupiter, and will be in conjunction with it on August 27 at 23h., Mars being 2.2° S. Jupiter is much the brighter of the two, its stellar magnitude declining from -1.7^m to -1.5^m during August. Saturn is now rising before midnight, and will be in opposition to the sun on August 31. The stellar magnitude declines from -0.02^m at the beginning of the month to 0.00^m at the end of the month. It is interesting to inquire whether there is any prospect of seeing all five of the naked-eye planets this year. Venus and Saturn make their closest approach in Right Ascension on August 18, when the two planets are 11h. 16m. 37s. apart. On account of their southerly declinations, they will not be simultaneously visible at Greenwich, or at any station north of terrestrial latitude 39° N. Observers at stations south of this limit will be able to see four of the five naked-eye planets at the same time. Venus goes off as Mercury comes on, but it may be possible to pick out both Mercury and Venus in the sunset at a southern station just after Saturn has risen, the best chance of success being right at the end of the month.

Announcements

It is announced in *Science* that Dr. R. H. Fowler, Plummer professor of mathematical physics in the University of Cambridge, has been appointed visiting lecturer in mathematics at Princeton University for the second term of next year.

THE annual autumn meeting of the Institute of Metals will be held in Newcastle-upon-Tyne on September 9-12, under the chairmanship of Dr. Harold Moore, president of the Institute. The Autumn Lecture will be delivered on September 9 by Dr. H. W. Brownson, who will take as his subject "Metal Melting—Its Effect on Quality"; the lecture will be followed by a discussion. Further information can be obtained from the Secretary, Institute of Metals, 36 Victoria Street, London, S.W.1.

A SPECIAL train has recently been organised in Germany for the rapid conveyance of first aid to any place where a great disaster such as a flood or earthquake has taken place.

ERRATUM. Prof. Hans Falkenhagen writes, in reference to the letter in *NATURE* of May 18, p. 830, entitled "Compressibility of Electrolytic Solutions", by Ch. Bachem and himself, that the expression $k = Ac + Bc^{3/2}$, as written by them, is incorrect. It should read $k = C + Ac + Bc^{3/2}$.

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

- A technical officer at the Royal Aircraft Establishment, South Farnborough, Hants, to assist in the investigation of aircraft problems relating to aerodynamics, strength and stiffness—Chief Superintendent, Royal Aircraft Establishment, South Farnborough, Hants, quoting A. 734 (July 29).

An assistant (Grade II) at the Building Research Station for work on problems connected with painting and decoration—Establishment Officer, Department of Scientific and Industrial Research, 16 Old Queen Street, London, S.W.1 (July 31).

A lecturer in mathematics with subsidiary biology at the Saltley Church of England Training College for Schoolmasters, Birmingham—The Principal (Aug. 1).

An engineer officer for the Indian Mercantile Marine Cadets Training Ship *Dufferin*—High Commissioner for India, General Department, India House, Aldwych, London, W.C.2 (Aug. 1).

An assistant lecturer in inorganic and physical chemistry, University College of the South West, Exeter—The Registrar (Aug. 5).

A full-time and a part-time graduate assistant in the Department of Mechanical Engineering, Guildford Technical College—Director and Secretary, Technical College, Park Street, Guildford.

Part-time lecturers in automobile engineering, drawing and design, and workshop processes in the Mechanical Engineering Department, The Polytechnic, Regent Street, London, W.1—Director of Education.

An assistant lecturer in civil engineering in the Battersea Polytechnic, London, S.W.11—The Principal.

A lecturer in plant pathology and zoology at the Swanley Horticultural College for Women, Swanley, Kent—The Principal.

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. 148.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Thermo-electric Effect and the Supra-conducting State

USING the supra-conducting galvanometer described in a previous issue of NATURE¹, we have tried to measure the thermo-electric effect of lead and tin when they were both supra-conducting. The method used to obtain a temperature difference between the junctions was similar to that described by Borelius, Keesom, Johansson and Linde².

One junction, *A*, was immersed in liquid helium, and its temperature was regulated by controlling the pressure over the liquid. The second junction, *B*, was enclosed in a metal container which was also immersed in the liquid helium; this container could be evacuated independently of the outer chamber containing liquid helium and so isolated thermally except for the metal connexions from *B* to the outside. The temperature of the junction *B* was first brought to the same value as *A* by the thermal conduction of the low-pressure helium gas in the *B* container; the temperature of *B*, which was measured by a helium gas thermometer, could be raised by means of a constantan heating coil.

With the temperature of *A* at 3.8° K. and *B* at a somewhat higher temperature, a current was registered by the galvanometer. With *A* at 2.0° and *B* anywhere between 2.0° and 3.7°, no current was indicated. When *B* was raised above 3.7°, while *A* remained at 2.0°, a current flowed in the galvanometer.

Since the supra-conducting point of lead is 7.2° K. and that of tin 3.7° K., we can conclude from this experiment that no thermo-electric effect exists when both junctions are in the supra-conducting state, but the effect comes in when either one of the junctions is raised above the supra-conducting point of one of the metals.

E. F. BURTON.
F. G. A. TARR.
J. O. WILHELM.

McLennan Laboratory,
University of Toronto.
July 2.

¹ NATURE, 135, 906; 1935.

² G. Borelius, W. H. Keesom, C. H. Johansson and J. O. Linde, *Leiden Comm.*, No. 217 c. Or *Proc. Kon. Akad. Amsterdam*, 34, 1365; 1931.

The Masses of Be⁸ and C¹²

THE recent set of nuclear masses proposed on the basis of disintegration experiments¹ includes the values 4.0034 for He⁴, 8.0071 for Be⁸ and 12.0027 for C¹². From these values it follows that the binding energy of two α -particles is either slightly negative or else very small (less than 200,000 volts) whereas that for three α -particles is quite large (7×10^6 volts).

This seems surprising, but may be obtained simply without assuming anything more than a Gamow type of interaction between two α -particles. Thus, taking this interaction potential in the form

$$V = 4e^2/r, r > r_0; \\ = -c, r < r_0;$$

with *c* and *r*₀ related in such a way as to give a certain small value for the binding energy of Be⁸, one finds that the observed mass of C¹² may be obtained by suitable adjustment of the single parameter *r*₀. For example, taking 200,000 volts for the binding energy of Be⁸, a value of *r*₀ slightly greater than 2×10^{-13} cm. will give the observed mass of C¹². Smaller values of *r*₀ than this give rise to increasingly larger binding energies than the observed, and these results are not critically dependent on the value assumed for the binding energy of Be⁸. More precise limits for *r*₀ will be fixed by consideration of heavier nuclei.

We have here a further example of the sensitivity of binding energies for short range fields to changes in the field parameters.

H. S. W. MASSEY.
C. B. O. MOHR.

Cavendish Laboratory,
Cambridge.

¹ Oliphant, Kempton and Rutherford, *Proc. Roy. Soc., A*, 150, 241; 1935. Bethe, *Phys. Rev.*, 47, 633; 1935.

Deposition of Artificial Radio-Elements by Electrochemical Exchange

THE method of preparation of sources of some natural radio-elements (polonium, radium *C*, etc.) on metallic plates by electrochemical exchange and the advantages that it presents are well known. I have tried to apply the method to the separation of radio-copper (period 10 hr.) from zinc. Preliminary experiments have shown that, of the metals nickel, tin, lead and iron which are in the series of tension between copper and zinc, lead gives the best results. The following method has been adopted:

8–12 gm. of zinc powder is attacked by concentrated hydrochloric acid, after irradiation by neutrons, until a residue of 200–300 mgm. remains. This is separated by filtration from the solution. Measurements made with the aid of a Geiger-Müller counter show that *practically all the activity is concentrated on the non-dissolved zinc*. The latter is now dissolved separately in concentrated hydrochloric acid and diluted with about two volumes of distilled water. A plate of lead of suitable dimensions and with one side covered by an insulating material is then rotated in this solution. After 30 minutes, more than half the radio-copper is deposited on the plate.

The method permits the preparation without co-precipitant and, consequently, without absorption of activity, of strong sources of radio-copper in extremely thin layers. Unfortunately, it is not applicable to other known artificial radio-elements, since the elements obtained up to the present by neutron bombardment are generally either isotopes of the elements bombarded or electrochemically less noble.

M. HAÏSSINSKY.

Institut du Radium,
Paris.
June 28.

Disintegration Constant and the Upper Limit of the Continuous β -Spectrum

SARGENT¹ discovered the relation between the disintegration constant of the radioactive elements which decay by emitting a β -particle and the upper limit of the continuous β -spectrum. He found that in the diagram obtained by plotting the logarithms of the disintegration constants against the logarithms of the upper limits, a straight line can be drawn through the points for RaE, MsTh₂, ThC and RaC, and a curved line through the points for RaD, UX₁, ThB, AcC'', ThC'' and UX₂. The points for AcB and RaB do not fall on either of these curves.

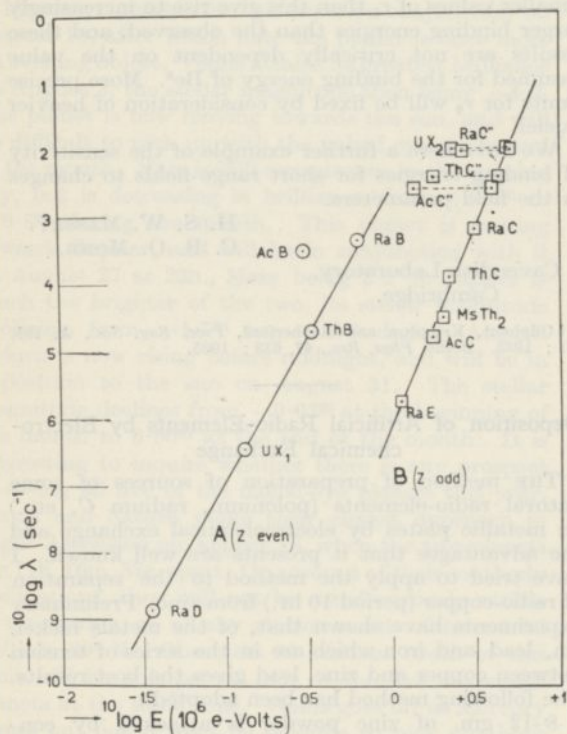


FIG. 1.

Recently, I remarked² that a simple diagram is obtained if the upper limits are plotted against $M - 1.5Z$ (M = mass number, Z = charge number). From this diagram the upper limits of the elements AcC and RaC'', which are not yet measured, can be estimated with good approximation. Using the two values obtained in this way ($1.8_1 \times 10^6$ and $2.6_2 \times 10^6$ electron volts respectively) to complete Sargent's diagram, one finds that the point for AcC falls on the straight line and that for AcC'' on the

curved line. In the same communication I directed attention to the fact that the upper limits are generally higher for the elements with odd charge number, than for those with even charge number. From this fact the question arose whether the difference between the even and the odd elements might be of interest for the interpretation of Sargent's diagram.

That this is really the case can be seen from Fig. 1, in which the diagram is reproduced completed with the points for AcC and RaC''. Instead of the curved line mentioned above, a straight line is drawn through the points for RaD, UX₁, ThB and RaB. Now, in the diagram, three groups of points are to be distinguished: (1) Points for the elements with even charge number which, with the single exception of AcB, fall on the straight line A; (2) points for the elements with odd charge number, RaE, AcC, MsTh₂, ThC, RaC, which fall on the straight line B; (3) points for the elements with odd charge number AcC'', ThC'', RaC'', UX₂.

If λ is expressed in sec.⁻¹ and E in 10^6 e.-volts (and if logarithms to the base of ten are used) the straight lines correspond to the formulæ:

$$A (Z \text{ even}): \log \lambda = -2.63 + 4.35 \log E = -2.63 + 1.45 \log E^3.$$

$$B (Z \text{ odd}): \log \lambda = -6.11 + 5.80 \log E = -6.11 + 1.45 \log E^4.$$

If the energy of an electron, $m_0c^2 = 0.510_4 \times 10^6$ e.-volts, is used as unit of energy, these equations become:

$$A (Z \text{ even}): \log \lambda = -3.90 + 1.45 \log E^3.$$

$$B (Z \text{ odd}): \log \lambda = 2(-3.90 + 1.45 \log E^2).$$

It may be of interest to remark that the four elements of the third group are all 'branch products'. Further, it was found, as is indicated in Fig. 1 by the dotted lines, that the points belonging to these four elements all can be brought on to the straight line B by adding $2.6_3 \times 10^6$ e.-volts to the value of the upper limit. This can scarcely be a mere chance. Moreover, this energy of $2.6_3 \times 10^6$ e.-volts is just equal to the energy of the intense γ -radiation which is emitted by ThC'', and is the hardest γ -radiation known. A γ -radiation of about the same energy is also observed with RaC + C' + C''. Here it is generally ascribed to RaC, but the possibility does not seem excluded that it has its origin in the nucleus of RaC''. Perhaps it would repay the trouble to look for such a hard γ -radiation also with UX₂ and AcC''.

G. J. Sizoo.

Natuurkundig Laboratorium
der Vrije Universiteit,
Amsterdam.

¹ B. W. Sargent, *Proc. Roy. Soc., A*, **139**, 659; 1933.
² G. J. Sizoo, *Physica*, **2**, 472; 1935.

Diffraction of X-Rays and Electrons by Carbon Tetrachloride Vapour

RECENT electron-diffraction investigations¹ of the molecular structure of gaseous carbon tetrachloride give values of the interatomic distances, which are appreciably lower than those obtained in earlier electron-diffraction measurements and those obtained by Bewilouga² from X-ray photographs. This discrepancy of about 4 per cent is so important that it cannot be explained by the probable errors given by the authors. As, moreover, carbon tetrachloride is generally used as a standard substance for testing the apparatus, it

seemed to us to be of interest to compare X-ray and electron-diffraction results from as wide a field as possible with the corresponding theoretical calculation, using in both cases the most trustworthy experimental methods.

The electron-diffraction apparatus used for this purpose was that constructed by de Laszlo³. We developed a narrow tube system, which absorbs the primary electron beam as soon as it leaves the vapour-jet system. This made it possible to reduce the pressure in the vapour-jet system and thereby all disturbing scattering effects. Perfect microphotometer records could be obtained of the photographic plates by rotating them at high speed. All influence of grain and dust was thus avoided. The theoretical scattering curve was obtained in the usual way, introducing the atomic form factors of James - Brindley and Heisenberg - Bewilogua's *S*-values for inelastic scattering. Supposing the atomic part of the theoretical intensity curve (monotonic curve, representing the total intensity without the details concerning molecular structure) rendered correctly by the corresponding experimental values, the influence of molecular structure on the atomic part of intensity could be compared with good accuracy.

We found that, at the first minimum and maximum, good agreement of theory and experiment could be obtained. At the fifth apparent maximum, however, the theoretical curve was more prominent than the record indicated. This discrepancy may be explained by the influence of thermal vibrations, which is rather important in this region. Using James's formula⁴ for this correction, we found that excellent agreement could be obtained. However, the detection of this thermal vibration effect had no influence on the interatomic distance measurements. The study of microphotometer records and the generally used visual measurements of ring diameters at large scattering angles both gave values for the chlorine-chlorine distance of 2.86 ± 0.03 A. and for the carbon-chlorine distance 1.75 ± 0.02 A. These values are in excellent agreement with those mentioned previously¹.

Up to the present time, the X-ray distance measurements of Bewilogua have never been controlled. Meanwhile, one of us⁵ has shown, however, that a more satisfactory agreement of intensity values could be obtained, if monochromatic X-rays were used; but the large volume of gas effective in scattering did not allow of the determination of trustworthy interatomic distances. An improved form of this arrangement with a circular mica window closing the vapour tube, combined with a powerful X-ray source, made it possible to reduce considerably the scattering volume of gas and to avoid the corresponding correction. With copper *K* α radiation, two maxima and three minima, with molybdenum *K* α radiation, five maxima and minima could be measured. The agreement between microphotometer records and corrected theoretical intensity curves was satisfactory in both cases and accurate distance measurements could be obtained. The mean values from several photographs are: 2.85 ± 0.03 A. for the Cl-Cl distance and 1.74 ± 0.02 A. for the C-Cl distance. These values are appreciably lower than those given by Bewilogua, and it seems that the experimental improvements effected are the reason for it.

The present investigation shows that the diffraction of X-rays and electrons by carbon tetrachloride agrees with theoretical calculation and both lead to the same values of interatomic distances.

Full details will be published shortly in the *Physikalische Zeitschrift*.

This work was carried out under the guidance of Prof. Debye in the Chemical Institute of the University of Liège.

CH. DEGARD.

J. PIÉRARD.

W. VAN DER GRINTEN.

Institut de Chimie générale,

Université de Liège.

June 14.

¹ V. E. Cosslett and H. de Laszlo, *NATURE*, **134**, 63; 1934. *Trans. Faraday Soc.*, **30**, 981; 1934. L. Pauling and L. O. Brockway, *J. Chem. Phys.*, **2**, 867; 1934.

² L. Bewilogua, *Phys. Z.*, **32**, 265; 1931.

³ H. de Laszlo, *Proc. Roy. Soc., A*, **146**, 672; 1934.

⁴ R. W. James, *Phys. Z.*, **33**, 737; 1932.

⁵ W. v. d. Grinten, *Phys. Z.*, **34**, 609; 1933.

Interaction between Acetylcholine and Sterols in Tissues

WE have recently carried out some experiments on the form of the contraction given by the gastrocnemius muscle of a winter frog¹ in response to a single electrical stimulus. In certain circumstances, of which the most important is the presence of thyroxine at slightly above the physiological concentration in the Ringer's solution in which the muscle is bathed, the muscle gives an abnormal prolonged contraction if either acetylcholine or one of several sterols is added to the medium. This abnormal contraction greatly resembles a tetanic contraction in form. It is of exactly the same type whether it is produced by the addition of acetylcholine or of a sterol. Further, if both acetylcholine and a sterol are added to the medium together, in a proportion which is different for different sterols but is well-defined for each, the contraction remains a normal twitch and shows no tendency to become prolonged. So long as this proportion between the concentrations of acetylcholine and sterol in the medium is maintained, the concentrations of both may be altered over a wide range and the contraction will remain a normal twitch.

These conclusions are illustrated by the results of the following experiment. A muscle was set up in a modified Ringer's solution containing acetylcholine at a concentration of $1/10^6$ by weight. After 60 min. it responded (to stimulation of its nerve by a single shock) with a prolonged contraction of 1.4 sec. Ergosterol $1/10^5$ was then added to the medium, which was otherwise unaltered. In ten minutes the contraction had returned to a normal twitch and it remained thus for 20 min., when it again lengthened. At 60 min. it was 2.35 sec. long. The concentration of acetylcholine was then raised to $1/10^5$, and the contraction again shortened and afterwards again lengthened to a prolonged contraction of 1.7 sec. Finally, the concentration of ergosterol was raised to $1/10^4$. In a further 60 min. the contraction had once again returned to a normal twitch. Later, it again lengthened to a prolonged contraction of 1.5-1.9 sec.

Results such as these have been obtained in many experiments. They show, first, that the normal twitch may occur with very different concentrations of acetylcholine and sterol. Secondly, it seems that the only way that the return to the normal twitch and the later resumption of the prolonged contraction after each addition of acetylcholine or sterol can be interpreted is to suppose that a balance between the concentrations of acetylcholine and sterol in the tissue is necessary if the contraction is to have the

form of a normal twitch. After each addition, the added substance diffuses into the tissue, and this balance is first re-established (when the contraction becomes a normal twitch), and then overturned on the opposite side (when the prolonged contraction is resumed). We do not wish to draw any conclusions from the actual concentrations of acetylcholine added to the medium. This substance breaks down rapidly in solution and it is probable that in such experiments as these the concentration in the muscle is not equivalent to that added to the medium.

So far, only a few sterols have been used in these experiments, but all those we have used are active to a greater or less extent. Cholesterol, both as supplied by The British Drug Houses and as a highly purified sample, was found to have one fifth the activity of ergosterol: di-hydrocholesterol had one tenth the activity of cholesterol. A few other sterols have been used. All these sterols were suspended in the medium with lecithin, which was itself shown to be inactive.

In view of these results, we have thought it worth while to investigate the action of sterols on the beat of the frog's heart, in order that any action of these substances might be compared with the well-known action of acetylcholine. We have obtained results which are parallel to those of our experiments on muscle. When the sterol is placed in the medium circulating through a heart, the beat is reduced in height and slowed and, if the quantity of the sterol is sufficient, the heart is stopped for a time. The reaction of the heart is precisely similar to its reaction to acetylcholine. Frogs' hearts vary greatly in their sensitivity to acetylcholine and sterols, and for this reason it is not so easy to balance a concentration of acetylcholine against one of a sterol in these experiments as in those on muscle. But, if the quantities of acetylcholine and sterol which are necessary to produce stoppages of equal length in the same heart are determined, and these quantities of both substances are then placed together in the medium, the change in the heart beat is very much less than is produced by either separately and often there is no change at all. As in the experiments on muscle, it seems that if a certain proportion is maintained between the concentrations of acetylcholine and sterol, the normal behaviour of the tissue is not disturbed, although the concentrations of both acetylcholine and sterol in the tissue are greatly altered.

Since both acetylcholine and sterols are natural constituents of animal cells, we think that these results suggest that, at least in the phenomena which we have investigated, the sterols play a part in the same chemical processes as those in which acetylcholine is concerned; and that a definite proportion between the concentrations of acetylcholine and sterols in the tissue is necessary for its normal functioning. Since several sterols are active in these phenomena, it is clear that many of the sterols can replace each other in this as in their other actions, and that the activity of any one sterol is no proof that it is the natural active substance.

G. S. CARTER.

Sub.-dept. of Exp. Zoology,
Zoological Laboratory,
Cambridge.

L. W. MAPSON.

Biochemical Laboratory,
Cambridge.
June 14.

¹ Carter, G. S., *J. Exp. Biol.*, 10, 256; 1933.

Estimation of Ascorbic Acid by Titration

UNDER this title McHenry and Graham¹ have published an investigation on the ascorbic acid content of raw and cooked foodstuffs. They found in the case of cauliflowers, carrots, parsnips, beets and potatoes more ascorbic acid in the cooked than in the raw food (determined by the method of Birch *et al.*). They believe the increase is due to the setting free of bound ascorbic acid, perhaps from an ester. In the case of certain plant tissues, then, a simple extraction and titration procedure does not give the complete value of ascorbic acid, but only measures the free acid.

From the following observations (Tables I and II) I conclude that this view is not correct, and that the increase by cooking is not a real increase; in reality, after cooking the ascorbic acid content decreases.

Table I.
mgm. Vitamin C in 10 gm. of a single potato under various conditions of extraction.

1. Ground up in a mortar under trichloroacetic acid (3 per cent)	3.05
2. Extract (1) after mercuric acetate and hydrogen sulphide treatment ²	3.11
3. Ground up without trichloroacetic acid and then diluted with trichloroacetic acid	0
4. Extract (3) after mercuric acetate and hydrogen sulphide treatment	3.11
5. Ground up under trichloroacetic acid after addition of 2.25 mgm. ascorbic acid	5.36
6. Extract (5) after mercuric acetate and hydrogen sulphide treatment	5.35
7. Ground up without trichloroacetic acid after addition of 2.25 mgm. ascorbic acid and then diluted with trichloroacetic acid	0.36
8. Extract (7) after mercuric acetate and hydrogen sulphide treatment	5.35

Table II.
mgm. Vitamin C in 10 gm. of a single potato before and after cooking.

1. Ground up under trichloroacetic acid before cooking	3.18
2. Extract (1) after mercuric acetate and hydrogen sulphide treatment	3.21
3. After cooking for 45 min., then ground up with trichloroacetic acid	2.67
4. Extract (3) after mercuric acetate and hydrogen sulphide treatment	2.59
5. After cooking for 45 min., then ground up without trichloroacetic acid and diluted with trichloroacetic acid	2.59
6. Extract (5) after mercuric acetate and hydrogen sulphide treatment	2.48
7. Ground up, cooked for 45 min., then diluted with trichloroacetic acid	0
8. Extract (7) after mercuric acetate and hydrogen sulphide treatment	0.13

Hence it follows that the apparent increase must be attributed to the destruction of an oxidase present in some vegetables*, which changes the reduced ascorbic acid into the reversibly oxidised state when the vegetables are ground up. Therefore it is necessary to reduce the extract with hydrogen sulphide after mercuric acetate precipitation². This oxidase is not active in 3 per cent trichloroacetic acid solution. So the discrepancy may be caused by omitting or adding too small quantities of trichloroacetic acid at the moment of grinding up the vegetables. The oxidase is destroyed by cooking, so that in an extract of cooked vegetables the vitamin is not oxidised.

Finally, attention must be directed to the fact that when determining the ascorbic acid content in blood, an analogous phenomenon takes place. The ascorbic acid in the blood is present in the reduced state. This is proved by the fact that the serum extract before and after mercuric acetate and hydrogen sulphide treatment contains the same amount of

* Tauber and Kleiner have isolated an 'ascorbic acid oxidase' from Hubbard squash (*Proc. Soc. Exp. Biol. and Med.*, 32, 577; 1935), Szent-Györgyi a 'hexoxidase' from cabbage leaves (*J. Biol. Chem.*, 90, 385; 1931). The oxidation of ascorbic acid by potato juice is due to the polyphenoloxidase, which oxidises phenol to quinone, then the quinone oxidises the ascorbic acid (Szent-Györgyi und Vietoris, *Biochem. Z.*, 233, 236; 1931).

ascorbic acid. However, in the presence of erythrocytes, the ascorbic acid is reversibly oxidised when precipitating the blood with trichloroacetic acid. Hence only after reduction with hydrogen sulphide (after mercuric acetate precipitation) can the quantity of ascorbic acid be determined³.

M. VAN EEKELLEN.

Laboratory of Hygiene,
University of Utrecht.
June 15.

¹ McHenry and Graham, *NATURE*, **135**, 871; 1935.
² Emmerie, *Biochem. J.*, **28**, 268; 1934. Emmerie and Van Eekelen, *Biochem. J.*, **28**, 1153; 1934.
³ Van Eekelen, Emmerie, Josephy and Wolff, *Klin. Wschr.*, **13**, 564; 1934.

Proteolytic Digestion in the Ammocæte Larva

MISS ALCOCK¹, in an early publication on digestion in the ammocæte larva, stated that extracts of the liver, alimentary canal and skin showed proteolytic activity of the peptic type. More recently, however, Berrill^{2,3} has described an enzyme of the tryptic type in the 'liver' and skin (hatching enzyme) of ascidians, and in view of the phylogenetic relationship between these forms, Miss Alcock's work, which was carried out before the realisation of the importance of pH control, clearly demands reconsideration.

In the course of investigations, still in progress, into the problems of digestion in the Cyclostomata, I have found that proteolytic digestion in the ammocæte larva of the brook-lamprey is in fact markedly similar to that of the Ascidiacea, for in extracts of the anterior end of the so-called mid-gut (by which is meant the main wide portion of the intestine) and of the skin, it is possible to demonstrate, using as substrates casein (for formol - caustic soda titration) and gelatine, strong proteolytic activity of the tryptic type, the optimum being at about pH 8. The intestinal extract is stronger than that of the skin. No such effect is obtainable from extracts of the liver or of the remainder of the mid-gut, although all four extracts show a very weak proteolytic activity in an acid medium of a pH at least as low as 1.5; the most reasonable explanation of this latter effect would seem to be that it is due to the presence of an autolytic tissue enzyme.

With regard to the localisation of the digestive enzyme in the mid-gut, it may be noted that recent work (Boenig⁴, Cotronei⁵ and others) on the so-called 'pancreas' of the Cyclostomata appears to have established firmly the fact that this organ is exclusively endocrine in nature, Cotronei pointing out that the zymogen cells must therefore still be confined to the intestinal epithelium. Now Brachet⁶ had previously directed attention to the presence in the epithelium at the anterior end of the mid-gut of specialised granular cells, characterised especially by the possession of very large nucleoli, and had suggested that these might represent a localisation of zymogen cells. It will be seen that my results indicate that the proteolytic enzyme of the mid-gut is produced in precisely this region.

E. J. W. BARRINGTON.

Department of Zoology,
University College,
Nottingham.
June 20.

¹ *J. Anat. Physiol.*, **33**; 1899.
² *Brit. J. Exp. Biol.*, **6**; 1929.
³ *Phil. Trans. Roy. Soc.*, **B**, **218**; 1929.
⁴ *Z. mikr.-anatom. Forschung*, **17**; 1929.
⁵ *Pub. Staz. Zool. Napoli*, **8**; 1927.
⁶ *Anat. Anz.*, **13**; 1897.

Guanine in the Excreta of Arachnids

SINCE the work of Gorup-Besanez and Will in 1849¹, it has been classical to regard guanine as taking the place of uric acid as the main nitrogenous end-product of arachnid metabolism. This view is accepted in all the monographs on comparative biochemistry, such as that of von Fürth², but it appears to rest wholly on colour tests of uncertain value and deductions from crystal form.

Accordingly, it was thought desirable to examine the Arachnida and their metabolic products with the aid of the specific deaminating enzyme guanase which occurs in mammalian (rabbit) liver and forms xanthine from guanine. A number of different species of spider were examined, and the work will be continued on tropical material in Siam. Here only the experiments on the collected excreta of the common garden spider, *Epeira diadema*, will be mentioned. By this specific method, following the details given by G. Schmidt³, an average of 12 per cent of the weight of the excreta was found to be guanine. In view of the fact that no separation of the product of the Malpighian tubes from that of the gut was made, this figure is fairly considerable.

This is the first demonstration of the presence of guanine in arachnid excreta using a specific enzyme.

KLOOM VAJROPALA.

Sir William Dunn Institute
of Biochemistry,
University of Cambridge.
June 27.

¹ Gorup-Besanez and Will, *Ann. Chem. u. Pharm.*, **69**, 117; 1849.
² von Fürth, "Vergl. Chem. Physiol. nied. Tiere", p. 298, 1903.
³ G. Schmidt, *Z. physiol. Chem.*, **203**, 225; 1932.

Structure of the Proboscis in Blood-Sucking Diptera

DR. S. K. SEN¹ has expressed the view that the food-canal of blood-sucking Diptera is not formed, as is generally supposed, by the apposition of the labrum-epipharynx and the hypopharynx, but that it is actually the lumen of the hypopharynx itself, a channel which has been regarded hitherto as the continuation of the salivary duct. From the studies I have made it appears to me that this view is quite incorrect. An adequate reply to Dr. Sen would occupy too much space in this journal, but I have fully explained my views in various papers in *Parasitology* (1926, 1928, 1929 and 1932) and I must ask those who are interested in the subject to refer to them.

Dr. Sen says that the labrum-epipharynx is entirely unconnected with the buccal chamber (termed *hyoid* in my papers), but in fact in all the blood-sucking Diptera which I have studied, the epipharynx is continuous posteriorly with the dorsal part of the wall of the hyoid or, if this sclerite is absent, with the anterior membranous wall of the pharynx. The apodemes (termed *stipites* in my papers) do not separate the labrum-epipharynx either from the buccal chamber (hyoid) or from the hypopharynx, since each of them is attached to the postero-lateral part or to the posterior process of the labrum. Furthermore, as regards the statement that the salivary duct terminates at the base of the hypopharynx, this view again appears unsound, since in all blood-sucking Diptera, with the exception of those of the genus *Culicoides*, the common salivary duct penetrates the hypopharynx and opens at its tip².

Dissection is of value only for the study of the general structure of the proboscis and its various components; the relation of these to each other, especially in the guttered part of the labium, can only be studied in complete series of transverse sections. It is, moreover, misleading to base any generalisation upon the study of a single species of this large order of insects.

B. JOBLING.

Wellecome Entomological Field Laboratories,
Claremont, Esher, Surrey.
June 26.

¹ NATURE, 135, 915; 1935.

² Jobling, *Bull. Ent. Res.*, 1928.

Kinetics of Heterogeneous Catalysis and of Enzyme Action

THE activation of the adsorbate recently described in NATURE¹ was explained by the formation of an adsorption complex $E-S^+$ in which the adsorbed molecule S has gained a quantum of rotation-vibrational energy from the surface molecule E . This complex will be dissociated into $E+S^+$ by the supply to it of a quantity of energy equal to that transferred from E to S in the formation of the complex. If the energy of activation of the free molecules S^+ be the critical increment of one of the reactions of the substance S , that reaction will be promoted by the surface of E molecules.

If now the number of molecules in the available surface be represented by E and the molecular concentration of the reactant (assumed to be constant) be represented by S , the initial velocity of formation of the adsorption complex will be k_1SE and at time t the velocity will have fallen to $k_1S(E-x)$, where x is the number of adsorption complexes which have been formed. The velocity of dissociation of these complexes at time t will be $k_2xe^{-Q_1/RT}$, where Q_1 is the amount of energy transferred from surface to adsorbate in forming the complex. If the concentration of S be constant, a stationary state will be established at which the velocity of the reaction promoted by the surface will be given by

$$r = k_1S(E-x) = k_2xe^{-Q_1/RT}.$$

By the elimination of x we have

$$r = \frac{k_1SEK}{k_1S+K}, \text{ where } K = k_2e^{-Q_1/RT}, \text{ and}$$

$$\log \frac{r}{k_1SE-r} = \log \frac{k_2}{k_1S} - Q_1'/T, \text{ where } Q_1' = Q_1/2 \cdot 303R.$$

If now the substance E be itself adsorbed as a unimolecular layer on a surface C with the formation of the adsorption complex $C-E^+$, the molecules of E will now be activated, the energy of activation being denoted by Q_2 . When these activated molecules adsorb the reactant S there will be formed the adsorption complex $C-E-S^{++}$, in which the total energy of activation of S^{++} is Q_1+Q_2 . This complex will be resolved by the absorption of the energy Q_1 into $C-E+S^{++}$ and the de-activated catalyst $C-E$ will be reactivated to $C-E^+$ by the absorption of the energy Q_2 . In this manner a reaction with a total critical increment of Q_1+Q_2 can be promoted by an adsorbed catalyst, the total energy being absorbed from the surroundings in two separate and distinct stages.

By analogy with the above simple case a stationary state will be established, if the concentration of the reactant S be maintained constant, the reaction velocity being given by

$$r = k_1S(E-x-y) = k_2xe^{-Q_1/RT} = k_3ye^{-Q_2/RT}.$$

By the elimination of x and y we obtain the same expression as before, namely:

$$r = \frac{k_1SEK^1}{k_1S+K^1};$$

$$\text{but } K^1 = \frac{k_2k_3e^{-(Q_1+Q_2)/RT}}{k_3e^{-Q_1/RT} + k_2e^{-Q_2/RT}}.$$

$$\text{Since } \frac{e^{-(Q_1+Q_2)/RT}}{e^{-Q_1/RT} + e^{-Q_2/RT}} = \frac{e^{-Q_2/RT}}{1 + e^{(Q_1-Q_2)/RT}},$$

the exponential term has a maximum value of $\frac{1}{2}e^{-Q_2/RT}$ when $Q_1=Q_2$. If $Q_1=Q_2$, there will be two exactly similar processes taking place under identical conditions and hence it is legitimate to assume that $k_2=k_3$. On these two assumptions the expression for the reaction velocity is much simplified and may be written in the forms

$$r = \frac{k_1SE \times 0.5k_4e^{-Q_2/RT}}{k_1S + 0.5k_4e^{-Q_2/RT}}$$

$$\text{and } \log \frac{r}{k_1SE-r} = \log \frac{k_4}{2k_1S} - Q_2'/T,$$

where $k_4=k_2=k_3$, $Q_2'=Q_2/2 \cdot 303R$ and Q_2 is one half the total critical increment of the reaction promoted by the adsorbed catalyst.

It may be suggested that enzyme reactions are of this two-stage activation type, since there is little doubt that the enzyme is adsorbed on the co-enzyme. The virtue of such an enzyme system is due to the fact that it is able to promote within a living organism a reaction the critical increment of which is so large that it cannot otherwise take place with measurable velocity at the temperature of that organism.

The equations and the specificity of enzyme systems will be described more fully in a further communication, but one important conclusion may be stated. Neither the critical increment of a heterogeneous reaction nor that of the de-activation of an enzyme system can be determined directly from measurements of the reaction velocity at two different temperatures, since it is $\log \frac{r}{\text{const.}-r}$ and not $\log r$ which is linear with the reciprocal of the absolute temperature.

E. C. C. BALY.

University,
Liverpool.
June 11.

¹ NATURE, 136, 28, July 6, 1935.

Shape of the NO₂ Molecule

In a recent paper¹, one of us has shown that the available data² on the contours of the infra-red bands of NO₂ are most consistently interpreted by a ring-like structure for the molecule, with the O-N-O angle approximately 60°. The theory of directed valency was employed there to provide a possible electronic configuration for this model. Closer investigation of the electronic structure, however,

indicates that a much more probable form has the O-N-O angle in the neighbourhood of 110° - 120° .

Dr. R. M. Badger and Dr. G. Herzberg have suggested independently³ that the wide-angled form is the correct one. The former points out that a ring-like structure would be inconsistent with the low value (641 cm.^{-1}) observed for the frequency ν_2 , while the latter shows that the fine-structure of the ultra-violet bands⁴ indicates a rather flat molecule. On these grounds, they both suggest a re-assignment of the fundamental frequencies as shown in the accompanying table. The object of this re-assignment is to avoid difficulties which would otherwise arise in interpreting the observed contours of the infra-red bands. A discussion of these cannot conveniently be given here.

Fundamental Frequencies of the NO_2 Molecule in cm.^{-1} .

Designation	ν_1	ν_2	ν_3
Sutherland	1373	641	1615
Badger and Herzberg	1615	641	1373

We have recently been making a study of the force fields in triatomic molecules, more particularly of the force constant controlling the bending frequency (ν_2), and from it we find that the wide-angled structure for NO_2 is definitely to be preferred. We find, moreover, that the original assignment of the fundamental frequencies seems more likely to be the correct one. This immediately leads to difficulties regarding the contours of the infra-red bands, which Badger and Herzberg's re-assignment was designed to avoid. Since the latter does not, however, resolve all the difficulties, we feel that an extensive and careful re-examination of the contours of the infra-red bands will be necessary before these can be used as a reliable guide to the shape of the molecule.

A full account of these investigations will be published later elsewhere.

G. B. B. M. SUTHERLAND.
W. G. PENNEY.

Laboratory of Physical Chemistry,
Cambridge.
June 19.

¹ Sutherland, *Proc. Roy. Soc.*, A, **145**, 278; 1934.
² Bailey and Cassie, *NATURE*, **131**, 239; 1933. Harris, Benedict and King, *NATURE*, **131**, 621; 1933. Schaffert, *J. Chem. Phys.*, **1**, 507; 1933.

³ In private communications, which we gratefully acknowledge.

⁴ Hermann, *Ann. Phys.*, **15**, 89; 1932.

Influence of Viscosity Variation on the Rupture of Plastic Bodies

THE term viscosity has frequently been used in a qualitative sense in describing the properties of solids and particularly of metals, but its use in the quantitative sense which has been developed through the study of liquids is a comparatively recent development. Viscosity may be defined quite generally as the ratio of the shearing stress in any plane to the rate of shear or velocity gradient perpendicular to the plane. Thus defined it appears always to be a variable quantity for solids, its value depending on a number of factors, but particularly on the magnitude of the shearing stress. No emphasis appears, however, to have been laid on the importance of the *degree of variability* of the viscosity in relation to the rupture of plastic solids.

The point is most easily explained by reference to 'runny' materials to which standard viscometric methods may be applied: (we avoid the word 'fluid', because this is sometimes taken to imply a constant viscosity). If some golden syrup is sucked up into a tube 10-20 cm. long, and about 1 cm. in diameter, it will run out quite continuously without forming drops. A clay paste, on the other hand, falls from the end of the tube in 'blobs' (they can scarcely be called drops). The surface tension is about the same in the two cases, and its influence is not large owing to the use of a very wide tube. The difference in behaviour must be due to viscosity. It cannot be a question of the absolute magnitude of the viscosities, as these can be considerably changed by altering the concentrations of sugar and clay without making the two materials behave alike. We can only attribute the difference to the fact that while the viscosity of a sugar syrup is independent of the stress, that of a clay paste varies very greatly, particularly in the neighbourhood of its 'yield value'. Soft soap, when warm, will run from such a tube, and has a viscosity which is not constant like that of syrup, but yet is not as steeply variable as that of a clay paste. It is interesting to observe that in falling from the tube this material forms blobs which, if they do not have to fall too far, do not become completely detached from one another. Its behaviour is thus intermediate, as we should expect.

We are not aware that similar reasoning has, as yet, been applied to the behaviour of solids in tension. In the case of flour dough we have developed, for the quantitative measurement of viscosity, a technique which has been considerably extended and improved in co-operative work with Dr. P. Halton of the Research Association of British Flour Millers, and there are strong indications that shortness in a dough is associated with a particularly rapid decrease of viscosity with increase in shearing stress. We have not sufficient personal experience with metals to make any assertion about their behaviour, but we venture to suggest that the rate of decrease of viscosity (as defined above) with increase in shearing stress may be a determining factor in their tensile strength. A general connexion between the manner of rupture and the degree of variability of viscosity may be found to hold even though the underlying mechanism is quite distinct as between different kinds of materials.

In practice, the position is apt to be obscured by factors in addition to shearing stress which influence viscosity. For example, heather (*Calluna vulgaris*) honey if kept in the tube overnight sets to a thixotropic gel which causes it to fall in blobs, whereas after stirring it behaves substantially like syrup. Again, flour dough strain-hardens on extension. As with metals, this delays 'necking' when cylinders of this material are extended.

The behaviour of rubber in benzene differs from both syrup and clay pastes because it has a much longer relaxation time (ratio of viscosity to rigidity modulus). We suggest, however, that such factors, though introducing complications, do not necessarily upset the postulated relationship between the degree of variability of viscosity and the manner of rupture, and that it may prove illuminating in the study of many materials.

R. K. SCHOFIELD.
G. W. SCOTT BLAIR.

Physics Department,
Rothamsted Experimental Station,
Harpenden, Herts.

Electrical Units and the I.E.C.

SIR RICHARD GLAZEBOOK says¹: "It is recognised that in addition to the three accepted units of length, time and mass a fourth unit is required for the specification of electrical quantities". Recognised by whom? What has happened to the upholders of the old doctrine that these three quantities are possessed of some mystical peculiarity in virtue of which they are necessary and sufficient as 'fundamental units'? Is it abandoned; if so, what do those who held it now believe? Or has a fourth magnitude possessed of this mystical property been found; if so, what is it?

Though I may be in a minority of one, I ask leave to repeat the conclusions that I have expounded at such length in my "Measurement and Calculation". If a 'unit' means something fixed by arbitrary choice and not by facts, then, if n quantities are to be defined, at least n 'units' are necessary. If it means a choice made by assigning a value to some arbitrarily constructed body or system, then no 'unit' is necessary (as Planck's 'natural' system shows), and the number of 'units' that is convenient is a matter of opinion. An 'absolute system', if it means anything, means one in which arbitrary choices are made so as to

make equal to unity all universal constants that have no theoretical significance. The suggestion to make many of the n arbitrary choices in this way is very valuable; but it does not impose a unique set of choices. In particular, it does not force us to make either three or four arbitrary choices in a manner different from the remainder.

Two main errors are responsible for a failure to accept these certain conclusions. One is the ignoring of the distinction between what I have called A and B magnitudes, and of the fact that many magnitudes can be both A and B . The other is the belief, fostered by mathematicians, that experiment can establish the equality of magnitudes of different kinds; every experimentalist knows that it can only establish their *proportionality*.

I am expressing no opinion whatever concerning the practical convenience of Prof. Giorgi's system. I am protesting only against the view, apparently entertained by himself and his followers, that the number 4 has any greater factual significance in connexion with the choice of 'units' than the number 3, which used to be favoured.

NORMAN R. CAMPBELL.

¹ NATURE, 136, 71, July 13, 1935.

Points from Foregoing Letters

By means of their newly-devised supra-conducting galvanometer, Prof. E. F. Burton, F. G. A. Tarr and J. O. Wilhelm find that no thermo-electric current flows in a lead-tin couple if both junctions are kept below 3.7° K., when the metals are in the supra-conducting state.

The relation between the mass of the atomic nuclei of carbon and beryllium and the binding energy of their constituent alpha particles has been derived by Drs. H. S. W. Massey and C. B. O. Mohr.

The energy of the hardest known gamma rays (2.6 million electron-volts) obtained from ThC" and supposedly from RaC can be related, Prof. G. J. Sizoo states, to the position of radioactive elements of odd charge, grouped according to their disintegration constants, plotted against the highest energy of the electrons (beta rays) they emit. The graphs show a simple relation between the two quantities in the case of elements of even and of odd charge number, and suggest that the hard gamma rays now ascribed to RaC may really be due to RaC" and that similar radiation may be expected from UX₂ and AcC".

New X-ray and electron-diffraction analyses of carbon tetrachloride vapour have been made by Messrs. Ch. Degard, J. Piérard and W. v. d. Grinten. Both methods give values for the interatomic distances in good agreement with recent electron-diffraction investigations. From microphotometer records of electron-diffraction photographs, the influence of thermal vibrations could be detected.

Drs. G. S. Carter and L. W. Mapson find that various sterols have an action similar to that of acetylcholine, weakening and slowing the beat of the frog's heart, but they nevertheless appear to balance one another's effects when present together. The addition of either a sterol or acetylcholine to the gastrocnemius muscle of a frog in the resting winter condition leads to prolonged contraction, but when added together, only a normal twitch is observed.

From the amount of vitamin C (ascorbic acid) extracted from a potato under various conditions, M. van Eekelen concludes that vegetables contain a ferment which partially oxidises the ascorbic acid and interferes with its titration. This effect may be eliminated by the addition of 3 per cent trichloroacetic acid. The apparent increase in ascorbic acid observed by McHenry and Graham was due, according to Van Eekelen, to the destruction of the interfering oxidases and not to the liberation of more ascorbic acid from an ester.

E. J. W. Barrington reports the occurrence in the intestine and skin of the ammocoete larva of the brook-lamprey of a proteolytic enzyme apparently similar to that already known to exist in the ascidians. The alimentary systems of these forms are thus physiologically more closely akin than had been suggested by early work on the same subject.

Prof. E. C. C. Baly considers theoretically the velocity of activated chemical reactions brought about in two stages, such as those occurring in biological changes where an enzyme is adsorbed on a co-enzyme.

Drs. G. B. B. M. Sutherland and W. G. Penney point out difficulties in reconciling the shape of the NO₂ molecule inferred from a study of the force fields of triatomic molecules with that deduced from the absorption of infra-red light, and suggest a re-examination of the contours of the absorption bands of NO₂.

Certain viscous materials like golden syrup run out continuously from an orifice while others like clay paste drop out in 'blobs'. Dr. R. K. Schofield and G. W. Scott Blair ascribe the difference to the rate of variation in viscosity with shearing stress, and direct attention to the importance of this factor in such practical matters as the 'shortness' of flour dough and the 'necking' and rupture of metal cylinders.

Research Items

Excavations at Tepe Gawra, Iraq

THE elimination of all but three archaeological expeditions to Iraq through the working of the Antiquities Law would add interest to almost any find in the season which has just passed; but the excavations which have been carried out by the joint expedition of the Museum of the University of Pennsylvania and the American School of Oriental Research at Tepe Gawra are in themselves of too great importance to need extraneous enhancement. Mr. Charles Bache, field director, in a report circulated by Science Service, Washington, D.C., states that he has now reached the level of the twelfth city (counting from above) on the site. This he dates at about 4000 B.C. Exploratory trenches have revealed the existence of eight earlier levels. In the recently discovered twelfth city, which appears to have been destroyed by fire, no trace of metal was found, and it is concluded that the inhabitants were still in the neolithic stage. Its architecture is superior to that of the three cities immediately following. The pottery here, as well as in the eight succeeding, later levels, is of the 'painted' type. In a large building which has just been uncovered, the largest of the many rooms measures 37 ft. \times 17 ft., a remarkable feature being that its mud-brick walls are coated with a fine white plaster. This is the earliest use of white plaster that has been discovered hitherto, and indicates knowledge of the process of burning lime. The fact that the walls of the room appear to be oriented to the cardinal points suggests a knowledge of astronomy. While no flat seals have been found, two impressions indicate their use.

Sex and Cultural Status

DR. J. D. UNWIN, in an address delivered to the Medical Section of the British Psychological Society in March last ("Sexual Regulations and Cultural Behaviour", Oxford University Press. Pp. 63. 2s. 6d. net), restates the argument for his view that opportunity for the satisfaction of the sexual impulse is related to the type or grade of culture of a society. Societies are classified according to their behaviour in relation to their objects of worship: 'deistic', when temples are erected to a god; 'manistic', when there are no temples, but acts of worship are performed at the graves of the powerful dead; and 'zooistic' when in times of difficulty offerings are placed before a "strange power". Each of these types of society has a characteristic form of sexual opportunity. Societies permitting pre-nuptial freedom are zooistic; those inflicting an occasional continence are manistic; while those insisting on a complete pre-nuptial continence are deistic. An analysis of social conditions on these lines indicates that there is a relation between sexual energy and social energy, the latter being a manifestation of certain inherent powers which remain potential except under conditions of continence. They are then released and the society becomes 'expansive'. In the past, sexual opportunity has been reduced to a minimum only with the introduction of absolute monogamy; and in human records there is no case of an absolutely monogamous society which has failed to display great

energy. On the other hand, if the condition of absolute monogamy is relaxed, as usually has happened, the society loses its energy and power of expansion and passes from one grade to another, as happened in the Christian church, when, the regulations of continence being relaxed, it ceased to be purely deistic, and passed to the manistic stage with the introduction of the medieval cult of the saint.

Application of Vocational Guidance Methods

REPORT No. 6 of the National Institute of Industrial Psychology presents the results and methods of "A Vocational Guidance Research in Fife" carried out by F. M. Earle and J. Kilgour. The inquiry was designed to give comparisons between children in different stages of growth, by testing the same children at intervals with the same tests; to differentiate between children of urban and rural areas; to study the question of the best age at which vocational guidance studies should be begun; and to determine minimum standards of qualities of abilities and temperament desirable for various occupations. The investigation showed the town children to be superior in verbal ability, and the country children to be superior in non-verbal processes and practical activities. Interesting results concerning the consistency of test-scores from year to year are presented. Those of general intelligence show the highest consistency, but the tests of English and arithmetic gave comparable scores after a one-year interval, but not longer. In the case of mechanical ability the results suggested that it was of relatively late development, and could be measured more accurately between the ages of twelve and fourteen years than between ten and twelve years. Measures of mechanical ability were applicable at all ages, but reliable for short periods only. In view of these conclusions, the report recommends that there should be two stages in the application of vocational guidance methods; at the first the child should be tested before the age of twelve years with regard to recommendations for specialisation in later school work, and at the second stage, between the ages of twelve and fourteen years, he should be tested with regard to vocational recommendations.

Results of the Vernay-Lang Kalahari Expedition

THE freshwater fishes and the reptilia and amphibia are reported on by Henry W. Fowler and V. Fitzsimons respectively in vol. 16, pt. 2, of the *Annals of the Transvaal Museum* (Scientific Results of the Vernay-Lang Kalahari Expedition, March to September, 1930), February 1935. The fishes are very interesting, most of them showing a large range of variation, especially in colour. 900 specimens were secured, representing thirty species, of which twelve are new. The fishes from the Tsotsoroga Pan and from the Nata River are probably the first ever collected in these localities, those from the first having come originally from the Okovango inundations, the Nata River rising independently in Southern Rhodesia and running directly into Makarikari Lake, which is strongly brackish. Some of the fishes survive even in the larger brackish pools. The reptilia and

amphibia are not confined to the Kalahari, but include specimens from Bechuanaland Protectorate, Transvaal and Southern Rhodesia. They form a large collection of 1,452 specimens, belonging to 23 families and sub-families, 60 genera and 99 species and sub-species: tortoises and turtles, one crocodile, lizards, chameleons, snakes, frogs and toads. 18 new species and sub-species are fully described, preliminary diagnoses having been published already by the author. These include a *Kiniscys* and a *Pelusos*, a *Typhlops*, a *Chlorophis*, a *Psammophis* and a *Xenocalamus*, with several *Lacertilia* and *Amphibia*. Valuable field data are given, including breeding notes in many cases.

Life-History of a Nematode in Mice

B. SCHWARTZ and J. E. Alicata (*J. Wash. Acad. Sci.*, 25; 1935) describe the life-history of *Longistriata musculi*, a nematode parasitic in mice. The eggs hatch in about twenty-four hours after passing from the host, and the larvæ undergo one moult and are then infective to mice; these larvæ correspond in morphology and behaviour to third-stage larvæ of trichostrongyles in general. White mice were infected by the larvæ by way of the mouth and through the skin, and each portal of entry resulted in the worms reaching the small intestine, where they underwent their entire development, including two moults. The route from the skin to the intestine has not been ascertained; passage through the lungs was exceptional. In three white mice infected through the skin, egg-production by the worms was limited to about two weeks. Infection of two mice by way of the mouth resulted in a much greater output of eggs by the worms, which persisted as long as the mice survived, 32 and 63 days respectively, after the infection. It is suggested that the striking difference in egg-production by the worms in these two groups is probably due to a marked stimulation of the defence mechanism of the host coincident with the migration of the larvæ following infection through the skin. This stimulation is either lacking or not marked when the larvæ enter by way of the mouth.

Structure of *Drosophila*

THE fly *Drosophila melanogaster* has become one of the most widely used laboratory animals for genetical and other studies. The general structure of the creature, as distinct from the group of *Diptera* to which it belongs, has attracted comparatively little attention. This gap in the knowledge of *Drosophila* has been met to some extent by a recent publication by Mr. Eduard H. Strasburger. In a 60-page brochure, entitled "*Drosophila melanogaster*, Meig. Eine Einführung in den Bau und der Entwicklung" (Berlin: Julius Springer, 1935. 6.90 gold marks), he describes the general external and internal anatomy of the insect in its larval, pupal and adult phases, together with an account of metamorphosis and a very brief statement on the embryology. The work is illustrated by 71 text-figures and is accompanied by a short bibliography. It should prove useful as an introduction to its subject, especially to workers who are not specialists in entomology.

Sooty Mould Fungi

MISS LILIAN FRASER has made a study of the fungi causing sooty moulds (*Proc. Linn. Soc. New South Wales*, 58, Parts 5-6, 1933; 59, Parts 3 and 4, 1934). Sooty moulds are caused by several fungi, which

together produce a dark brown or black felt of mycelium upon the leaves and branches of certain plants following attack by aphids. Miss Fraser's first paper shows that the fungi all belong to three groups—the *Capnodiaceæ*, *Atichiaceæ*, and *Fungi Imperfecti*. After a review of the species of sooty mould occurring in New South Wales, it became obvious that two main types appeared—annual and perennial. The former were constituted largely from mixtures of *Dematium*, *Cladosporium*, *Alternaria*, *Asbolisia* and *Triposporium*, whilst perennial moulds incorporated members of the *Capnodiaceæ*, *Atichia*, and a species from the *Fungi Imperfecti*. The second paper records a large number of results from cultural experiments with all types of sooty mould fungi. They are all shown to require different optimum concentrations of specific carbohydrates and nitrogen, and this fact may explain their distribution on plants attacked by woolly aphid or greenfly. 'Honey-dew' secreted by these insects consists of dextrin and other specific complex carbohydrates, along with protein material.

Chinese Loess Deposits

Observations by Prof. G. B. Barbour on the loess of North China (*Geograph. J.*, July 1935) clear up some points in regard to the nature and origin of the Chinese loess. The term loess has been employed to embrace three types of surface deposit. Loess accumulated during the Malan (Upper Pleistocene) stage of aggradation, which is generally unbedded, over much of the North China highlands rests on an older deposit having certain distinctive features. This deposit is more clayey and has a crude layer structure. The thick layers are more loessic in character, darker in colour and very like the upper Malan loess. It would appear that these layers represent a succession of soil horizons from which the soluble material was leached, and the arrangement suggests that deposition was interrupted by long intervals during which the surface was exposed to weathering. This series of deposits Prof. Barbour terms banded loessic loams. Still older is a series of red clays referred to the Pontian stage of the early Pliocene. These are associated with a less rugged topography than that of to-day. Chemical and mechanical analyses of the material showed that the æolian process was dominant in the deposition of the Malan loess and the banded loams. Prof. Barbour goes on to try to correlate these deposits with climatic changes. The general conclusions point to warm semi-arid conditions in the lower Pliocene, with increase of rainfall in the middle of the period and cooler and drier conditions at its close. At the end of the lower Pleistocene, a milder and damper climate (Choukoutien stage) was followed by the cold semi-arid Malan stage, which gave way to present conditions at the close of the Pleistocene.

Weather Cycles and Droughts

In a paper read before the American Meteorological Society in June, Mr. Halbert P. Gillette attributes the recent severe drought in the United States to the coincidence of the minima of several long cycles of rainfall. The most marked of these is about 152 years in length, with an amplitude of 25 per cent; he finds this cycle not only in New England rainfall but also in the Nile floods, the tree rings of pine and *Sequoia* in Arizona and California, and the annual 'varves' or clay laminae deposited during the

retreat of the last ice sheet in Canada. He considers that this cycle also determined the succession of halts and rapid retreats of the ice sheet in Finland. Judging by the evidence presented, the cycle of 152 years is probably real, and is important in geo-physical phenomena; but the method of periodogram analysis adopted is not mathematically rigid, and the shorter cycles tabulated rarely agree with those found in meteorological data by more exact methods. A novel point is that each cycle is supposed to go through a 'cycle of amplitude' of many times its own length, that of the 152 year cycle being estimated as 1,825 years, but for the shorter cycles at least this apparently represents merely the 'beat' with the annual cycle.

A Recording Manometer

PAPER No. 91 published by the Safety in Mines Research Board is entitled "A Recording Manometer having Low Inertia", by G. Allsop and H. Lloyd. The principle of this manometer is the use of a thermionic valve connected to an oscillograph, which records the displacement of a small diaphragm exposed to transient pressures such as are produced by explosions. Various improvements on the original type are described, and it is shown that this manometer, with small variations, can also be used as a dynamometer. The appliance appears to be quite satisfactory, but is tolerably expensive, and is not likely to replace ordinary manometers for everyday work in mines, in which explosion pressures do not have to be measured. For measuring such transient pressures, especially where the cost of an appliance does not enter into the question, this ingenious manometer appears to be quite satisfactory.

Kiln-drying of Wood with Ozonised Air

This problem has recently been discussed by S. N. Kapur (*Indian For. Rec.*, 20, Pt. 13. Delhi: Manager of Publications, 1935). The method consists in drying wood in an atmosphere containing small quantities of ozone, and is based on the assumption that the constituents of the wood during the long periods required for air-seasoning are subject to slow oxidative changes, which transform the sap contents chiefly—and according to some authorities the wood substance as well—into more stable compounds, thereby making the wood less liable to shrink and swell with changes in the humidity of the surrounding atmosphere, and consequently, more suitable for high-quality work. In summing up the results of his investigations, the author says that woods containing oils and oleoresins, which are difficult to 'kiln-dry', are in no way benefited by the addition of ozone to the circulating air in the kiln; that the addition of ozone to the air in the kiln does not accelerate the rate of drying of either resinous or non-resinous woods; and that timbers dried in an atmosphere of ozone, that is, 'artificially aged', do not show any greater stability towards changes of atmospheric humidity than those dried in a kiln without the addition of ozone.

Structure of Platinum Compounds

THE structure proposed for platinumous compounds of the 4-covalent type $[\text{Pt} a_2 b_2]$ by Werner was that the valencies have a planar arrangement. A test of this, and a differentiation between a planar and a tetrahedral arrangement of valencies, is provided by substitution derivatives of bisethylenediaminoplatinous salts, $[\text{en}_2 \text{Pt}] \text{X}_2$. Diphenyldimethyl

derivatives have been prepared by W. H. Mills and T. H. H. Quibell (*J. Chem. Soc.*, 839; 1935), and the optical activity of the compounds leaves little doubt that the planar configuration proposed by Werner is the correct one. The salts investigated proved capable of resolution into antimeric optically active forms showing a high degree of optical stability. The regular tetrahedral arrangement of valencies is excluded, and there are no reasons for inferring a pyramidal rather than the more symmetrical planar configuration. The planar arrangement of the platinum valencies with the intervalency angle of 90° is also shown to give rise to a practically strainless ring, whilst an arrangement with a tetrahedral valency angle would give rise to a very considerable strain in a 5-atom ring composed of carbon and nitrogen atoms and one 4-covalent platinum atom.

Einstein's Gravitational Equations

WE have received a very brief letter on this subject, dated June 2, from Prof. J. Ghosh; to make it intelligible to a wider range of readers it seems advisable to incorporate it with some references to Einstein's own work. The gravitational equations originally proposed, namely,

$$R_{im} - \frac{1}{2} g_{im} R = -8\pi T_{im},$$

represented a law of conservation such as that of momentum or mass and energy. Moreover, the left-hand side of the equation arose naturally in at least two mathematical processes. In spite of this, Einstein later (*Math. Ann.*, 97, 99; 1927) gave electromagnetic and cosmological reasons for suggesting that the coefficient $\frac{1}{2}$ should be replaced by $\frac{1}{4}$. Prof. Ghosh (*Z. Phys.*, 85, 511; 1933; and 94, 411; 1935) has investigated the solutions of the new equation in four cases, corresponding to empty space, a single particle, an electron, and a rather more general system with radial symmetry. The results all contain a term belonging to de Sitter's world. Thus the new field equations automatically involve the cosmological constant, which is usually introduced as a special hypothesis. It is desirable that Prof. Ghosh's work should be extended to a more general distribution of masses, but this appears to be difficult.

Changes in the Spectrum of γ Cassiopeia

THE spectrum of γ Cassiopeia contains hydrogen lines each made up of double emission lines superimposed on a broad absorption line. Unlike many such stars, the spectrum had been considered to be always the same until recent observations by Dr. W. J. S. Lockyer showed that the two components of each of the double emission lines went through regular changes of relative intensity. This brought the star into line with other bright hydrogen line stars, most of which show similar changes. Later observations described by Dr. Lockyer (*Mon. Not. R.A.S.*, 95, 520), however, show a most unusual type of change in these lines. The red component of each double had faded right out in March 1934, after which the remaining single emission lines (at that time forming the violet components) moved across to the position of red components, and in November new faint violet components appeared, the lines being again double, but with strong red and faint violet components. Such a change is believed to be unique in the history of such stars, and is difficult to explain by any of the current hypotheses.

Native Iron from West Greenland

By Sir Harold Carpenter, F.R.S.

THE structure and constitution of the native iron of Ovifak, Disco Island, West Greenland, have been the subject of controversy in the past, and in particular, uncertainty exists as to whether it does or does not possess the Widmanstätten structure which is characteristic of meteoric

the maximum percentage of the different elements reported in the analyses of the iron which have been carried out by numerous analysts (cf. Mellor, "Inorganic and Theoretical Chemistry", vol. 12, p. 522) while the figures in the third line represent the average of 318 analyses of meteoric iron calculated

FIG. 1.

× 75 FIG. 3.

× 75

FIG. 2.

× 75

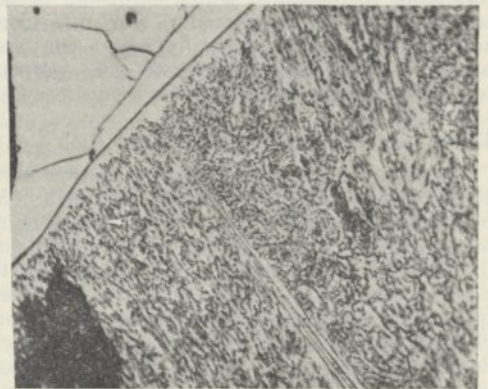
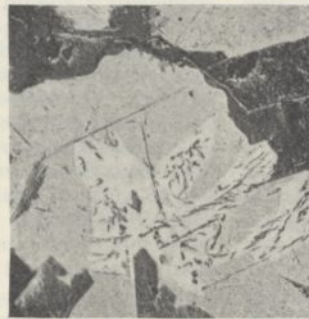
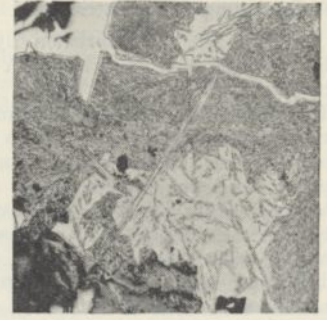


FIG. 5.

× 75 FIG. 6.

× 75 FIG. 4.

× 750

iron. By the kindness of Dr. L. J. Spencer, I have recently been enabled to investigate a sample which is contained in the collection of minerals in the Natural History Museum.

The iron was found to be friable and somewhat oxidised. When crushed, it was seen to consist of grains of metallic matter which were apparently cemented together by basalt and oxidised material. As it was impossible to drill a sample, a piece of it was ground in a percussion mortar and after screening the powder the metallic matter was separated from the residue with a magnet and then analysed. The sample thus obtained was contaminated with a little oxidised material, but the results shown in the first line of the table below give a good approximation to the composition of the metal.

	Fe	Ni	C	Co	Cu	SiO ₂	CO ₂
Ovifak iron	93.9	2.50	1.63	0.98	0.21	0.24	nil
Mellor's analysis	95.15	2.55	3.11	0.93	0.48	4.18	
Meteoric iron	90.85	8.52	0.03	0.59	0.02		

The figures in the second line of the table represent

by O. C. Farrington (Mellor, p. 525). It will be seen that the carbon content of the Ovifak iron is greatly in excess of that found in meteoric iron, while its nickel content is considerably lower—in fact the maximum nickel content of this iron, namely, 2.55 per cent, is well below the minimum for meteoric iron, which according to Mellor is about 5 per cent.

A small piece broken from the sample was ground and polished for microscopic examination. When etched with 1 per cent nitric acid in alcohol, the structure was found to consist mainly of a massive white constituent in a finely divided duplex matrix, in which there were thin needles and bars which appeared to be of the same material as the white constituent (Fig. 1). Here and there in the specimen irregular white patches occurred, scattered through which were small particles that appeared to be of the same phase as the needles (Figs. 2 and 3). At high magnification the duplex constituent was resolved into a globular type of eutectoid structure (Fig. 4). When the specimen was etched with a

boiling solution of alkaline sodium picrate, the massive white constituent and the needles and bars were stained brown, thus proving them to be cementite (cf. Figs. 5 and 6, which represent the same areas as Figs. 1 and 3). The duplex matrix was very lightly etched, which is consistent with the view that it is the eutectoid of ferrite and cementite, and the irregular white patches appeared to be segregated areas of this mixture. Constitutionally, therefore, this 'iron' is a high-carbon nickel-cobalt steel.

The microstructure of the metal is altogether different from what would be found in an alloy of this composition which had solidified from the liquid state, and the question arises as to how it has been formed. The following view is accordingly put forward. The metal, which may originally have been carbonless, has been heated to a temperature probably in the neighbourhood of 900° C. in contact with carbon or more likely with carbon monoxide. This gas may have been produced by the combustion of lignite, beds of which occur on the island. Indeed

it is possible that the metal has been produced from iron oxide which was first reduced by the gas to metallic iron and then carburised. The crystalline masses of cementite were formed in this way, but before the whole of the iron had been converted into the carbide, the temperature began to fall and the supply of carbon monoxide probably ceased, perhaps because of the exhaustion of the source of carbonaceous matter. At this point the alloy consisted of crystalline cementite and gamma iron saturated with carbon, that is, austenite containing more than 1 per cent carbon in solid solution. As the temperature fell, needles and bars of proeutectoid cementite crystallised from the austenite until the eutectoid temperature was reached, when the remaining austenite changed to the finely divided globular type of pearlite seen in the micrographs. The segregated areas may have been produced by slow coalescence of the cementite in the eutectoid during geological ages.

I wish to acknowledge the assistance of Mr. C. W. Dannatt and Dr. M. S. Fisher in this work.

Economics of Air Transport*

THE report on the Economics of Air Transport in Europe, recently submitted by M. Henri Bouchée to the special sub-committee of the Air Transport Co-operation Committee of the League of Nations, appointed to study the constitution and operation of a main network of permanent air routes, affords a dismal picture of the frustration of science. The report shows clearly that such free competition as exists in Europe to-day is chiefly competition in paying out subsidies. The waste and inefficiency in aviation which result from this commercial aviation are difficult to parallel. In the three years 1930-32, subsidies for aviation cost the European taxpayer about 2,000 million francs. Even in 1933, only four companies in Europe had advanced even half-way towards paying their way. At the end of 1932 British enterprises were nearly two thirds of the way, German enterprises only two fifths, French enterprises one fifth, Italian enterprises one fifteenth and air transport in Europe as a whole nearly one third.

In regard to actual use made of different air routes, the figures given in the report show the startling supremacy of the London-Paris air route, which in 1932 carried 5274 t. km. per km. of line, its nearest rivals being the Amsterdam-London route with 744 ton km. and the Paris-Amsterdam with 623 t. km. On certain routes, such as the Venice-Brindisi route, the figures are as low as 21 t. km., while financial returns indicate even more strikingly the supremacy of the London-Paris route, which shows more tonne-kilometres utilised than the whole of the Belgian, Swiss, Czechoslovak, Polish, Swedish, Danish, Finnish, Austrian, Hungarian, Yugoslav and Roumanian services put together.

M. Bouchée points out that if the aircraft of Great Britain and of Finland carried a complete load, they would no longer need a subsidy, while the aircraft of the Netherlands would be independent if they were

loaded to 75 per cent of their capacity. These figures prove that, from an economic point of view, certain lines are already operated very efficiently, and indicate that unsubsidised air transport in Europe is a matter of efficient technique and sound organisation. The obstacles to co-operation and efficiency are mainly political, and the relatively short distances flown in Europe will illustrate this point. They do not afford the decisive advantage which is possible in long-distance flights, and the system, as M. Bouchée remarks, is far more of the nature of propaganda than economic utility or the fulfilment of permanent needs. While surface traffic does not provide fast transport in Europe, the area is suitable for fast day-time flying, and that part of it which is most economically active will soon be a single territorial district which a fast aircraft will cross in half a day's day-time flying. The present services do little to meet the need for fast transport. Equally important is the question of giving air transport the freedom which is natural to it.

M. Bouchée calculates that, by rationalisation of European aviation, the whole of the present traffic could be carried with a quarter of the present European air fleet. Redundant or grossly uneconomic lines could be closed down and others at present non-existent could be set up. Air transport in Europe needs to be considered as a public utility service in the same way as the Postal Union or the International Sleeping Car Company, and the realities of the situation faced, so that aircraft no longer follow routes imposed on them or keep to Customs airports, 'corridors of approach' or 'prohibited zones'. The question, M. Bouchée concludes, is a political one. It cannot be solved merely by experts. Some form of internationalism is necessary if the present subsidies in Europe are to multiply direct and fast air services across territory better equipped and more freely accessible. In itself, the close co-operation essential might make a decisive contribution to the moral unity of Europe.

* Economics of Air Transport. By Henri Bouchée. Air Transport Co-operation Committee, League of Nations. (London: George Allen and Unwin Ltd., 1935).

International Conference on Folk Dancing

THE conference on folk dancing which formed part of the proceedings of the International (European) Folk Dance Festival, held in London on July 15-20 under the auspices of the English Folk Dance Society and the British National Committee on Folk Arts, met at Cecil Sharp House, Regent's Park, London, under the chairmanship of Prof. John L. Myres. One session was held at the Phoenix Theatre, Charing Cross Road, for the exhibition of cinematograph films and lantern slides illustrating the Morris and kindred dances and Dutch traditional dances.

The communications submitted to the conference numbered fifteen. It was thus possible, by adhering more or less closely to a fixed time-table, to allow ample opportunity for discussion and illustration by dance displays. The majority of the papers were concerned with the description of specific forms of national or regional dances; one by Mr. Rodney Gallop dealt with the principles and methods of recording folk dances, and the remainder discussed on broader lines questions of interpretation arising out of the comparative study of the dance as a popular mode of emotional and æsthetic expression among European peoples.

Of the communications of a more general character, that with which the conference opened, by Dr. Elise van der Ven Ten (Netherlands), on some aspects of the folk dance in various stages of the development of folk art, with the discussion which followed, was of importance for its clear-cut formulation of the relation between the scientific study of the folk dance and the revival of folk dancing as a means of individual, social and national expression. The author classified the folk dances of Europe according to the place they now fill in the life of the people, pointing out that while in eastern Europe they are still a living form of art, in central Europe they are dying, or even, as in modern Germany, have virtually become extinct; but in north-western Europe they are a revived art, largely owing to the work of Cecil Sharp (of which an account was given by Mr. Douglas Kennedy, director of the English Folk Dance Society, at a later stage of the conference).

It was laid down as a definite principle by Dr. van der Ven Ten and also by speakers in the discussion which followed the paper, that scientific study of the forms of the dance and its significance in the life of the folk is an essential condition of successful revival. Both in Germany and in Sweden, it was pointed out, such study had been found the essential preliminary in the revival of forms of the dance which would give full play to the development of individual and national consciousness.

Dr. Curt Sachs (Paris), in dealing with the symbolism of the dance, also stressed the importance in folk dance revival of study of the meaning or purpose of the primitive dance, which survives in the folk dance, although forgotten. The primitive dance, not being entirely æsthetic in origin, is on one hand a response to an internal physiological and psychological urge which raises the performer to an ecstatic magical plane, while externally its forms and associa-

tions with material symbols, such as the garland and the bridge, by mimicry or representation lead symbolically to a culmination in the promotion of fertility.

Among communications dealing with national or regional forms of the dance, such as that, for example, by Mlle. Louise Witzig (Zurich) on the Swiss folk dance and its significance in the revival of rural culture, and Prof. Césara Ehrenkreutz-Jedrzewicz-kowa on Polish wedding customs, reference was made to the reciprocal borrowing between court and peasantry. Such borrowing was also shown by Miss Violet Alford to have affected the character of the Morris dance. In her study of the Morris and the Morisca, she argued that before the Morris was affected by the fashion for the Moors, which was responsible for the dancers' black faces, and before the name 'Morisca', or 'Morris', was applied to it, it had once belonged to a pre-Christian European group of dances which were connected with a sacred animal.

An alternative view of the origin of the sword and stick dances, to which Miss Alford had referred, was put forward by Dr. Richard Wolfram (Vienna), who, elaborating from extended observation, especially in South Germany, a theory propounded four years ago, argued that these and associated 'chain dances' are a dramatisation of an initiation ceremony. He relied largely on the evidence of the association of such dances with secret societies; but, in the discussion which followed, reluctance was shown to accept his views as an exclusive or generally applicable interpretation, while a further obstacle to acceptance was the fact that there is no evidence in initiatory rites of the seasonal element inseparable from the sword and cognate dances.

Among the numerous points of interest which emerged from the communications of a more purely descriptive character, reference can be made here to one or two only—such, for example, as the relation between music, song and dance in Norway (Dr. O. M. Sandvik, Oslo), the primitive magic of the hobby horse of the Calușari of Rumania (Prof. R. Vuia, Cluj), and the taboos on partnership in the dance between certain individuals, varying with the stage of the proceedings, in the dances which accompany the wedding ceremonies of Poland, as described in the communication to which reference has been made above. A remarkable cycle of folk dances from Holland and the rites with which they are associated was shown in a cinematograph film by Dr. D. J. van der Ven. These ranged from children's processional customs to obsolescent dances now performed only by the older folk in keeping up the practices of their younger days, and to the living customs of the Harvest Home, or the midsummer bonfire and accompanying battle, or the remarkable and characteristic Dutch feat of 'flag waving', a combination of calisthenics and juggling, which on account of its associations with folk festivals, as well as its action, may well link up, as Dr. van der Ven maintains, with the fertility magic of the other peasant customs which he described.

South-Eastern Union of Scientific Societies

ANNUAL CONGRESS

THE fortieth annual congress of the South-Eastern Union of Scientific Societies was held at Bournemouth on June 26-29, under the presidency of Prof. A. C. Seward, Master of Downing College, Cambridge.

In his presidential address, Prof. Seward took as his subject "The Herbarium of the Rocks". He invited his audience to accompany him on a journey to a partially reconstructed forest of the Tertiary era. The Miocene Mascall flora of the John Day Basin of Oregon shows a close resemblance to that of the present-day Redwood Forest belt, although the former is many miles north of the latter. During the Oligocene period, Redwood forests very similar to those of California to-day have left traces in the Bridge Creek flora of the Crooked River Basin, south of the John Day Basin, and amongst other elements of this, for the most part dicotyledonous, flora is an Asiatic element showing relationship with Chinese plants. A similar flora to the Bridge Creek flora is found to have a wide range, since it occurs in Switzerland, Greenland, Siberia and Manchuria, but it is now confined to a narrow belt on the coast of California and Oregon. The Goschen flora of Upper Eocene times is another flora that differs widely from modern floras in corresponding latitudes. The view that these floras owe the members that they have in common to a southward migration of the parent plants from high northern latitudes has been confirmed in recent years. There must be a common origin for the similar living floras on both sides of the Pacific. Fifty-nine per cent of the genera of the Goschen flora are recorded from Cretaceous beds in the northern hemisphere where now is an arctic climate. Prof. Seward suggested that perhaps the Cretaceous ancestors of Tertiary plants were more tolerant of low temperatures. The ring of Tertiary floras that girdles the polar regions shows a decline of climate as compared with those of Cretaceous times. The Mull flora has much in common with that of arctic lands, and this with the other Tertiary flora represented by the inadequately-studied flora of Bournemouth show that there were then two distinct botanical provinces.

In the Archaeological Section, Mr. T. D. Kendrick spoke on "Early Christian Art in the British Isles". Mr. J. B. Calkin demonstrated that prehistoric Bournemouth was full of interest. He has made a large collection of pottery and flint implements, which for want of a public museum are not available to the general public. His story of Bournemouth began with prehistoric man's implements found in the gravels between that town and Christchurch. Whilst there is no evidence of glacier conditions, the area was abnormally cold during parts of the Pleistocene era. Acheulean man lived here before the gravels were laid down, which were due to subsidence. At one time the area contained more than a hundred barrows. Few have been properly excavated, an exception being those of Hengistbury. Strangely enough, scarcely a single barrow faces Poole Harbour. Ten drinking beakers out of eighteen for the whole of Hampshire have been found in the district. Two food-vessels have come from Swanage, associated in

each case with a human skull. In one Bronze Age site more than a hundred urns came to light, although most of them had been destroyed. An early Iron Age culture was found in Long Field, Hengistbury, corresponding with that of Hallstatt on the Continent. Mr. Calkin exhibited many of the remains to which he alluded in his paper.

Prof. R. J. Tabor and Prof. M. C. Potter read papers of a botanical nature. The Rev. F. C. R. Jourdain spoke on ornithological progress during the past fifty years, and commented on the new nomenclature that he and others were successful in bringing into effect, and on the increased study of bird-life as shown by the British Ornithologists' Union, now numbering more than 400 members, although it commenced in 1858 with twenty members. Some attention was given to the modern recognition of races of birds as well as species. "If the breeding ranges of two forms overlap or coincide and yet remain apart they must be species; if on the other hand they are obviously closely allied and yet replace one another geographically they are races." The hooded and carrion crows are distinguishable at a glance, and although they as a rule have different breeding ranges, there are places in Scotland, Germany and Russia where they interbreed. Mrs. K. Grant spoke on "Migration of Butterflies" and showed an exhibit from the entomological department at Rothamsted.

In the Geological Section, Dr. H. D. Thomas made out a good case for certain lines of evolution, or trends, in respect of fossil foraminifera and other lowly forms of life. A lecture by Lieut.-Colonel C. D. Drew on "Recent Excavations at Maiden Castle" was followed by a visit under his guidance by about seventy members to the earthworks. Here the cutting into the filled-up ditch, which had yielded neolithic evidence, was seen and also the remains of the Roman temple, round which were strewn innumerable roofing-tiles. Reference should be made to the small bronze bull which was found, with the upper parts of three human figures on its head and back; this was afterwards seen in the Dorchester Museum. In the museum was noticeable a large area covered with Roman tessellated pavement, laid down as originally on the floor of a Roman villa.

Dr. Vaughan Cornish gave one of his delightful talks on "Scenic Amenities in Town and Country".

Visits were made to Corfe, Littlesea, Beaulieu Abbey, Poole Pottery Works, Wareham, and other places of scientific interest, whilst on the social side of the Congress, the Mayor and Corporation gave the Union a civic reception at the Pavilion.

Educational Topics and Events

EDINBURGH.—Sir Charles Sherrington has been appointed Gifford lecturer for the years 1936-37 and 1937-38.

At the medical graduation ceremonial on July 17, the honorary degree of LL.D. was conferred on Prof. A. N. Richards, professor of pharmacology in the University of Pennsylvania.

LEEDS.—Mr. H. S. Clough has given £250 towards the erection of an observatory to house the telescope and other astronomical instruments recently presented by Mrs. Bolton of Bramley.

LONDON.—The following appointments have been made: Dr. James Whillis, since 1923 lecturer in anatomy at the College of Medicine, Newcastle-on-Tyne, to be reader in anatomy (Guy's Hospital Medical School) as from October 1; Dr. Jerzy Neyman, since 1927 lecturer in mathematical statistics at the Central College of Agriculture, Warsaw, and also since 1928 head of the Biometric Laboratory, Nencki Institute, Warsaw, to be reader in statistics (University College) as from October 1.

The title of professor of statistics in the University has been conferred on Dr. E. S. Pearson, in respect of the post held by him at University College.

The Sir George Jessel studentship in mathematics for 1935 has been awarded to Mr. A. E. Chapman, of University College.

Mr. E. P. Stibbe, senior demonstrator of anatomy at the London Hospital Medical College, has been appointed to the University readership in anatomy tenable at King's College from October 1.

PROF. A. NORMAN SHAW has been appointed head of the Physics Department and director of the Macdonald Physics Laboratories at McGill University, Montreal, in succession to Prof. A. S. Eve, who has retired.

A 'SABBATICAL YEAR' for university teachers is a notion that has obviously much to recommend it, but it has failed hitherto to gain effective acceptance in Great Britain as a feature of university policy. In a statement recently submitted on behalf of the Association of University Teachers to the University Grants Committee, it has been urged as a "highly desirable reform" and in an article by Mr. G. F. H. Harker, of University College, Cardiff, published in the April issue of the *Universities Review*, the case for it is argued with considerable force. The writer quotes Bertrand Russell's "Every university teacher ought to have one year in every seven to be spent in foreign universities . . ." and points to the spectacular rise of America to the front rank in so many fundamental branches of thought and action as attributable in some measure to American universities encouraging the members of their teaching staffs to do this very thing. English universities are more or less autonomous, and are proud of the fact, but they suffer, especially the smaller ones, from a correlative tendency to isolation. During vacations the average university teacher, except for spells of necessary relaxation, divides his time between private work for supplementing his income and the preparation of lecture courses for the ensuing session. Moreover, only a lengthy stay abroad, and that not during vacations, can give any real insight into universities in another country.

THE Tennessee Valley Authority has provided for the world an object lesson in the operation of a planned economy without recourse to compulsion. The salient features of this vast undertaking are already widely known in Great Britain thanks to the recent publication in *The Times* of special articles by Prof. Julian Huxley. An account of its more specifically educational aspects is given in *School Life* of March under the heading "A New Frontier in Education". The authority assumes towards its labour force responsibilities more like those of the head of a family than the mere cash nexus of the paymaster. It charges itself with the organisation of an environment

suitable for a civilised life. In its various training programmes it has grappled successfully with the difficulties of providing ample facilities for instruction for employees without disorganising the work on which they are engaged. The normal working hours are 5½ hours a day for six days a week. For the more talented workers opportunity is provided for changing every five weeks from one to another of ten different types of work. The authority has created a civil service of its own in which appointments are, it is stated, made on the basis of merit only. This would-be Happy Valley covers 40,000 square miles and some six million people are or will be affected.

Science News a Century Ago

Death of Gilbert Thomas Burnett

ON July 27, 1835, at the early age of thirty-five years, Gilbert Thomas Burnett, the first professor of botany in King's College, London, died, worn out by "multiplied literary, lecturing and professional labours". The son of a London surgeon and born on April 15, 1800, Burnett began the study of medicine at fifteen years of age, and, after commencing practice as a surgeon, gave lectures on medical and general botany at the Great Windmill Street School of Medicine. He frequently lectured at the Royal Institution, gave a course at St. George's Hospital, and in 1831, on the opening of King's College, was appointed to the chair of botany. At the time of his death he was also professor of botany to the Apothecaries' Society. His "Outlines of Botany" in two volumes appeared shortly after his death, while a large series of "Illustrations of Useful Plants Employed in the Arts and Medicine", which was published during 1840-49 with drawings by his sister, contained text chiefly by Burnett himself.

J. D. Forbes in the Pyrenees

ANOTHER entry from the "Journal" of Forbes during his visit to the Pyrenees in 1835, dated July 29, said: "I left Luz on foot at half-past five, for Gavarnie. . . . Beyond Gèdre, where we breakfasted, I found in accordance with the accurate account of Charpentier, magnificent crystallised limestone in the granite: the granite here, like that of Héas, is altogether a strange rock, and often passes into a slaty structure, becoming gneiss, or mica slate, besides enclosing masses of these rocks, and forming an absolute breccia. But where crystalline, it seems to me never stratified; the fissures and the flat surfaces they leave can never be traced to any distance, and when they disappear, are as often at right angles to the former as not. The appearance of vertical stratification is often caused by the rain courses, as in the valley of the Reuss at St. Gothard, to some parts of which this valley has a great resemblance. . . ."

Berzelius in Paris

ON July 31, 1835, *The Times* announced that "The celebrated chymist M. de Berzelius has just arrived in Paris. He is accompanied by one of his former pupils M. Dahestraeno, professor of chymistry at Stockholm. It is the intention of these two savans to remain in Paris until the beginning of September, when they will set out for Germany, to be present at the meeting of the naturalists at Bonn."

Societies and Academies

PARIS

Academy of Sciences, June 12 (*C.R.*, 200, 1997-2044).

HENRI DESLANDRES: A simple and general relation of the molecular spectrum to the electrons and rings of electrons of the constituent atoms. JEAN REY: The energy yield of thermo-compressors. The importance of its definition. DAVID WOLKOWITSCH: The conoid of Plücker. JEAN LERAY: The problems of conformal representation of Helmholtz: the theory of [ships'] wakes and bows. JEAN MARIANI: The general signification of the macroscopic theory of fields. A. A. GUNTZ and E. BELTRAN: The influence of H^+ ions in the phenomena of reduction and hydrogenation. The view is put forward that the attraction of the H^+ ions and the electrostatic repulsion of the nuclei suggests that the H^+ ions present in certain media may possess the property of preactivating a large number of molecules producing catalysis and syntheses. Mlle. SUZANNE VEIL: Contact batteries and the effect of short-circuiting them. MARCEL SERVIGNE: Some phenomena of cathodic phosphorescence. Comparison of the cathodic phosphorescence of precipitated and natural calcium tungstate (scheelite), showing the effect of the crystalline state and of the addition of traces of silver on the phenomenon. LÉON and EUGÈNE BLOCH: Research on the regularities of the Cu III spectrum. MARTIN BATTEGAY and EUGÈNE RIESZ: The di-anthraquinonylguanidines. JOSEPH WIEMANN: The synthesis and constitution of a dimethylhexite. ANTONIN LANQUINE: The relations of the Saint-Maximin (Var) Trias with the south-eastern termination of the Sainte-Victoire chain and with the eastern termination of the Olympe chain. ROBERT PERRET and JACQUES BOURCART: The lavas of Adrar and Asger. JACQUES FROMAGET: The discovery of new evidence of the upper marine Trias in the Haut-Laos synclinal. Mlle. HÉLÈNE ARLAUD: The Turonian of the neighbourhood of Cassis and the Cretaceous movements in western Provence. MARCEL CORMIER: Hydrocyanic acid in *Pyroclydonia Winkleri*. Similar to the parent quince tree, the hybrid *Pyroclydonia Winkleri* furnishes hydrocyanic acid, existing in the plant in the state of heteroside. The proportion of hydrocyanic acid is about seven times that found in the parent quince. HENRI COLIN and HENRI BELVAL: The glucides of flour and dough. BASILE LUYET: Nuclear structure studied *in vivo* by the method of ultra-violet photography. The resolving power of the microscope can be about doubled by using ultra-violet light with quartz objectives with glycerol immersion. Chromatin is specially opaque to the ultra-violet rays, contrasting with the cytoplasm, which is much more transparent. The author has applied these facts to the study of the physical structure of the caryoplasm. SERGE TCHAKHOTINE: The localised flocculation of colloids in the cell by ultra-violet micropuncture. LOUIS COTONI and JACQUES POCHON: A new method of titrating antipneumococcal sera by neutralisation of the antibodies *in vitro*. ALFRED BOQUET and ROGER LAPORTE: Bail's phenomenon and tuberculin intoxication.

CAPE TOWN

Royal Society of South Africa, April 17. M. R. LEVYNS: Veld-burning experiments at Oakdale, Riversdale. These experiments have extended over five years and have been carried out on rhenosterveld.

The results after burning differ from those previously obtained at Stellenbosch. There an immediate return to rhenosterveld was demonstrated. In this case the vegetation undergoes a series of successional changes before rhenosterveld is once more established.

May 15. F. G. CAWSTON: A second intermediary host for trematodes. J. V. L. RENNIE: On the flora of a high mountain in South-West Africa. In the higher parts of the Auas Range, near Windhoek, the thornveld is replaced by small shrubs, several of which might be interpreted as relics of an older flora in South-West Africa. *Passerina* and *Stoebe plumosa* are recorded for the first time from that territory. It has generally been assumed that the presence of certain Cape genera in East Africa and Angola is due to migration in former times via the eastern side of the subcontinent. The species here recorded suggest that at least certain elements of the Cape Flora could have reached the Huilla Plateau in Angola via a western route. A. GALLOWAY: Some prehistoric skeletal remains from the Natal coast. J. L. B. SMITH: The "Galjoen" fishes of South Africa. The Galjoen fishes are placed in a genus of somewhat doubtful taxonomic position. Owing to a combination of characters the institution of a new family (*Dichistiidae*) is proposed. E. E. GALPIN and E. A. GALPIN: Some biological notes on *Boscia rehmanniana*, Pest., and *Olea verrucosa*, Link. W. E. ISAAC and B. GERSHILL: The organic matter content and carbon-nitrogen ratios of some semi-arid soils of the Cape Province. The average C:N ratio for these, namely, 10.6:1, is contrasted with that of the winter-rainfall area (15:1). Decreasing organic matter content is accompanied by a decreasing C:N ratio. Although the organic matter of the semi-arid type of soil is low, the percentage of nitrogen in the organic matter itself is higher than for the winter-rainfall series. Hydrogen ion concentration figures show that the semi-arid type of soil is the more alkaline of the two. I. DONEN: The effect of time of picking on the chemical changes of Kelsey and Gaviota plums in store (read on March 20). Time of picking has no marked effect on chemical changes in the Gaviota plums. First appearance of bladderiness in all samples was noticed after about 44 days in store at 34°-36° F. Coincident with this breakdown a complete reversal of the sugar equilibrium was observed in the last two pickings. In the first two pickings of Kelsey plums, rate of loss of sugar was initially high and then declined rapidly to a minimum. In the last two pickings it remained uniform throughout the observed storage life. Internal browning of the tissue, accompanied by a reversal of sugar equilibrium, occurred sooner in the early pickings than in the later ones. Acid loss was high when sugar consumption was low and it is suggested that increase in rate of loss of acid is an 'overdraft' on stored acid due to insufficient supply of acid from oxidation of sugars. Low nitrogen and low acid therefore favour good keeping quality. This is correlated with delay in time of picking.

CRACOW

Polish Academy of Science and Letters, April 1. C. BIALOBRZESKI and I. ADAMCZEWSKI: The application of dielectric liquids to the study of the 'bursts' of ionisation caused by the cosmic rays. Compressed gas in the ionisation chamber is replaced by a liquid, such as hexane. The phenomenon is more distinct and more frequent. M. CENTNERSZWER and

T. CHECINSKI: Thermal dissociation of silver nitrite. Dissociation of silver nitrite can be represented by the equation $2\text{AgNO}_2 \rightleftharpoons \text{Ag} + \text{AgNO}_3 + \text{NO}$. The constants of the Nernst equation have been determined. M. BLUMENTHAL and T. CHECINSKI: Kinetics of the thermal dissociation of silver nitrite. A. SKAPSKI: Enunciation of the law of mass action in systems of one or several phases, especially from the point of view of the equilibrium of reactions in metallurgy. M. HLASKO and A. SALIT: Measurement of the electrolytic conductivity of extremely dilute solutions. Measurements can be carried out by the authors' method at dilutions down to 10^{-7} normal. The values thus directly obtained differ only by 0.1–0.2 per cent from the values obtained by Kohlrausch's extrapolation formula. The apparatus used in such measurements must be constructed entirely of quartz. K. DZIEWONSKI, K. BERNAKIEWICZ and W. MALICKI: The reactions of thiourea with the arylalkylketones. M. KSLAZKIEWICZ: The zone of the external Carpathian klippen in the neighbourhood of Andrychow. (3) The stratigraphy of the klippen and their position in the tectonic of the western Carpathians. T. WISNIEWSKI: *Hydrilla verticillata* of the lacustral region of Suwalki (northern Poland). T. WISNIEWSKI and MLE. L. GOETZEN: The structure of the lamellae of the leaves in European species of the genus *Polytrichum*. B. PAWLOWSKI: The final climax association of the Alpine stage of the Tatras. ST. MARKOWSKI: The influence of changes of the medium on the development of the eggs of *Bothriocephalus scorpii*. M. RAMULT: The embryonic and larval development of the crustacean *Sacculina* in media of different osmotic conditions. K. PASSOWICZ: Researches on the behaviour of the daphnid *Daphnia pulex*, Geer, in liquids of different hydrogen ion concentration.

May 6. K. DZIEWONSKI and L. STERNBACH: New studies on the reactions of benzoyl chloride on the aromatic amines and on their products, compounds derived from quinazoline. J. NOWAK: Origin of the flint in the Pleistocene of Volhynie. M. KAMIENSKI: Remarks on the Trojaga andesites. W. FRIEDBERG: *Turritella scalaria* and some remarks on gastropods with unfolded testa. W. SZAFAER and BR. JARON: A lake of Pleistocene age in the neighbourhood of Jaslo. MLE. A. KOZLOWSKA: Characteristics of the forest associations of the mountainous region of the Cieszyn district. ST. JASNOWSKI: Inheritance of some characters of the ear of wheat. F. GORSKI: Gaseous exchanges in some submerged aquatic plants in the course of assimilation. Study of the gaseous exchanges of *Elodea canadensis*. About 30 per cent of the oxygen escapes as bubbles, the remainder dissolving in the water. The bubbles contain 50–60 per cent of nitrogen and about 1.5 per cent of carbon dioxide. MLE. IRÈNE REJMENT: Contributions to the knowledge of the Hepatic flora in the sub-Carpathian region near Cieszyn. JAN TRELA: The interglacial period at Samostrzelniki near Grodno from the point of view of the results of pollen analysis. J. ZACWILICHOWSKI: The innervation of the hooking organs in *Argulus foliaceus*. F. ROGOZINSKI and ZB. GLOWCZYNSKI: (1) The nutritive value of Canary grass seed (*Phalaris canariensis*). (2) Irradiation and growth. With animals submitted to a complete and well-balanced food regime, irradiation by ultra-violet light has no influence on growth, but if the diet is defective, the light exerts a very marked favourable effect. MME. B. KONOPACKA: Histochemical researches on the development of fish. Vitellogenesis in the gudgeon and carp.

Forthcoming Events

[Meetings marked with an asterisk are open to the public.]

Sunday, July 28

BRITISH MUSEUM (NATURAL HISTORY), at 3 and 4.30.—Miss M. H. Smith: "Plants".

THIRD INTERNATIONAL CONGRESS OF SOIL SCIENCE, July 30–August 7, to be held at Oxford. Sir John Russell: President.

Official Publications Received

Great Britain and Ireland

The North of Scotland College of Agriculture. Guide to Experiments and Demonstration Plots at Craibstone, 1935. Pp. xii+77. Bulletin No. 40: The Management of Temporary Pasture. By W. M. Findlay. Pp. 8. (Aberdeen: North of Scotland College of Agriculture.) Experimental Researches and Reports published by the Department of Glass Technology, The University, Sheffield. Vol. 17, 1934. Pp. iv+384+7 plates. (Sheffield: The University.) 7s. 6d. Rothamsted Conferences. 19: The Production of Pigs for Bacon; being the Report of a Conference held at Rothamsted on March 6th, 1935, under the Chairmanship of John A. Fox. Contributions by J. B. Busby, J. Hammond, A. E. Law, H. R. Davidson, and others. Pp. 28. (Harpenden: Rothamsted Experimental Station.) 1s. 6d. Second Greenwich Catalogue of Stars for 1925.0. (In 2 Parts.) Fundamental Stars and Stars in the Zone $+32^{\circ}0$ to $+64^{\circ}0$ from Observations with the Transit Circle made at the Royal Observatory, Greenwich, 1922–1930, under the direction of Sir Frank Dyson. Pp. xxii+257. (London: H.M. Stationery Office.) 17s. 6d. net.

Other Countries

Spisy vydávané Přírodovědeckou Fakultou, Masarykovy University (Publications de la Faculté des Sciences de l'Université Masaryk.) Čís. 197: O difuzních potenciálech, 2 (On the Diffusion Potentials, Part 2). Napsal V. Čupr. Pp. 14. Čís. 198: Výklad vzniku netlučených kmitů mechanických (Über die Erregung von ungedämpften mechanischen Schwingungen). Napsal Josef Zahradníček. Pp. 18. Čís. 199: O některých nových nebo kritických rostlinách na slovensku a podkarpatské rusi (Plante slovakie et rossie subcarpatice novae vel criticae). Napsal Vlad. Krist. Pp. 16. Čís. 200: Hydrolysa Benzen-sulfonantů hliníkových (Hydrolysis of the Aluminium Benzenesulfonates). Napsal V. Čupr a B. Sliva. Pp. 13. Čís. 201: Příspěvky k mineralogii země moravskoslezské (Beiträge zur Mineralogie Mährens und Schlesiens). Napsal Jaroslav Kotta. Pp. 16. Čís. 202: Nové názory na stratigrafií křídly podještědské a podkrkonošské (Neue Ansichten über die Stratigraphie der Kreide am Fusse des Jeschken- und Riesengebirges). Napsal Břetislav Zahálka. Pp. 23. Čís. 203: Roční změny v působení oceánity na podnebí Československa (Parcours annuel de l'océanité climatérique en Tchécoslovaquie). Napsal Bohuslav Hrudíčka. Pp. 15. Čís. 204: Regular Growth of Orthoclase and Quartz from Striegau in Prussian Silesia (Zákonný srůst ortoklasu a křemene od Striegau v Pruském Slezsku). By Miss B. Bobková. Pp. 18. Čís. 205: Sur une surface du sixième degré (O jistě ploše šestého stupně). Par Ladislav Seifert. Pp. 19. (Brno: A. Píša.)

Biologické spisy Vysoké školy Zvěrolékařské, Brno (Publications biologiques de l'École des Hautes études vétérinaires.) Svazek 13, Spis 176–185. Pp. iii+166. (Brno: A. Píša.) 50 Kč.

Sborník vysoké školy Zemědělské v Brně (Bulletin de l'Institut National agronomique.) Sign. C29: Individuální nepřetržitě měřené zrna pšeničného a kukuřičného v destilované vodě a jejich fyzikální změny. Napsali Prof. Dr. O. Kopecký a V. Almendinger. Pp. 52. Sign. C30: Vliv píneální žlázy na vývoj druhotných znaků pohlavních (Influence de la glande pinéale sur le développement des caractères sexuels secondaires). Napsal Dr. Jan Zahálka. Pp. 31+4 plates. (Brno: A. Píša.)

Zprávy komise na Přírodovědecký výzkum Moravy a Slezska. Oddělení geologické, Č. 12: Dodatky ke geologické mapě okolí olomouckého (speciální mapa č. 4158) a poznámky k některým listům sousedním (č. 4059, 4159, 4258, 4259). Napsal M. Remes. Pp. 28. Oddělení zoologické, Č. 21: Kulkice (Tachinidae) Pavlovských kopců (Tachinaires des collines "Pavlovské kopce"). Napsal Dim. Jacentkowský. Pp. 13. (Brno: A. Píša.)

Department of Public Instruction: Technical Education Branch, New South Wales. Technological Museum: Curator's Annual Report for Year ended 31st December 1934. Pp. 8. (Sydney: Government Printer.)

Catalogues

The Wild-Barfield Heat-Treatment Journal. Vol. 1, No. 5, June, Pp. 55–68+iv+4 plates. (London: Wild-Barfield Electric Furnaces, Ltd.)

Chemical Pumps: Rotary Oil Air Pumps for use in Chemical, Bacteriological and Pharmaceutical Laboratories. (Prospectus No. 780a.) Pp. 6. (London: W. Edwards and Co.)

Cambridge Microtomes. (Folder No. 49.) Pp. 6. (London: Cambridge Instrument Co., Ltd.)

A Catalogue of Important Books on Botany from the Libraries of the late Lord Battersby, Miss Ellen Willmott, and other Recent Purchases. (No. 509.) Pp. 40. (London: Bernard Quaritch, Ltd.)

Recent Scientific and Technical Books

Volumes marked with an asterisk (*) have been received at "NATURE" Office

Mathematics : Mechanics : Physics

Aourriol, J. B. Chaleur. 8vo. Pp. 304. (Paris: Gauthier-Villars, 1935.) 35 francs.

Ballard, P. B., and Hamilton, E. R. Fundamental Geometry. Cr. 8vo. First Series, Pupil's Book 3. Pp. 48. Paper, 8d.; cloth, 10d. First Series, Books 1, 2 and 3, Teacher's Book. Pp. 94. 2s. 9d. (London: University of London Press, Ltd., 1935.)

Bate, W. G. Everyday Life Arithmetic. Imp. 16mo. Book 2. Pp. vi+74+24. 1s. 9d. net. Book 3. Pp. v+82+21. 2s. net. (London: Sir Isaac Pitman and Sons, Ltd., 1935.)

Carathéodory, Constantin. Variationsrechnung und partielle Differentialgleichungen Erster Ordnung. Med. 8vo. Pp. xi+407. (Leipzig und Berlin: B. G. Teubner, 1935.) 22 gold marks.*

Department of Scientific and Industrial Research: Illumination Research. Technical Paper No. 1: The Terminology of Illumination and Vision. Second edition, revised. Roy. 8vo. Pp. iv+24. (London: H.M. Stationery Office, 1935.) 6d. net.*

Ebner, F. Technische Mathematik: Differential- und Integralrechnung. Unter Mitarbeit von L. Roth. (Teubners H.T.L.-Bücherei, Band 154.) Roy. 8vo. Pp. 167. (Leipzig und Berlin: B. G. Teubner, 1935.) 4 gold marks.

Faraday. Faraday's Diary: being the various Philosophical Notes of Experimental Investigation made by Michael Faraday, D.C.L., F.R.S., during the Years 1820-1862 and bequeathed by him to the Royal Institution of Great Britain, Now, by order of the Managers, printed and published for the first time, under the Editorial supervision of Thomas Martin. Vol. 6: Nov. 11, 1851-Nov. 5, 1855. Roy. 8vo. Pp. xiv+495+8 plates. (London: G. Bell and Sons, Ltd., 1935.) 7 vols., £12 12s. net.*

Flügge, W. Statik und Dynamik der Schalen. 8vo. Pp. 240. (Berlin: Julius Springer, 1934.) 21 gold marks.

Fuchs, R., Hopf, L., und Seewald, Fr., Herausgegeben von. Aerodynamik. Zweite völlig neubearbeitete und ergänzte Auflage der "Aerodynamik" von R. Fuchs und L. Hopf. 3 Bände. Roy. 8vo. Band 1: Mechanik des Flugzeugs. Pp. 339. (Berlin: Julius Springer, 1934.) 30 gold marks.

Fulford, R. J. Revision and Mental Tests in Arithmetic, Trigonometry and Algebra. Cr. 8vo. Pp. viii+91. (London: University Tutorial Press, Ltd., 1935.) 1s.

Knoblauch, O., und Koch, W. Technisch-physikalisches Praktikum. Roy. 8vo. Pp. 167. (Berlin: Julius Springer, 1934.) 13.50 gold marks.

Lilliman, A. J. Tests in Mental Mathematics, Feap. 8vo. Pupil's Book 3. Pp. iv+60. 10d. Teacher's Book 3. Pp. xii+76. 1s. 6d. (London, Bombay and Sydney: George G. Harrap and Co., Ltd., 1935.)

Lodge, Sir Oliver. My Philosophy: Representing My Views on the Many Functions of the Ether of Space. Cheap edition. Roy. 8vo. Pp. 318. (London: Ernest Benn, Ltd., 1935.) 7s. 6d. net.

Magie, William Francis. A Source Book in Physics. (Source Books in the History of the Sciences.) Med. 8vo. Pp. xiv+620. (New York and London: McGraw-Hill Book Co., Inc., 1935.) 30s. net.*

Marsh, M. C. Controlled Humidity in Industry. Roy. 8vo. Pp. 123. (London: Charles Griffin and Co., Ltd., 1935.) 6s. net.

Meissner, K. W. Spektroskopie. (Sammlung Götschen, Band 1091.) Pott 8vo. Pp. 180. (Berlin und Leipzig: Walter de Gruyter und Co., 1935.) 1.62 gold marks.

Menger, K., Herausgegeben von. Ergebnisse eines mathematischen Kolloquiums. Roy. 8vo. Heft 6: 1933-34. Pp. 47. (Leipzig und Wien: Franz Deuticke, 1935.) 1.50 gold marks.

Müller, Horst. Führer durch die technische Mechanik. Roy. 8vo. Pp. 118. (Berlin: Julius Springer, 1935.) 8.50 gold marks.

Sitte, K. F. Mehrstufige Rahmenformeln: Flotte Verfahren und bequeme Formeln für Zehntausende von praktisch Fällen nebst der allgemeine Grundformeln, eine Anleitung, Zahlenbeispielen und Quellenangaben. Band 1. 8vo. Pp. 238. (Brünn: Rohrer Verlag, 1934.) 8 gold marks.

Engineering

Aspinall, H. Turner. Worked Examples in Electro-technics. Part 1. Cr. 8vo. Pp. 156. (London: E. and F. N. Spon, Ltd., 1935.) 5s. net.

Bolton, D. J., Honey, Philip C., and Richardson, N. S. Electrical Water Heating: with Special Reference to the Domestic Storage Heater. Ex. Cr. 8vo. Pp. viii+192. (London: Chapman and Hall, Ltd., 1935.) 7s. 6d. net.*

Burrill, L. E. Ship Vibration: Simple Methods of Estimating Critical Frequencies. Roy. 8vo. (London: E. and F. N. Spon, Ltd., 1935.) 2s. 6d. net.

David, Pierre. Les filtres électriques: théorie, construction, applications. Deuxième édition augmentée d'un complément sur les systèmes sélectifs complexes. 8vo. Pp. 211. (Paris: Gauthier-Villars, 1935.) 50 francs.

De Ville, Eric. Elements of Electrical Engineering. Cr. 8vo. Pp. viii+216. (London, Glasgow and Bombay: Blackie and Son, Ltd., 1935.) 5s.

Eweis, M. Reibungs- und Undichtigkeitsverluste an Kolbenringen. (Forschungsheft 371.) Sup. Roy. 8vo. Pp. 23+3 plates. (Berlin: V.D.I. Verlag G.m.b.H., 1935.) 5 gold marks.

Friedmann, W. Bestimmung der Biegewechselfestigkeit von Drähten: Bau einer entsprechenden Materialprüfmaschine. (Mitteilungen der Wöhlerinstitut, Braunschweig, Heft 32.) 8vo. Pp. 93. (Berlin: N.E.M.-Verlag, 1934.) 4.50 gold marks.

Goldingham, Arthur H. Diesel Engines. Third edition. Demy 8vo. Pp. 263. (London: E. and F. N. Spon, Ltd., 1935.) 10s. 6d. net.

Goldingham, Arthur H. High Speed Diesel Engines. New impression. Demy 8vo. Pp. 156. (London: E. and F. N. Spon, Ltd., 1935.) 5s. net.

Hawks, Ellison. The Book of Electrical Wonders. (Modern Boys' Bookshelf.) New edition, revised. Demy 8vo. Pp. 316. (London, Bombay and Sydney: George G. Harrap and Co., Ltd., 1935.) 5s. net.

Ibbetson, W. S. Electric Circuits and Installation Diagrams. Demy 8vo. Pp. 198. (London: E. and F. N. Spon, Ltd., 1935.) 6s. net.

Kraft, E. A. Die Dampfturbine im Betriebe: Errichtung, Betrieb, Störungen. Sup. Roy. 8vo. Pp. 277+10 plates. (Berlin: Julius Springer, 1935.) 37.50 gold marks.

Le Mesurier, L. I., and Humphreys, H. S. Fuel Consumption and Maintenance Costs of Steam and Diesel Engine Vessels. Roy. 8vo. (London: E. and F. N. Spon, Ltd., 1935.) 2s. 6d.

L'Orange, P. Ein Beitrag zur Entwicklung der kompressorlosen Dieselmotoren. 8vo. Pp. 83. (Berlin: Schmidt und Co., 1934.) 3.40 gold marks.

Macgregor, R. A., and others. The Relation of Fatigue to Modern Engine Design. Roy. 8vo. (London: E. and F. N. Spon, Ltd., 1935.) 5s. net.

Middleton, Reginald E., and Chadwick, Osbert. A Treatise on Surveying. Fifth edition, revised by M. T. M. Ormsby. Vol. 1. Cr. 8vo. Pp. 398. (London: E. and F. N. Spon, Ltd., 1935.) 10s. 6d. net.

Mines Department: Safety in Mines Research Board. Paper No. 92: The Deterioration of Haulage Ropes in Service. By S. M. Dixon and M. A. Hogan. Roy. 8vo. Pp. iii+32+4 plates. (London: H.M. Stationery Office, 1935.) 1s. net.*

Reinhardt, A., und Kranz, H. Strömungsmaschinen. Zum Ähnlichkeitsgesetz für Hohlraumbildungen, von A. Reinhardt; Strömung in Spiralgehäusen, von H. Kranz. (Forschungsheft 370.) Sup. Roy. 8vo. Pp. 31. (Berlin: V.D.I. Verlag G.m.b.H., 1935.) 5 gold marks.

Schultz, E. Mathematische und technische Tabellen für Maschinenbau und Elektrotechnik. Neubearbeitet von S. Jakobi und O. Kehrman. Neunzehnte Auflage. 8vo. Pp. 784. (Essen: Baedeker Verlag, 1934.) 9 gold marks.

Younger, John E., and others. Structural Design of Metal Airplanes. Med. 8vo. Pp. 354. (New York and London: McGraw-Hill Book Co., Inc., 1935.) 24s. net.

Zeleny, Anthony. Elements of Electricity. Second edition. Demy 8vo. Pp. 552. (New York and London: McGraw-Hill Book Co., Inc., 1935.)

Chemistry: Chemical Industry

Alten, F., und Trénel, M., Herausgegeben von. Ergebnisse der Agrarkulturchemie: ein Jahrbuch für landwirtschaftliche Chemie. Band 3: 1934. Roy. 8vo. Pp. 156. (Berlin: Verlag Chemie G.m.b.H., 1935.) 8 gold marks.

Beilsteins Handbuch der organischen Chemie. Vierte Auflage. Die Literatur bis 1 Januar 1910 umfassend. Herausgegeben von der Deutschen Chemischen Gesellschaft. Band 20. Roy. 8vo. Pp. 566. (Berlin: Julius Springer, 1935.) 119 gold marks.

Bennett, H., Editor-in-Chief. The Chemical Formulary: a Condensed Collection of Valuable, Timely, Practical Formulae for making thousands of Products in all Fields of Industry. Demy 8vo. Vol. 1. Pp. x+604. Vol. 2. Pp. ix+570. (London: Chapman and Hall, Ltd., 1933-1935.) 25s. net each Vol.*

Berl, Ernst, Herausgegeben von. Chemische Ingenieur-Technik. Sup. Roy. 8vo. Band 2. Pp. xvi+795. 88 gold marks. Band 3. Pp. xvi+580. 64 gold marks. (Berlin: Julius Springer, 1935.)

Castell, R. A. S. Concise Practical Chemistry: for School Certificate. (Dent's Modern Science Series.) Cr. 8vo. Pp. ix+82. (London and Toronto: J. M. Dent and Sons, Ltd., 1935.) 1s. 6d.

Department of Scientific and Industrial Research: Fuel Research. Technical Paper No. 40: The Hydrogenation-Cracking of Tars. Part 1: Preliminary Experiments. Roy. 8vo. Pp. viii+107+2 plates. 2s. net. Technical Paper No. 41: The Hydrogenation-Cracking of Tars. Part 2: The Preparation of a Catalyst. By J. G. King and C. M. Cawley. Roy. 8vo. Pp. vi+17+1 plate. 6d. net. (London: H.M. Stationery Office, 1935.)*

Faust, O., Herausgegeben von. Celluloseverbindungen und ihre besonders wichtigen Verwendungsgebiete dargestellt an Hand der Patent-Weltliteratur. Band 1. Pp. xv+1495. Band 2. Pp. vii+1496-3098. (Berlin: Julius Springer, 1935.) 480 gold marks.

Haas, Arthur. Die Umwandlungen der chemischen Elemente. Med. 8vo. Pp. viii+118. (Berlin und Leipzig: Walter de Gruyter und Co., 1935.) 4.30 gold marks.*

Holderness, A., and Lambert, John. A Class Book of Problems in Chemistry to Higher School Certificate. Demy 8vo. Pp. vi+50. (London: William Heinemann, Ltd., 1935.) Without Answers, 1s.; with Answers, 1s. 6d.

Landolt-Börnstein Physikalisch-chemische Tabellen. Fünfte, umgearbeitete und vermehrte Auflage, herausgegeben von W. A. Roth und K. Scheel. Ergänzungsband 3, Teil 1. Imp. 8vo. Pp. viii+734. (Berlin: Julius Springer, 1935.) 108 gold marks.*

Littler, W. Short Test-Papers in Chemistry. Pott folio. Pp. 32. (London: G. Bell and Sons, Ltd., 1935.) 6d.

Mittasch, A. Berzelius und die Katalyse. Pp. 23. (Leipzig: Akademische Verlagsgesellschaft m.b.H., 1935.) 1.5 gold marks.

Perkin, F. Mollwo. Qualitative Chemical Analysis: Organic and Inorganic. Fifth edition, revised by Julius Grant. Demy 8vo. Pp. x+377. (London, New York and Toronto: Longmans, Green and Co., Ltd., 1935.) 9s. net.*

Speller, Frank N. Corrosion, Causes and Prevention: an Engineering Problem. Second edition. Med. 8vo. Pp. xiii+694. (New York and London: McGraw-Hill Book Co., Inc., 1935.) 42s. net.*

Geology: Mineralogy

Bertrand, Léon. Les grandes régions géologiques du sol français. (Bibliothèque de philosophie contemporaine.) Cr. 8vo. Pp. 339+8 plates. (Paris: Ernest Flammarion, 1935.) 15 francs.

British Museum (Natural History). Catalogue of Fossil Cirripedia in the Department of Geology. Vol. 2: Cretaceous. By Thomas Henry Withers. Demy 8vo. Pp. xiv+534+50 plates. (London: British Museum (Natural History), 1935.) 30s.*

Corbin, Paul, et Oulianoff, Nicolas. Carte géologique du massif du Mont-Blanc (Partie française) à l'échelle de 1:20,000. Feuille: Mont-Dolent. 26 in. x 19 in. Notice explicative. Demy 8vo. Pp. 15. (Paris: Société française de Stéréotopographie, 1934.) Carte et la Notice explicative, 20 francs.*

Hecker, O. Möglichkeiten der Erforschung des Erdinnern: Vortrag, gehalten in Stuttgart 11 März 1935. Roy. 8vo. Pp. 26. (Jena: Gustav Fischer, 1935.) 1.40 gold marks.

Schaffer, F. X. Lehrbuch der Geologie. Teil 3: Geologische Länderkunde. (Regionale Geologie.) Lieferung 6. Sup. Roy. 8vo. Pp. ii+481-576. (Leipzig und Wien: Franz Deuticke, 1935.) 6 gold marks.*

Skeats, Ernest W., Edited by. Outline of the Physiography and Geology of Victoria. Roy. 8vo. Pp. 60. (Melbourne: Melbourne University Press; London: Oxford University Press, 1935.) 2s. net.*

Srbik, R. Ritter von. Geologische Bibliographie der Ostalpen von Graubünden bis Kärnten. 2 Bände. Sup. Roy. 8vo. Band 1. Pp. 687. (München und Berlin: R. Oldenbourg, 1935.) Vollständig, 70 gold marks.

Tröger, W. Ehrenreich. Spezielle Petrographie der Eruptivgesteine: ein Nomenklatur-Kompendium. Roy. 8vo. Pp. vi+360. (Jena: Gustav Fischer, 1935.) 20 gold marks.

Woldstedt, P. Geologisch-morphologische Übersichtskarte des norddeutschen Vereisungsgebietes. 1: 1 500 000. 80cm. x 46cm. Text. 8vo. Pp. 33. (Berlin: Geologisches Preussischen Landesanstalt, 1935.) 3 gold marks.

General Biology: Natural History Botany: Zoology

Baker, Martin. Scouting and Nature: for Scouts, Guides, Schools and Hikers. Cr. 8vo. Pp. 136. (Glasgow: Brown, Son and Ferguson, Ltd., 1935.) 1s. 6d. net.*

Bělehrádek, J. Temperature and Living Matter. (Protoplasma-Monographien, Vol. 8.) Demy 8vo. Pp. x+277. (Berlin: Gebrüder Borntraeger, 1935.) 18 gold marks.*

Bessey, Ernst Athearn. A Text-Book of Mycology. Demy 8vo. Pp. xv+495. (Philadelphia: P. Blakiston's Son and Co., Inc., 1935.) 4 dollars.*

British Museum (Natural History). Insects of Samoa and other Samoan Terrestrial Arthropoda. Part 9: Summary, Fasc. 2. By P. A. Buxton. Cr. 4to. Pp. 33-104. (London: British Museum (Natural History), 1935.) 5s.*

British Museum (Natural History). British Antarctic (*Terra Nova*) Expedition, 1910. Natural History Report. Zoology, Vol. 4, No. 8: Report on the Tunicata. Part 2: Copelata. By Walter Garstang and Elizabeth Georgeson. Roy. 4to. Pp. 263-282. (London: British Museum (Natural History), 1935.) 1s. 6d.*

Chamberlain, Charles Joseph. Gymnosperms: Structure and Evolution. Med. 8vo. Pp. xi+484. (Chicago: University of Chicago Press; London: Cambridge University Press, 1935.) 21s. net.*

Corbet, A. Steven. Biological Processes in Tropical Soils: with Special Reference to Malaysia. Demy 8vo. Pp. xiv+156+16 plates. (Cambridge: W. Heffer and Sons, Ltd., 1935.) 7s. 6d. net.*

Daglish, E. Fitch. Our Wild Flowers and How to Know Them. (How to Know Them Series, No. 4.) Cr. 8vo. Pp. 127. (London: Thornton Butterworth, Ltd., 1935.) 2s. 6d. net.

Davison, G., and Davison, T. Brooke. Dogs from Pet to Show Bench. Cr. 8vo. Pp. 208. (London: Herbert Jenkins, Ltd., 1935.) 3s. 6d. net.

Duncan, F. Martin. Some Birds at the London Zoo. Cr. 8vo. Pp. 113. (London: John Bale, Sons and Danielsson, Ltd., 1935.) 6s. net.

Elms, E. F. M. Our Resident Birds and How to Know Them. (How to Know Them Series, No. 2.) Cr. 8vo. Pp. 126. (London: Thornton Butterworth, Ltd., 1935.) 2s. 6d. net.

Elms, E. F. M. Our Migrant Birds and How to Know Them. (How to Know Them Series, No. 3.) Cr. 8vo. Pp. 126. (London: Thornton Butterworth, Ltd., 1935.) 2s. 6d. net.

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