

Editorial & Publishing Offices :

MACMILLAN & Co., LTD.
ST. MARTIN'S STREET
LONDON, W.C.2



Telegraphic Address :
PHUSIS, LESQUARE, LONDON

Telephone Number :
WHITEHALL 8831

No. 3440

SATURDAY, OCTOBER 5, 1935

Vol. 136

Organisation of Agricultural Research

STATE assistance to agricultural research in Great Britain began with the Development Act of 1909, and in accordance with the principle of that Act, the finance of the schemes then initiated remained with the Development Commission, while the administration rested with the departments of agriculture, until in 1930 the Agricultural Research Council was set up. This council, though equally under the Privy Council, has not quite the same status as its parallel bodies, the Department of Scientific and Industrial Research and the Medical Research Council, both of which administer directly the whole of the funds available from the Treasury for research in their subjects. It would be difficult to explain to a foreigner the curious machinery which now prevails for the purpose of making grants, involving as it does the Research Council, the Development Commission, the two departments of agriculture in England and Scotland, and finally the Treasury.

A recent article in *Planning* is very insistent on simplification, on the ground that all these separate strands of red tape not only result in delay in the consideration of applications for grants, but also are obstacles to the proper planning of agricultural research. Of course, no one would devise such an organisation *de novo*; it grew by stages, its excuse is the dread all Governments have of legislation, its justification is the necessity of maintaining continuous touch between the research workers and the agricultural departments, the administration of which should be guided by the conclusions reached by research. It may be doubted whether delays are greater than in any other dealings with a Government department. Speed of action is the attribute only of an autocracy, and of an autocracy on a small enough scale to allow of immediate access to the autocrat.

As to planning, it was for that purpose the Research Council was set up; it surveys the whole field, it reviews the work of each Institute, and though that Institute may be financed by the Development Commission and administered by the Ministry of Agriculture, it would scarcely be able to ignore the recommendations or criticism of the Council. As the writer in *Planning* admits, the cumbrous organisation is being made to work, and so it will remain until there comes along some Government willing to spare some of its precious 'time' in order to secure order and logic in its machinery of administration.

The article also discusses the failure to obtain any substantial addition to the funds for research from the farming community, but that is inevitable because of the way the industry is split up into small units of production. The Marketing Boards do possess powers of making a levy on their very considerable turnover that would raise ample funds for research, without imposing any perceptible burden upon the individual, but the awkward administrative question of reconciling the responsibility of the Council for the direction of research with the power of the purse possessed by the Marketing Boards is still unsettled.

The most weighty criticism of the *Planning* article is directed against the indifferent scale of salaries prevailing in the research institutes, which it is alleged are failing to attract men of initiative and high mental capacity. But as the head of one of our universities has pointed out, only a small fraction of the men who graduate each year are really of the first grade, a fraction well below the demand that is made upon the universities by the various services, business and professions. When, however, all allowance is made for this and for the fact that research

offers a sheltered career with an attraction of its own, irrespective of income, there is undoubtedly much dissatisfaction among the agricultural research workers, a small body not more than five hundred in all, a large proportion of whom are not established. There is need for an unbiased review of the situation, and this is presumably within the reference of the Research Council. Agricultural research workers do need favourable terms, for they have few outlets for escape into well-paid business. It is precisely this alternative which renders recruiting for research in veterinary medicine so difficult in the veterinary profession; the great increase in administrative appointments of recent years has offered to any graduate of quality prospects much superior to those the research institutes can offer.

We doubt if the suggestion that the Research Council itself ought to appoint super-directors of its own for each group of subjects is helpful. The man in charge of a research station, the man who is immersed in the subject, may be guided and may benefit from the critical examination of his work by men of quality in the cognate pure sciences, but he cannot be made to work to order or forgo his responsibility. If one believes in research, one must trust the research worker's personality. The practical outcome of such a plan would be to withdraw the few outstanding men of originality from the active prosecution of research into administration.

The real function of the Research Council is not to control research nor to manage the research workers; it is to survey the field as a whole and to think out priorities, and to bring an enlightened

judgment to bear upon the many proposals put before the Council. It has to decide whether the possibilities offered by the project are of the order of probabilities, and how far the pursuit of pure knowledge has an economic justification. Sometimes it will see a neglected opportunity, sometimes it must override a director in the interests of a more comprehensive organisation, sometimes it must advise a director that an investigation is becoming a routine, a blind alley. But ultimately it has to recognise that research is the product of the imagination and insight of individuals; its highest wisdom is to back the right horse.

Finally, the writer in *Planning* directs attention to the weakness of the organisation for getting the results of research passed over to the farmer and translated into action. It is a question which troubles the agricultural administration in every country, and particularly obsesses the public men concerned with agriculture. The inherent difficulty lies in the fact that agricultural production is split up among a number of relatively weak units, limited by lack of capital and personality. In agriculture there are no great corporations the resources of which enable them to take a long view about the adoption of a new process. The educational service which is in direct contact with farmers is outside the purview of the Research Council, and is doing excellent work. But the industry will have to become organised before it can reap the full harvest of research; as the Marketing Boards gain experience, they will be able to press upon the producers, their members, the improved methods that are the outcome of investigation and knowledge.

Study of Crystal Structure

A Study of Crystal Structure and its Applications

By Prof. Wheeler P. Davey. (International Series in Physics.) Pp. xi+695. (New York and London: McGraw-Hill Book Co., Inc., 1934.) 45s. net.

AFTER a rather quiescent period, the study of crystals sprang into great activity as soon as it was discovered that crystalline materials could be used as three dimensional gratings for radiation of the wave-lengths of X-rays. The earlier work of crystallographers on the theory of space groups was presented in forms more useful

for the new developments by Wyckhoff and by Astbury and Yardley. The Laue and Bragg methods, and the powder photographic method, were employed in the analysis of the internal structures of the simpler substances, and the subject advanced at a rapid rate.

As the substances examined increased in complexity, more data had to be obtained to permit of the deduction of their structures. Rotation and oscillation photographic methods were developed, special types of camera designed and much ingenuity displayed in devising reasonably quick graphical methods of interpreting the photographs; as

examples, may be quoted, on the practical side, the Weissenberg camera, and, on the theoretical side, the conception of the reciprocal lattice.

The extension of our knowledge of atomic structure factors enabled considerations of the intensities of the reflected beams to add their full quota towards structure determination. The Fourier analysis method, first suggested by W. H. Bragg, was developed by many investigators and, in the hands of W. L. Bragg and his school, formed the basis of the determination of the structures of the complex silicate groups. All these problems are dealt with by W. P. Davey in the first half of this book. In view of the increasing importance of intensity measurement, however, it would have been appropriate, perhaps, to find room for some reference to improvements in intensity determinations of photographically recorded reflections.

If enough were known concerning the fundamental properties of matter, it ought to be possible to calculate the physical and chemical properties of crystalline materials, and in illustration the author considers the refraction of light by crystals, and more particularly W. L. Bragg's calculation of the optical constants of calcite and aragonite.

Atomic sizes, lattice energies, diffraction by

amorphous materials, polycrystalline texture and solid solutions, all find their places in the text, but liquid crystals and fibre structures might have received more detailed consideration.

Of particular interest at the moment is the study of the imperfections of real crystals, that is, their deviations from ideal lattices. This involves much more than X-ray observations alone and, quite justifiably, a whole chapter has been devoted to this subject. It is unfortunate, however, that the chapter deals so fully with Zwicky's secondary lattices, a conception which is now generally considered to be built upon a rather unsafe foundation, while other hypotheses receive scant mention.

The volume concludes with four appendixes, of which the first gives a limited account of apparatus for the production of X-rays, the second deals with charts for use in the interpretation of powder photographs and the third records space group tables. The author disclaims any use for the Hermann Mauguin symbols, but, after devoting three pages to their reproduction, it seems a pity that he does not give a word in explanation of the individual symbols the various combinations of which form the complete space group notation.

R. E. GIBBS.

Herpetology: Popular and Systematic

(1) Reptiles of the World:

the Crocodylians, Lizards, Snakes, Turtles and Tortoises of the Eastern and Western Hemispheres. By Dr. Raymond L. Ditmars. New revised edition. Pp. xx+321+90 plates. (London: John Lane, The Bodley Head, Ltd., 1933.) 18s. net.

(2) A Monograph of the Frogs of the Family Microhylidae

By H. W. Parker. Pp. viii+208. (London: British Museum (Natural History), 1934.) 15s.

(1) THIS well-known book has long been recognised as a standard work on reptile life, and the several reprints which have appeared since its first publication in 1910 testify to its wide popularity and usefulness. In the preface of the revised edition, the author once more expresses the hope that the book will be "everywhere in accord with the latest results of the scientific study of the subject". However, the new edition contains very little new information, and recent herpetological literature is not well covered. Thus, in treating of the Opisthoglyph snakes, the author speaks of "the absence of

records to show what their venom is capable of doing", though Fitzsimons (1919) has recorded the potency of Boomslang venom. Besides being dangerously poisonous to man, this is a familiar and abundant South African species which might well have been mentioned here.

It is a source of disappointment to find that the author's experiences in the field, and his unique observations on the feeding, care and treatment of reptiles in captivity during the twenty-three years since the first edition appeared, have not found a place in the new edition of his work. While the nomenclature has been brought up to date, the revision is unfortunately inconsistent: it will be misleading to readers unfamiliar with the subject to see the same genus mentioned within a few lines of print under the two names *Glauconia* and *Leptotyphlops*, while the largest genus of skinks is inconsistently referred to as *Lygosoma* and *Leiolopisma* in different parts of the book.

Misprints appear to be few: the following should be rectified in the next edition: "comical", p. 29 (conical); "Abamidae", p. 33 (Agamidae).

The revision might well have been extended to correct a number of awkward expressions (such as that on p. 43, where we read: "One generally anticipates an awakening of insect life with the coming of darkness, and he is not disappointed") and grammatical errors (such as the use of "dove" for "dived"). Throughout the book "habitat", a word which normally has an ecological rather than a geographical significance, is incorrectly used for "distribution".

Referring to the parallelism of characteristic genera in the Old World Agamidae and the New World Iguanidae, we do not agree with the author's statement "This in no way relates to adaptation". It is significant that many of these unrelated lizards resemble one another, not only in outward appearance, but also in habits and habitat, and this similarity—as, for example, in the arboreal *Agama atricollis* and *Uraniscodon plica*, the desert-dwelling *Moloch* and *Phrynosoma*, and the cursorial *Liolepis* and *Dipsosaurus*—is probably the result of adaptation to a similar mode of life. It would be interesting to have reliable evidence (which is yet lacking) for the belief, here repeated, that the lateral skin-flaps of the gecko *Ptychozoon homalocephalum* "serve the animal in parachute-like fashion, enabling it to make long, scaling leaps from tree to tree". One function of these flaps is certainly cryptic, in that they tend to eliminate the gecko's shadow, and thus add to the effectiveness of its resemblance to lichen-covered bark.

The shortening of the book by some fifty pages is a doubtful improvement, for it has been made at the expense of the bold type which characterised the earlier edition, and which is here replaced by smaller and less clear print. A fine study of *Varanus komodoensis* appears on the frontispiece: otherwise the illustrations are the same, and the steep-angle photograph of *Natrix natrix* reappears upside-down on plate 38. The plates have now been conveniently collected at the end of the volume, and the printers' rendering of the author's many excellent photographs on a better quality paper is a distinct improvement on earlier editions.

(2) In making this much-needed revision, now published as "A Monograph of the Frogs of the Family Microhylidae", Mr. H. W. Parker has successfully accomplished a difficult task. The work has evidently been prepared with great care, and it comes well up to the high standard which one associates with publications sponsored by the trustees of the British Museum. Embodying as it does the latest ideas on the classification of this group of frogs, it will be welcomed by students of herpetology, for it represents the first complete account of the family written in English since the

publication in 1882 of Boulenger's well-known "Catalogue of the Batrachia Salientia", which accounts for less than one quarter of the species of the family known to-day.

During the past fifty years, various schemes of classification have been proposed, only to be rendered in turn more or less obsolete by the progress of research and with the accumulation of fresh material. Earlier classifications were found unsatisfactory because they were based upon characters later shown to be unreliable. The author has had access to ample material comprising the large majority of known species, and his classification of the group will be the more valuable on that account.

The introductory section (pp. 1–18) opens with a historical résumé of the family. This is followed by a detailed account of the characters, mainly osteological, to which taxonomic importance is attached. The larval stages (known in relatively few species) are considered in their bearing upon a natural classification of the group. Seven sub-families are now recognised—an arrangement which expresses the inter-relationships of the various genera, and which, the author tells us, "has the merit of according with the facts of geography as well as of morphology". The present distribution of the family is discussed in relation to its past distribution in time and space, of which, in the entire absence of fossils, our knowledge must largely rest upon a foundation of conjecture rather than of fact.

The second and main section of the work (pp. 19–200) contains the systematic account of the 184 species, which are assembled into forty-three genera. Under each of the latter, the author gives a list of references—the type species being designated—a definition of the genus, and a synopsis of the contained species. For each species, there is a synonymy referring to all the more important papers, the locality of the type specimen being given. Following the description, there is a statement of the known distribution, and a list of the specimens (in all, more than 1,600) actually examined by the author, with particulars as to source, date, sex, locality, and the collector's name where this has been traced. A number of clear original text figures and a very complete index add materially to the usefulness of this well-arranged and well-printed volume.

To the systematic herpetologist Mr. Parker's work will be indispensable: but it is to be hoped that the book—providing as it does an excellent and trustworthy means for identification—will also stimulate a wider interest in this large but obscure group of frogs, the habits and life-histories of which are little known.

HUGH B. COTT.

Vitamin B in the Diet of Man

The Vitamin B Requirement of Man

By Prof. George R. Cowgill. (Published for the Institute of Human Relations.) Pp. xix+261+4 plates. (New Haven, Conn.: Yale University Press; London: Oxford University Press, 1934.) 18s. net.

THE title of this book is so intriguing that all who are interested in nutrition will wish to know how the author has arrived at such a definite assertion, especially in view of the fact that man's requirement for vitamin B cannot be studied by direct experimentation.

Dr. Cowgill has attempted the problem indirectly. He has ascertained the minimum vitamin B requirement of different species of animals (rat, mouse, pigeon, dog) in terms of a special yeast preparation, using animals of widely different weights. His data pointed to the minimum vitamin B requirement being related to some power of the body weight. By trying various values for this power, he found that the figures agreed with the expression $\text{vit. B} = K \times Wt.^{5/3}$, and that there was a factor common to all the species. Bringing into account the maximum normal size of the different animals, the expression became

$\text{vit. B} = 4.9 \times W^{0.66} \times \frac{W}{W_{\text{max.}}}$ and it agreed

remarkably with the experimental figures. As $W^{0.66}$ may be taken to indicate metabolism, since basal metabolic rate and body surface are functions of the $2/3$ power of the body weight, and as from food intake figures $\text{Calories} = 1.5 \times W^{0.66}$, the expression becomes $\text{vit. B} = 4.9 \times \frac{\text{Cal.}}{1.5} \times \frac{W}{W_{\text{max.}}}$.

Since $W_{\text{max.}}$ is a constant, the formula reduces to $\text{vit./Cal.} = K \times W$. For man, taking 115 kgm. as the maximum weight, the formula is $\text{vit./Cal.} = \frac{3.27}{115,000} \times W$, or $0.0000284 W$. The vitamin is

taken in milligrams of the special preparation and the weight in grams. It should be noted, though not mentioned by Cowgill, that a vitamin/carbohydrate ratio was suggested by Randoïn and Simonnet and a vitamin/Calorie ratio by Plimmer, Rosedale and Raymond, who considered that it should have a constant minimal numerical value.

By plotting vit./Cal. ratios as ordinate against weight as abscissa and using the line given by the maximum weight of 115 kgm., a series of ratios are given for different body weights. Reference to the chart shows the vit./Cal. ratios of 1.25, 1.50, 1.75, 2.00 corresponding to weights

40, 50, 60, 70 kgm. respectively. The minimum ratio for a man of 70 kgm. is thus 2.00. Figures near the line are border-line, figures above show sufficiency and below too little vitamin B.

To check the accuracy of the vit./Cal. ratio, Prof. Cowgill has collected together the diets of peoples in various parts of the world which did and did not give rise to beriberi. Beriberi is due to a deficiency of vitamin B in the diet. These diets have been evaluated for their vitamin B content in terms of the special yeast preparation. Foodstuffs had been tested by other workers, some of which had been tried by all the workers and also by Cowgill. It was thus possible to calculate all the figures on the same unit. A useful table of these values is given, and it is possible to recalculate the figures in terms of other units, or the international unit, as a table is shown giving the approximate equivalents of the various units. The vit./Cal. ratio of any diet could thus be determined.

The diets of the sufferers from beriberi had vit./Cal. ratios of 1.74, 1.96 to 2.18, 1.35 and lower values. Diets on which beriberi did not appear had the corresponding ratios of 2.18, 2.26 to 2.46, 1.97, 2.96. These figures agree closely with those shown on the chart. Occasionally there were discrepancies, but on referring to the weight it was found that the weights of the individuals were either above or below the chart line. An examination of a series of diets consumed in the United States showed the vit./Cal. ratios of 2.01-3.39. The value of 2.05 is regarded as borderline for a man of 60-70 kgm.

Though many workers will not agree with Cowgill's method of trying to fix a vitamin B-Calorie ratio as a means of determining the vitamin B requirement of man, yet it must be granted that an analysis of the diets leading to, or preventing, beriberi for their vitamin B content is an essential step. The book gives further details of the occurrence of beriberi since the date of Vedder's book, the diets of the peoples in the beriberi districts and other useful information. A chapter is devoted to other clinical conditions associated with lack of vitamin B. It is hoped that the attention of physicians be directed to the importance of vitamin B to health. It is not correct to believe that there is plenty of vitamin B in the ordinary diet and dismiss it from consideration. The vitamin/Calorie ratio should be checked in cases of enlarged heart, bradycardia and disorders of the digestive tract.

Biochemical Progress

Annual Review of Biochemistry

Edited by James Murray Luck. Vol. 4. Pp. vii + 639. (Stanford University, Calif.: Annual Review of Biochemistry, Ltd., 1935.) 5 dollars.

THE three previous volumes of these reviews have proved of so much value to biochemists that the form of their continuation is a matter of general interest. In no branch of science is there a greater flood of published work, more need of analysis and a better chance of an unexpected discovery illuminating further progress. The subject is essentially fluid, and reviews under stereotyped headings may easily become sterile. Hence the editors have encouraged the policy of analysis of selected papers chosen on account of their intrinsic importance and significance. It is for the reviewers and the readers of reviews to co-operate, the former by selecting and the latter by suggesting subjects which are ripe for comment.

It should be remarked that the three trial years being completed, the enterprise of editing and publishing the "Review" becomes one and the same, and is established as a non-profit earning corporation. It is appropriate to hope that it will receive a generous measure of support from the ever-growing number of British biochemists.

Turning to the recognition of fields of immediate interest, this volume includes reviews on choline and allied compounds by Gaddum, the biochemistry of malignant diseases by Holmes, plant hormones by Thimann. In all, there are twenty-seven reviews by an international assembly of authors.

Enzymes are a subject in which there is annual progress; this time it is reported by J. B. Sumner that six enzymes and two zymogens have been isolated in the crystalline state. Enzyme chemistry is becoming more or less identified with protein chemistry, and we are perhaps on the road to clear up some of the facts relating to the higher molecular state of proteins.

The domain of carbohydrates is likewise never without new problems and new discoveries; it is handled by the sympathetic pen of Sir James Irvine, who confines his summary to the more purely chemical developments, leaving for the moment the striking observations connecting polysaccharides with immunological reactions. The synthesis and constitution of ascorbic acid is perhaps enough for one year, but there is much else to chronicle.

As to the proteins and their constituent amino acids dealt with by Edwin J. Cohn, it is noteworthy that progress owes much to physical measure-

ments, particularly X-ray diffraction studies which reveal both the distances between carbon atoms in the chain, and further, the relations between atomic groupings in the peptide and hydrocarbon chains and much else besides. This very important review seeks to set forth principles in terms of which a complete description of behaviour may ultimately emerge.

The sulphur compounds, reviewed by Howard B. Lewis, retain their interest, particularly glutathione with its role as activator or co-enzyme for enzyme activity. The evidence for, and against, the view that the sulphhydryl group is a specific stimulus for growth is summarised: it appears to be a promising line of research.

Plant pigments are summarised by R. Kuhn, who has contributed so much to their elucidation. He describes the carotenes with their established formulæ, and shows how the cleavage of the carbon skeleton of a carotinoid with forty carbon atoms yields in theory other natural products, the structure of which depends on the point of cleavage. Four natural pigments are now recognised as provitamin A. The flavins first obtained from milk have been characterised and synthesised; as much pigment has been made from 100 gm. of dimethyl-4-amino-5-methylamino benzene as from 750,000 litres of milk. This shows how advanced is the chemical technique of dealing with minute quantities.

The elucidation of the molecular structure of the alkaloids, particularly morphine and strychnine, is one of the most difficult problems which confronts the chemist. It is one in which he will not admit defeat, and to solve it he tries method after method of attack. The progress is, therefore, steady rather than spectacular; it is appropriately summarised by Robert Robinson.

A new subject for review is that of growth substances in plants, in particular auxin, of which the structural formula has been established. This field may be expected to yield remarkable results in the not too distant future.

Space will not permit of further specific reference, but enough has been said to indicate the utility of the annual reviews and the amazing amount of work which is in progress. The chemist has been accused of war-promoting activities: such are as nought compared with the attempts to understand living tissues which are being made in a thousand and more laboratories.

"Farther, deeper may you read,
Have you sight for things afield."

E. F. A.

Atomic Physics

By Dr. Max Born. Authorised translation from the German edition by Dr. John Dougall. Pp. xii+352. (London, Glasgow and Bombay: Blackie and Son, Ltd., 1935.) 17s. 6d. net.

IN 1933, Prof. Max Born published in German "Moderne Physik", which has given rise to the present English version by Dr. John Dougall. This book is, however, more than a mere translation, for it has been brought thoroughly up to date so as to include the discovery of new particles and their role in the constitution and disintegration of atomic nuclei. The author has included a clear account of his own views suggesting a higher limit to the possible magnitude of an electromagnetic field, somewhat as the velocity of light appears in physics as the maximum velocity of particles. In this way, Born retains Maxwell's equations and the usual relation between energy and mass, and obtains for the size of the electron 2.28×10^{-13} cm. and for the absolute field 9.18×10^{15} E.S.U., but these values may be modified by the effect of spin, which, as he points out, has not yet been satisfactorily dealt with as a real electromagnetic angular momentum from the point of view of his theory. Incidentally, there is on page 46 and appendix vii an ingenious and simple derivation of the Einstein formula $E = mc^2$.

This book gives a comprehensive review of modern atomic physics in 256 pages, while the proofs of formulæ are placed in 31 appendixes (87 pages). The author is careful to point out the limitations and defects of modern theories no less than to set forth their brilliant successes, while he attempts to erect signposts for guidance in future advances.

The relations between the two types of statistics and the symmetric and antisymmetric wave forms are stated with exceptional clearness. The necessarily elusive character of modern views is sufficiently indicated. A wave packet should be almost evanescent, and yet it is possible to hold in the hand a large pitchblende crystal and to state it has remained almost in its present form for 1,400 million years. The microscopic universe is as indeterminate as an animal in the Zoo, when you do not know in which cage it may be, and, if found, the animal dashes off to hide as soon as you try and look at it. Sometimes, however, it leaves a trail, sometimes flashes a light.

A. S. EVE.

The Pineapple

By Maxwell O. Johnson. Pp. xii+306. (Honolulu: Paradise of the Pacific Press, 1935.) 5 dollars.

THE pineapple industry of Hawaii has been built up within the last forty years. In 1896 a large consignment of plants of the 'Smooth Cayenne' variety was imported from Queensland and formed the foundation of the present industry. A few thousand canned fruit were produced by 1902, and by 1913 the production had risen to 2,600,000 cases. It has now reached the enormous total of 12,000,000 cases, or about 300,000,000 marketable fruit per annum.

In 1916 cultivation was confined to the uplands, as plants grown on the lower lands suffered from what

was known as 'pineapple yellows'. The discovery by the author that this was due to lack of available iron in the soil, and that the disease could be cured by spraying with iron sulphate, meant an immediate and rapid expansion of the area under pineapples. Other ailments from which the crop suffered have been investigated and largely controlled.

The author of this book, and other technical workers, have been mainly responsible for the maintenance and development of this industry, and there can scarcely be anyone more competent to write a study which deals so admirably with all aspects of cultivation of this crop and which describes in detail the methods adopted to control disease. The book closes with an account of the marketing of both the fresh and the preserved fruit.

This work not only deals with the pineapple in Hawaii but also summarises the experience gained in other countries, many of which have been visited by the author in his search for knowledge of the crop.

Mid-Ice: the Story of the Wegener Expedition to Greenland

By Johannes Georgi. Translation (revised and supplemented by the Author) by F. H. Lyon. Pp. xiv+247+24 plates. (London: Kegan Paul and Co., Ltd., 1934.) 12s. 6d. net.

THE Wegener expedition to Greenland in 1930 planned to maintain a meteorological observatory on the ice sheet in the heart of the country. The volume before us is the story of how this task was achieved. Transport from the coast, some two hundred and fifty miles away, broke down, but the work at the central station was not interrupted although the party, and at times Dr. Georgi alone, lived in a hole in the ice. They had food, but little else. Here in diary form is the frank record of life under those dreary conditions. Wegener himself lost his life on a journey to the coast; but the expedition has important results. Few of these, however, are given in this general volume, which has its interest chiefly in showing what man can endure in the cause of scientific discovery.

China's Geographic Foundations: a Survey of the Land and its Peoples

By Dr. G. B. Cressey. Pp. xvii+436. (New York and London: McGraw-Hill Book Co., Inc., 1934.) 24s. net.

THE author knows China from end to end, and has produced a valuable book, which should be studied by every student of geography. So much that is written on China is solely political and superficial; but this study strikes down to basic physical conditions, and from position, relief, soil and climate builds up an explanation of Chinese life and activities. Problems of climate and their relation to agriculture are especially well treated. Manchuria and the outer dependencies of China are included. There are numerous clear maps, many excellent illustrations and copious bibliographies. Prof. Cressey has succeeded in writing geography without dullness, and given a survey of lasting value.

Centenary of the Landing of Charles Darwin on the Galapagos Islands

CHARLES DARWIN landed on the Galapagos Islands on September 16, 1835, and spent about five weeks observing and collecting in the archipelago. His observations, especially on the differences presented by the finches and the giant tortoises found on the different islands, provided the basis for the new line of thought which resulted in the hypothesis of the "Origin of Species".

The committee of Section D (Zoology) of the British Association arranged that the centenary of his landing should be commemorated by a series of communications occupying the afternoon meeting at Norwich on September 6.

Sir Edward Poulton, in an opening address, reminded the audience that Darwin sailed in the *Beagle* in December, 1831, when he was not yet twenty-three years of age. Nearly four years later the ship reached the Galapagos Islands, and Darwin observed how every kind of animal, and particularly the finches and the giant tortoises, on each island differed slightly from those on the other islands. He realised that these observations, if well founded, "would undermine the stability of species"; that, in fact, he must abandon the idea of the separate creation of species, though he was entirely unable to account for their origin. The solution of this problem became the great work of his life.

Sir Edward Poulton divided the past century of evolutionary thought into three periods. First came a time of inactivity for nearly everyone except Darwin, who began his first notebook on evolution in 1837. In the following year he read Malthus "On Population", and "in a sudden flash of insight" came the idea of natural selection as the great motive force of evolutionary progress, and on this he worked and pondered for twenty years. The second period opened in June 1858, when Darwin received Wallace's letter and manuscript, written at Ternate, in the Moluccas, which showed that Wallace had reached an identical position. Their views were placed before the Linnean Society on July 8, and Darwin's "Origin of Species" was published in the following year. The third period began with the rediscovery in 1900 of the work of Mendel, at first supposed by many to be opposed to Darwinism, but which threw new light on inheritance, led to many new facts consistent with natural selection and solved the difficulty, which Darwin had felt to be the greatest of all—the supposed "swamping effect of intercrossing". Sir Edward Poulton

reaffirmed his strong belief in the value of the theory of natural selection.

Prof. J. H. Ashworth gave an account of Charles Darwin as a student in Edinburgh from October, 1825 until April, 1827. The sources of information on this period were the minute book of the Plinian Society of Natural History of the University of Edinburgh, of which Darwin was a member during his second academic session, and a notebook begun by Darwin in March, 1827. The minute book is of interest as showing the range of subjects discussed in the students' natural history society in Edinburgh one hundred years ago, and as containing the record of Darwin's presentation to the Society on March 27, 1827 of his original observations on the 'ova', which were in fact larvae, of the polyzoan *Flustra* and on the 'ovum' or egg-case of the marine leech *Pontobdella muricata*. Darwin's observations on these two subjects occupy four and a half pages in his notebook, which also contains notes on other marine animals, which he collected in the Firth of Forth and examined in Edinburgh.

Prof. Ashworth referred to other papers found among Darwin's Edinburgh notes, and to a few of Darwin's friends, of whom the most important were Robert Grant, a very energetic collector and investigator of sponges and other marine invertebrates, who left Edinburgh in 1827 to be the first professor of zoology in University College, London, and William Macgillivray, then assistant keeper of the Natural History Museum of the University of Edinburgh, who was well known for his special knowledge of birds. Prof. Ashworth concluded that in Edinburgh Darwin laid the foundation of his knowledge of the science of natural history.

Prof. G. D. Hale Carpenter, who was asked to speak on Darwin and entomology, pointed out that Darwin's early interest in entomology was overshadowed in later years as other subjects became more absorbing. He proceeded to refer to one aspect of entomology which has been much aided by the principle of natural selection, namely, the study of the coloration of insects. Prof. Carpenter held that concealing coloration, warning coloration and mimicry could all be accounted for by natural selection, and not by any other explanation which has yet been brought forward. Before Darwin's day, conspicuousness could not be satisfactorily explained except by appeals to anthropocentric ideas or terminology.

Prof. E. W. MacBride said that if Darwin had produced no other book than his journal of researches during the voyage round the world of H.M.S. *Beagle*, he would have shown himself to be one of the finest naturalists that ever lived, and his description in this work of the Galapagos Islands and of their fauna is a most masterly production. Prof. MacBride proceeded to refer to the giant tortoises, the lizards and the birds, and said that Darwin was at an utter loss to account for the prodigality of creative power which had resulted in the different islands having distinct species of tortoises and birds. Later Darwin applied his theory of natural selection to the explanation of the occurrence of the variety of species in the different islands. Prof. MacBride expressed his strong dissent from this explanation and from Sir Edward Poulton's views, and concluded by stating that in his opinion the ultimate cause of difference in species is difference in habits and in reaction.

Mr. H. W. Parker recalled Darwin's statement that the reptiles of the Galapagos gave "the most striking character to the zoology of these islands". During the last century, the number of species of reptiles was found to be greater than Darwin

had realised, but the increased knowledge emphasises what he considered "by far the most remarkable feature in the natural history of this archipelago—that the different islands to a considerable extent are inhabited by a different set of beings". Mr. Parker, in giving an account of the present distribution of the reptiles in the islands, stated that of the fourteen species of giant tortoises, three are probably extinct and most of the others exceedingly rare. The curious marine lizards (*Amblyrhynchus*) and the land lizards (*Conolophus*) are also in grave danger of extermination. Man has been the principal destructive agent in the past, but the future of all species, large and small, is jeopardised by the presence on the islands of introduced pigs, dogs, rats and cats which have run wild. That the remnants of the fauna are in imminent danger has been realised by the Government of Ecuador, which has passed decrees proclaiming certain of the islands as 'asilos reservados', and also giving protection to all the interesting indigenous species throughout the archipelago. Mr. Parker urged that only international co-operation could make this legislation effective, and that the British Association should initiate action to this end.

An Early Stone Age Culture of America

REFERENCE to the discovery of 'Folsom points' and to 'Folsom man' in the archaeological literature of the United States from time to time within the last decade has given rise to an expectation that it might be possible, within a comparatively short time, to construct some sure and certain foundation for the claim to a relatively high antiquity for early man in America, which has often been advanced, but never satisfactorily substantiated. Since the Folsom point was first recognised in 1927 as an early and specific stone age industry of North America, occurring on occasion in association with a presumed early fauna, later discoveries and further study of its characteristics and distribution have given clearer definition to the archaeological problem and indicated the direction of intensive search for the geological and palaeontological data upon which the solution of the chronological problem ultimately will depend.

Passing reference has been made in the columns of NATURE from time to time to the discovery of evidence relating to Folsom man. Such evidence was by no means always such as to carry conviction, nor did it give, although the 'point' itself

is sufficiently characteristic, any clear impression of a specific cultural phase. Such uncertainties, however, are now to a great extent removed by the recent examination and partial excavation by Frank H. H. Roberts, Jr., archaeologist of the Bureau of American Ethnology, of a Folsom midden in a locality now particularised as the Lindenmeier Site, twenty-eight miles north of Fort Collins, in northern Colorado. His report* has not only made important and substantial additions to knowledge of the Folsom culture and technique, but it has also crystallised previous evidence and affords opportunity for review of the data relating to the Folsom culture as a whole.

It may not be out of place to point out that, while it is now possible, thanks to Mr. Roberts's new evidence, to form a fairly clear conception of the Folsom phase of culture, Folsom man is unknown. No human skeletal remains have been discovered in association with Folsom artefacts as yet.

In the light of the evidence from the Lindenmeier Site, as will appear later, there is now justification

* "A Folsom Complex: Preliminary Report on Investigations at the Lindenmeier Site in Northern Colorado". *Smithsonian Misc. Collect.*, 94, No. 4.

for speaking of a 'Folsom culture' of which the existence previously had been a matter of inference only, from the type of a single class of implement, and of which the picture even yet is not complete in detail. It is the culture of a hunting people closely associated with the bison. A concurrence of evidence, geological, palæontological and archaeological, points to the conclusion that not only does it represent an earlier phase in the American cultural sequence than that of the 'Basket-Makers' of the Pueblo area, hitherto regarded as the earliest to appear in the south-west, but also that in the instance of the Folsom implements a case for a quaternary dating has been made out with a closer approach to certainty than in any other culture of the American stone age.

The Folsom point, the characteristic implement of the culture, is of a triangular, or rather leaf-shape, in which the greatest breadth lies between the tip and the middle point of the blade. In size, it varies from 17 mm. to 75 mm. in length, 14 mm. to 32.5 mm. in breadth and 3 mm. to 6 mm. in thickness. A variant form has rather a wider range in size. The material is varied, chalcedony, jasper, chert, quartzite, petrified wood, moss agate, geyserite (rare) and white sandstone, all being recorded.

The indigenous inhabitants of North America have always been essentially a stone-using people. Even the native copper area of Lake Superior developed a chalcolithic rather than a true metal culture. Within living memory, stone implements continued to be made in California in full view of the railway track. In the course of their long history of stone using, the Indians developed many eccentric forms of implement, for which anthropologists, in default of a better understanding, have been content perforce to accept the designation 'ceremonial'; but of all the implements fashioned for practical use, probably none is more distinctive than the 'Folsom point'. Its peculiar characteristic is a longitudinal groove, or channel, running down the middle of the blade, which leaves a ridge on each side parallel with the edge. As the two faces of the typical implement are identical in form, this gives it in section the shape of a double concave. The sides are prolonged at the base to form wings, making the base a semi-circular gap or notch.

The form of the point, obviously the tip of a projectile weapon, either arrow or spear, made it peculiarly liable to fracture. The vast majority of the implements of this type which have been found are broken, only the tip or the butt-end being found. The predominance of the butt-end on the Lindenmeier Site no doubt was due, as Mr. Roberts has suggested, to a practice of retrieving the shaft of the weapon and bringing it back to camp to fit a new point. The purpose of the

remarkable channel is unknown, although the groove in the modern bayonet at once suggests an analogy.

A brief reference to the course of research which has led up to Mr. Roberts's investigation, will not be out of place, especially as, in so far as it relates to the question of distribution, it has a bearing on the interpretation of the evidence relating to the Folsom culture which needs further elucidation.

As already mentioned, the specific character of the Folsom point was established in 1927. Before that date, and indeed so far back as 1897, the peculiar features of the implement had been noted; but as the specimens were mostly surface finds, their significance had not been appreciated. In 1925, the attention of J. D. Figgins, director of the Colorado Museum of Natural History, was directed to a bone deposit on the upper sources of the Cimmaron River near Folsom, New Mexico. Investigations in the following year brought to light evidence which seemed to demonstrate beyond question the definite association of stone artefacts and an extinct bison. Additional 'points' were found in 1927 by investigators working on behalf of the Colorado Museum, and Dr. Barnum Brown of the American Museum of Natural History found one specimen still embedded in the matrix between two of the ribs of an animal skeleton, where it still remains on exhibition in the Colorado Museum. It was seen *in situ* by Dr. A. V. Kidder, as well as by Mr. Roberts. It was then agreed that not only could the association not be questioned, but also that the points were totally different from the ordinary types of stone implement hitherto found in the south-west.

In the following year (1928), joint operations by the American Museum of Natural History and the Colorado Museum under Dr. Barnum Brown and Dr. Clark Wissler were made the occasion of an informal conference of geologists, palæontologists and archaeologists, who arrived at the generally accepted conclusion that the Folsom find indicated an earlier appearance for man in the south-west than had hitherto been allowed. It was under date of this year that the first account of the Folsom point appeared in Europe in an article by E. B. Renaud on the antiquity of man in North America in *L'Anthropologie*, 38, 23-49.

Of later activity in the study of the problem and search for further evidence, mention may be made of the work in New Mexico of E. B. Howard, of the Pennsylvania University Museum, and of Prof. E. B. Renaud, of the University of Denver, and his students in their archaeological survey of Colorado and Nebraska. The former has found in a cave in the Guadalupe Mountains in the south-eastern part of New Mexico a Folsom point in conjunction with musk ox and an animal of the

musk ox group. These occurred in a stratum underlying a level containing Basket Maker material. This find thus established definitely the priority of the Folsom culture. At the same time, the musk ox being a cold-climate animal, it is generally considered to be evidence of the contemporaneity of Folsom man with an Ice Age fauna. Further investigations by Mr. Howard near Clovis, New Mexico, also point to the co-existence of Folsom man and an extinct fauna; but here the evidence is considered open to question, and until it has been published in fuller detail, must be regarded as still *sub judice*.

On the general question of the quaternary age of the Folsom implements and the associated extinct fauna, opinion is at present divided. While some would see in this association evidence for the existence of man in America in late Pleistocene times, others maintain that it points rather to a late survival of Ice-Age animals into recent periods, and that there is no evidence that man was actually present in America in the Ice Age.

Of Prof. Renaud's investigations, what must be regarded as the most important outcome to date is a distinction in the character of the culture which he recently claims to have established. This differentiates the Yuma point from the Folsom point. The former, on the basis of typology, he considers to be older than the Folsom. The two occur in association on many sites as surface finds, and their relative antiquity is still under discussion.

We may now turn to Mr. Roberts's investigations on the Lindenmeier Site, which must be regarded as one of the most important contributions of recent years to prehistoric archaeology in America.

The Lindenmeier Site was first discovered by Judge C. C. Coffin and his son, A. L. Coffin, in 1924. From it they collected some 83 points or portions of points, as well as about the same number of other artefacts. They were not, however, then aware of the significance of the former; and it was not until 1930 that they were informed by Prof. E. B. Renaud that they were Folsom points. Further surface finds were made afterwards; but it was only in 1934, when the site was examined by Mr. Roberts, that any intensive investigation was attempted. The finds by members of the Coffin family had been made in a restricted area, some 70 yards by 150 yards in extent; but the point at which Mr. Roberts's excavations were carried out lies apart from this area, and is situated in the side of a ravine or gully about a quarter of a mile away. Here an undisturbed and intact layer of midden material was found at about 14 ft. below present ground-level and about 12 ft. above the bed of the gully. This was partially excavated in October and part of November, 1934; and it is hoped to carry the

work further on a future occasion. The midden lies at the deepest point of an implementiferous area lying between the edge of the gully and a terrace, and covering ground approximately 250 yards by 200 yards. The objects of bone and stone are found just above a clay stratum in a layer six inches to one foot in thickness. Except at the midden, where was the main concentration of archaeological material, finds over this area are in the nature of chance accumulations.

Of the actual finds, the Folsom points both whole and fractured, as well as flakes and specimens spoiled in making, have afforded Mr. Roberts material for pertinent suggestions as to the obscure technique of manufacture upon which it is not possible to touch here. A large proportion of the other artefacts are scrapers, of which there are several varieties. Some show minute and careful chipping, others are rough and crude. Most belong to the curved end, or 'thumb-nail' type. Of the side-scrapers some are almost paper-like in their thinness. While there is no definite knowledge as to the uses to which some of these scrapers, such as the turtleback and the side scraper, were put, they would serve for dressing skins as well as for knives, gouges, adzes or abrading tools. One of the most interesting types is a graver, an implement familiar in European archaeology; but no other evidence is to hand of the practice of the graver's art by Folsom man. Most of these graters are fortuitous flakes, which have been modified by chipping a small sharp point on one side or end. Some, however, are more definitely shaped. A number of specimens among the implements are classified as knives. The best are carefully chipped blades, which exhibit typical Folsom characteristics in their fluted faces and the marginal retouch. Several of them are made from the channel flakes resulting from the manufacture of points. Among other implements are blades and choppers. Miscellaneous objects include pieces of sandstone showing signs of use—there is no material of this character in the neighbourhood—pieces of hæmatite, smooth and striated from rubbing (a good indication that they supplied pigment material) nodules with battered ends (no doubt hammers) and a number of fragments of bone, which had served as tools.

Most of the bone material was scrappy. Bison, fox, rabbit and wolf have been identified. It is noted as a matter of considerable interest that the bison is identical with the two extinct forms found at Folsom, *Stelabison occidentalis taylori* and *Bison oliverhayii*.

It will be seen that the excavations which have been carried out by Mr. Roberts on the Lindenmeier Site have extended very considerably knowledge of this stone-using, hunting culture, in which

future excavation may well fill in further detail. One point remains to be mentioned. On determination of the specific character of the Folsom point and the advancement of its claim to a high antiquity, attention was directed, as already mentioned, to the fact that it was already known, in one instance at least, having received the name of the "Seneca River point". It was shown to have a wide distribution—from southern Canada to the Gulf of Mexico and from the Rockies to the Atlantic. Further study, however, has demonstrated that the true Folsom points are confined to the High Plains on the eastern slope of the Rockies, while the more widely distributed point is a larger, more generalised form, centring notably in the Finger Lakes section of New York State, in Ohio, Tennessee and southern Virginia. The affiliation and the chronological and distributional relation of the two forms are problems which are

now being made the subject of study by Mr. Roberts.

Until the typological and chronological relations of the two forms of point are established with some degree of precision, no finality in the interpretation of the archaeological evidence is attainable. Tentatively, however, it may be pointed out that the evident antiquity and the known distribution of the true Folsom point are consistent with the view that it is a specialised form developed by the people who, it has been suggested, penetrated to the south-west in the period of transition at the close of the Ice Age along a corridor on the eastern slopes of the Rockies. It will be interesting to see if the researches in Siberian archaeology, upon which Mr. E. B. Howard is to engage, produce any typological evidence of an Asiatic ancestry for this remarkable American type of implement.

The Percy Sladen Expedition to Lake Huleh

HULEH is a shallow lake lying in the northern end of the Jordan Valley, where it extends towards Mount Hermon. The sides of this valley are formed here by two parallel ranges of mountains, but at the south end of the lake the valley is closed by low hills except where the Jordan has cut a deep gorge into Lake Tiberias, the fall to which is 600 feet. The actual lake is approximately five miles long by three across, and is roughly pear-shaped, with its broad end to the north. Its maximal depths are 10–12 feet, but its greater part is not more than 4–5 feet. On its east side the mountains, which are basaltic, commence their rise close to the lake, and the shore is rocky, much large material being carried down the numerous water-courses. On the west side, a broad plain extends out from the lake, for the strong winter torrents have brought down quantities of gravel, which form spits projecting into the lake. Over most of the central area, the bottom of the lake is of soft grey mud, which is largely populated by plants of *Potamogeton*. At the extreme south, there is a small area where *Phragmites* dominates, and this also grows on the eastern side in isolated patches. On both sides of the lake there are numerous springs, and some cold patches in the lake are supposed to mark further effluents.

The lake is bounded on its northern side by a large swamp, through which the Jordan flows as a swift stream, even in the dry season. The swamp begins as a band of floating lilies (*Nuphar*)

across its north end, extending down each side for half a mile. On the inside of the lilies, the plant succession is at present being studied. The swamp is not homogeneous in structure, and its most striking feature is the papyrus, which over large areas is the dominant plant form. Through it, progression is only possible along waterways, which are kept open by the Arabs, who use it for many purposes. The swamp consists of a mass of roots, much matted and bound together with plant debris in various stages of decomposition. The roots appear to be floating in the water, and it is easy to sink waist deep through masses of debris, where the papyrus is not too thick. At various places clear pools are found, these apparently due to springs. At the sides of the swamp the land is being reclaimed by Arabs for the planting of maize and millet.

The channel of the Jordan runs down the middle of the northern swamp, where heavier silt has been deposited during the floods of the rainy season. Local observations suggest that the swamp is extending southwards and encroaching on the lake, almost as if pushed by the processes of reclamation on its shores. One of the most striking features of the lake is the large quantity of fine silt brought down by the Jordan, when irrigation is occurring further up the valley. It is of a light grey colour, and quite different from the mud formed by plant decomposition. It is deposited generally over the lake, and forms in addition a broad bar across its northern end.

The rights over the lake have recently been purchased by the Palestine Land Development Co. from the Arab owners. The company has employed engineers to estimate the cost of the drainage of the lake and swamp, and is now selling it upon these estimates. Several interested companies are employing their own engineers to check these. Up to the present, no work has been commenced, but it is anticipated that the drainage, which is a simple question, will be completed in 1936 or the following year.

The biological survey of Lake Huleh is in charge of Mr. Roger Washbourn with a botanist, both from the University of Birmingham. The lake is interesting mainly in comparison with Lake Tiberias and other parts of the Rift Valley in Palestine and East Africa. The presence of animals of African affinity was shown by Annandale in 1916, and the biologists are largely concerned

with investigating the fauna and flora before the lake ceases to exist. In addition, Huleh lies near the southern boundary of several palæartic species. The ecology also of a lake with a papyrus swamp in this latitude should prove interesting. Having these objects in view, the zoological part of the work is largely the collection of animals from the varied habitats that the lake and swamp present. To define these accurately, the physical and chemical conditions are being studied, and these are, of course, a prime factor in governing the plankton. The botanist is fully occupied with his study of the swamp and the interrelations of the plants in their different habitats. The difficulty of transport is considerable—and the lake is fever-stricken—but it is hoped that an impression will be secured of the plant and animal life of an area which will soon have ceased to exist.

The Chemotherapy of Malaria*

QUININE was discovered by Pelletier and Caventou in 1820 and was promptly manufactured in France and England in quantities sufficient to permit of its use in the treatment of malaria, in place of crude cinchona bark. This was an early and unconscious application of the principle upon which Ehrlich was to found chemotherapy ninety years later. By that time, thanks to the labours of Hesse, Skraup, Königs, von Miller and Rohde and Rabe, constitutional formulæ had been assigned to quinine and the other cinchona alkaloids, which Rabe and his collaborators confirmed in a series of researches culminating in the complete synthesis of dihydroquinine and dihydroquinidine in 1931. Partial syntheses had been effected some years earlier and the methods employed had been extended to the preparation of products allied to the cinchona alkaloids in type, but of simpler structure. In 1891 Grimaux and Arnaud prepared from cupreine a series of homologues of quinine, one of which, ethylcupreine, was tried clinically and found to be somewhat more active than quinine, and this first French experiment in the production of 'modified cinchona alkaloids' led to the preparation of many other substances of this type.

Chemists had in fact accumulated a mass of possible anti-malarials, the therapeutic value of which there was no practical means of testing. This want was supplied when Roehl devised his

technique of testing such drugs in bird malaria, using canaries for this purpose. Of the various 'leads' then available for the synthesis of new anti-malarials, Prof. Schulemann and his co-workers, Schönhöfer and Wiegler, selected methylene blue, which had been shown to have some action in malaria, and from this starting point they evolved plasmoquine in 1924. This was followed by atebtrin, discovered by Mauss and Mietzsch in 1930.

These two drugs have one feature in common, a dialkylaminoalkylamino-side-chain, $-NH-CHMe-CH_2-CH_2-CH_2-NR_2$, attached at position 8 in 6-methoxyquinoline, in the case of plasmoquine, and at position 5 in 2-chloro-7-methoxyacridine, in the case of atebtrin; but as acridine is quinoline with a benzene ring fused on, both drugs can be regarded as derived from 6-methoxyquinoline, a characteristic they share with quinine, which, however, has a different and more complex side-chain. Plasmoquine acts preferentially on the sexual forms (crescents or gametocytes) and atebtrin and quinine on the asexual forms (schizonts) of the malaria parasite. Their respective actions in the various types of malaria is not as clear-cut as this brief description implies, but it is permissible now to divide anti-malarial drugs into 'anti-gametocyte', represented by plasmoquine and its allies, and 'anti-schizont', of which quinine and atebtrin are types.

These discoveries have led to great activity in the synthesis of such drugs in Great Britain, France, Russia and elsewhere, and Prof. Robinson gave an account of the reactions used in the

* Based on a discussion, introduced by Col. S. P. James, in Section B (Chemistry) of the British Association meeting at Norwich on September 9. Other contributors to the discussion were Prof. W. Schulemann, Prof. R. Robinson, Dr. P. Tate (with Prof. Keilin and Miss M. Vincent), Dr. T. A. Henry, Sir Rickard Christophers and Prof. Warrington Yorke.

preparation of the extensive series of potential anti-malarials made in his laboratory. One of these, in which the side-chain of plasmoquine is replaced by $-NH-CH_2-CH_2-CH_2-NH-CH_2-CH_2-CH_2-NH_2$, was found to have a chemotherapeutic index 1:62 against 1:32 for plasmoquine and is, therefore, a promising material for clinical trial. The necessary bird malaria tests on these substances are being made in Prof. Keilin's laboratory at Cambridge by Dr. Tate and Miss Vincent, and the former described the methods used. Inoculation of infected blood provides material for tests on asexual forms of the parasite, and birds infected by bites from mosquitoes are used for tests of activity against gametocytes and sporozoites, and details were given of the results of such investigations of a number of Prof. Robinson's substances.

The bird malaria test has also been applied to a number of other problems. Drs. Buttle and Trevan have shown that the interesting series of alkaloids isolated by Messrs. Goodson and Sharp from ten species of *Alstonia* have no action in bird malaria, and the same is true of the alkaloids of *Picralima klaineana*, though both these drugs have some repute in various tropical countries as remedies for malaria. The same workers made a comparative examination of specially purified specimens of the principal cinchona alkaloids and found that, as an anti-schizont drug in bird malaria, quinine was about twice as active as quinidine or cinchonidine, and possibly five times as active as cinchonine.

These results are of considerable interest in connexion with the use of mixtures of cinchona alkaloids as a cheap substitute for quinine, and justify the action of the Malaria Commission of the League of Nations in providing a standard for such mixtures, which prescribes a minimum content of fifteen per cent of quinine. Much work has also been done, particularly by Giemsa, in assessing the therapeutic value in bird malaria of 'modified cinchona alkaloids'. The results show that, so far, no product of this type is much better than

quinine or dihydroquinine; but this work has provided a fund of information as to the influence on anti-malarial activity of modifications in the structure of drugs, which will probably be of great value in the biochemical and biophysical investigations, which are beginning to be made in the hope of ascertaining how and why such drugs exert their specific action. As an example of such work, mention may be made of the paper by Sir Rickard Christophers describing the methods he has used, and some of the results obtained in examining the view that chemotherapeutic effect is a result of some kind of combination between protein substance and the basic side-chains, which are a characteristic feature of effective anti-malarial drugs.

It was particularly appropriate that the discussion should be introduced by Col. James, who has had special opportunities for clinical investigation of the new drugs, plasmoquine and atebtrin. He provided a careful survey of their value as true causal prophylactics, as means of avoiding relapses and as preventives of spread of the disease, these being the principal characteristics of their action in which they surpass quinine, for they are to be regarded, not as substitutes for this alkaloid, but as additional weapons in anti-malarial campaigns.

Col. James finally expressed the hope that provision would be made in Great Britain for more intensive chemotherapeutical research. On the same point, Prof. Robinson emphasised the need for the closest co-operation between chemists and biologists in work of this kind, and Prof. Warrington Yorke pointed out that, although in a number of cases, such as sleeping sickness and amebic dysentery, the first useful chemotherapeutical observation had been made by English workers, we had failed to follow up these observations by systematic pharmacological and chemical work, with the result that the countries of the Empire still had to depend largely on imported synthetic drugs.

T. A. H.

Obituary

Mr. J. F. Herd

JAMES FLEMING HERD, senior scientific officer in the Radio Department of the National Physical Laboratory, died on July 22 at the early age of forty-seven years.

Born and educated in Dundee, Herd entered the Post Office, and became a highly skilled officer of the telegraph service. He served in the Royal Flying Corps and Royal Air Force, as an instructor in that part of the service which developed into the Wireless

and Electrical School. Retaining the rank of flight lieutenant in the R.A.F. Reserve of Officers, he joined the Meteorological Office as a senior professional assistant, for service at Meteorological Office Radio Station, Aldershot, then engaged in a study of atmospherics in relation to thunderstorm detection. On the formation of the Radio Research Board, that station was taken over by the Department of Scientific and Industrial Research, to which its two scientific officers were seconded, later to become substantive

members of the Department's staff. In the steady growth of the Department's organisation for radio research, he took a rapidly increasing load of responsibility, and the formation of the Radio Department, National Physical Laboratory, in 1933 brought him to the rank of senior scientific officer as officer-in-charge of the Slough Division of the new entity, and as secretary of a number of committees of the Radio Research Board.

Herd's published scientific work falls far short of representing his notable contributions to the progress of fundamental radio research. He submerged his individual interests in the development of that team-working which the Slough Station chose as its method of attack on the complex and varied problems in the pathology of radio communications entrusted to it for study. His contributions to the *Proceedings of the Royal Society*, the *Journal of the Institution of Electrical Engineers* and other papers, and his monograph (jointly with two departmental colleagues) on "The Cathode Ray Oscillograph in Radio Research" give some evidence of his rare gifts as an investigator. His gifts for scientific organisation did much towards the success of the London (1934) meeting of the Union Radio-Scientifique Internationale, in which he took an important part.

Dr. F. C. Shruballs

DR. FRANK CHARLES SHRUBSALL died at his home in Hampstead on September 25, aged sixty-one years.

He was the only child of a master mariner. Never robust, his health during childhood gave anxiety to his family, and he was taken on several sea voyages. Thus, early in life he came in contact with differing types of men, and this aroused in him that intense interest in the study of mankind which was to shape his whole career.

Shruballs was educated at Merchant Taylors' School and went up to Clare College, Cambridge, in 1892 with an entrance scholarship. He graduated in 1895 taking first class in the Natural Sciences tripos. He entered St. Bartholomew's Hospital and qualified in medicine in 1900 after a brilliant career as a student. Appointments at St. Bartholomew's and the Brompton Hospital for Chest Diseases gave him much experience in the practice of medicine, and intensified his interest in the study of human types. He proceeded to his M.A. degree at Cambridge in 1899 and took the M.D. in 1903. His remarkable clinical gifts were speedily recognised; he was appointed in 1908 to a Hunterian professorship at the Royal College of Surgeons and elected to the fellowship of the Royal College of Physicians in 1912.

When the British Association met in Cambridge in 1904, Shruballs read a paper in Section H (Anthropology) on the influence of selection by disease on the constitution of city populations. This paper at once established his position among British anthropologists. He became a secretary of Section H and for eighteen years continued to hold this onerous post. During this period, he contributed many articles to the Section of original and important

character and did an immense amount of work on research committees.

The opportunities for continued research held out by the work of the school medical service attracted him, and in January 1909 he was induced to enter the service of the London County Council. Here he found immediate work to hand in the collating and analysis of an immense amount of raw material in the shape of physical measurements which had been collected. As the result of the growth of the work of the school medical service, Shruballs found himself in 1912 attached to the headquarters staff in charge of the special school division. Thus began his association with problems of mental deficiency and juvenile delinquency, matters in which he was destined to become acknowledged the foremost expert in the country. Increasing pressure of public work compelled him to relinquish his secretaryship of Section H in 1923, and he was elected president of the Section for the Toronto meeting in 1924. He took as the subject of his presidential address "Health and Physique Throughout the Ages".

At the time of his death, Shruballs was a senior medical officer of the London County Council in charge of a section which included special and reformatory schools, mental deficiency, care of the blind, and medical examination of employees.

The value of Shruballs's services to British anthropology and of his pioneer work in the sphere of public health, particularly that associated with the elucidation of the problems of mental deficiency and juvenile delinquency, cannot be too highly estimated. He was a man of great generosity and kindness of character, and was greatly beloved by all his co-workers in every sphere. C. J. T.

WE regret to announce the recent death of Baron Léon Frédéricq, emeritus professor of physiology at the University of Liège, at the age of eighty-four years. He was born in 1851 at Ghent, where he became doctor in natural science and medicine in 1871. After studying experimental methods in several foreign laboratories he became assistant in the Department of Physiology and Comparative Anatomy at the University of Ghent, where he carried out investigations on the presence of fibrinogen in the blood plasma. In 1879 he succeeded Theodor Schwann at Liège in the chair of physiology, which he held for more than forty years, during which he carried out important researches on the physiology of circulation, respiration and the nervous system. He was the author of a standard treatise on physiology and a handbook of technique and demonstrations in general and special physiology. At the beginning of the century he was the co-founder with Paul Héger of the *Archives internationales de physiologie*. He also founded a biological station for botanists and zoologists. Frédéricq was a corresponding member of the Institut de France, commander of the Legion of Honour and of the Crown of Italy and fellow of the Physiological Society of London, in addition to many other distinctions.

News and Views

Sir John Flett and the Geological Survey

ON October 1 Sir John Flett retired from the directorship of the Geological Survey and Museum. He joined the Survey in 1901, in 1903 he was appointed petrographer, and in 1911 he succeeded Dr. John Horne as assistant director for Scotland. On the retirement of Sir Aubrey Strahan in 1920, he was made director. He took over his new duties at a moment when several important changes had been introduced; the Committee of Advice on the Geological Survey, which had reported to the Board of Education since Sir Jethro Teall's induction to office, now gave place to the Geological Survey Board, reporting to the Lords of the Committee of the Privy Council for Scientific and Industrial Research; at the same time there was a considerable increase in the scientific staff. With characteristic energy, Sir John Flett began at once to make full use of the improved conditions: one of the first steps was the establishment of three branch offices in coal-field centres, which proved of great value in permitting closer contacts with the industry.

DURING Sir John Flett's directorship, not only has steady progress been made with the primary 6-inch survey, the re-survey of economically important areas, and the provision of colour-printed 1-inch maps, but also there has been marked improvement in the production and style of reproduction, both of maps and memoirs. Other departments of the Survey's activity—the investigation of underground water supplies, recording of boreholes, photography of geological subjects for educational and record purposes, the study of geophysical methods of surveying—have been vigorously stimulated, and useful collaboration has been set up with other bodies in relation to research upon soils, coal and building stones. Sir John's single-minded devotion to the work of the Survey and Museum and to the needs of the public, backed by a keen and able staff, achieved a fitting culmination with the opening of the new Museum of Practical Geology and Survey offices in South Kensington last July.

As recorded in *NATURE* of July 20, p. 96, Dr. Bernard Smith has been appointed to succeed Sir John Flett as director of the Geological Survey of Great Britain. It is now announced that Mr. Henry Dewey has been appointed to succeed Dr. Bernard Smith as assistant director (England and Wales). Mr. C. E. N. Bromehead, district geologist in York, will shortly take charge of the London District, now vacated by Mr. Dewey. Mr. T. H. Whitehead has been promoted district geologist, and will take over the Survey Office in York upon Mr. Bromehead's withdrawal to London. Dr. J. Phemister has been appointed petrographer in succession to the late Dr. H. H. Thomas.

Faraday's Eyesight and the Blind Spot

UNDER the heading "Science News a Century Ago" a paragraph headed "Faraday's Eyesight" appeared in *NATURE* of January 12, p. 77. The note referred to an entry in Faraday's "Diary" of date January 15, 1835, in which Faraday stated he had noticed "a slight obscurity of the sight of my left eye". Dr. Frank Marsh, writing from the Pathological Laboratory, c/o Anglo-Iranian Oil Co., Ltd., Masjid-i-Suliman, via Ahwaz, South Iran, suggests that the quotation in *NATURE* indicates that "Faraday had discovered his 'blind spot', that is, the optic disc, the place of exit of the optic fibres from the retina, which exists in the retina of every normal person". We have consulted a leading authority on ophthalmology upon Dr. Marsh's suggestion, but he thinks that the explanation of the blur in Faraday's vision as being due to his blind spot is not satisfactory for several reasons. Faraday describes it as a "slight obscurity of the sight", that is, it was a definite blur—in ophthalmological phrase, a *positive* scotoma. The blind spot causes a hiatus in vision, but no positive blur; in other words, causes a *negative* scotoma. Apparently the blur was first noticed when Faraday used both eyes in reading, though it is not definitely stated that the right eye was open. If both eyes were being used, the blind spot would not be noticed in reading. Moreover, the size of the scotoma ("about half an inch in diameter") does not correspond with the visual angle subtended at the nodal point of the eye by the normal blind spot. Faraday's description is meticulously accurate, as one would expect from him, and it is unlikely that he would write "to the right and below the axis of the eye" if the true projection were to the left, as would be the case for the blind spot. It is probable that Faraday had a temporary retinal lesion, possibly a small retinal hemorrhage, and that this accounted for the obscurity he described. In concluding his letter, Dr. Marsh asks whether Faraday's entry was "the earliest reference to observations on the physiological 'blind spot'". It was certainly not; for in the second volume of the *Philosophical Transactions* it is recorded that Mariotte demonstrated the blind spot to the Royal Society before King Charles II in 1668.

A Science News Service in London

OF recent years the desirability of establishing a closer relationship than exists at present between the very different realms of science and the newspaper press has been realised by an increasing number of leaders in both; and a year ago attention was again directed to the movement towards a British Science News Service by Sir Richard Gregory, who made "Science in the Public Press" the subject of his presidential address to the Association of Special Libraries and Information Bureaux. The formation

of a British Science Service, either as an independent venture or as a London bureau of Science Service of the United States, had long been desired by the director of Science Service, Mr. Watson Davis, and after a necessary period of preliminary discussion and experiment an organisation in the second form has recently been opened at 102-5 Shoe Lane, London, E.C.4, under the direction of Mr. Donald Caley. About twenty representatives of different departments of pure and applied science, including Sir F. G. Hopkins, president of the Royal Society, have consented individually to act in consultative capacities in connexion with this London organisation. The co-operation of scientific workers with the new venture is invited, by supplying information relating to researches on which they are engaged (such information to be treated as confidential when and for as long as desired); sending advance proofs of original communications to scientific journals which they edit or control, or regular copies of the journals, which will invariably be mentioned in newspaper summaries; and to make to Mr. Donald Caley any suggestions which may help him to increase the scope and usefulness of the organisation.

Cultural History in Nebraska

IN another column of this issue (see p. 555) there appears a brief summary of certain conclusions as to cultural sequences in Nebraska, United States, which have emerged as a result of a review of the archaeology of that State by Mr. W. D. Strong. It does less than justice to a record of remarkable interest. Among the numerous investigations of recent date, to which Mr. Strong refers, is that of Signal Butte, a stratified site examined by himself, on which evidence of three distinct cultures is to be observed. The levels in which these are found are separated from one another by deposits of Æolian origin, the whole series being superimposed upon sands, which Mr. Strong himself holds to be water-borne and of Pleistocene age. The level of the earliest human occupation is immediately superimposed on these sands. The interpretation of the deposits in terms of climatic variations, based on a correlation with data from other sources, postulates for the whole series, beginning with the period of earliest human occupation, a period of 7,000-10,000 years. Further, this is the only site as yet discovered in America on which stratification gives a clue to the progressive development of type implements of stone in chronological succession. No less interesting and revolutionary in its geographical, archaeological and historical implications is a discovery, which hitherto has escaped the attention of archaeologists, that while there was a hunting culture on the plains dependent on the bison, in the earliest and in the latest phase of aboriginal existence until it was swept away by Caucasian culture, there intervened between early and recent hunters a semi-horticultural mode of life, akin to that of the Eastern Woodland type, which was forced back to the Missouri with the coming of the horse. This carries with it implications, fully elaborated by Mr. Strong, which necessitate a

modification of current views on geographic controls in the Plains area.

Primitive Traits in Amerindian Skulls

IT is now generally accepted that no skeletal remains of the genus *Homo* other than those of 'modern' man have hitherto been found on the American continent. Since the arguments put forward by Ameghino early in the present century in support of the primitive character and high antiquity of the skulls he had found in South America were shown by Dr. Aleš Hrdlička to be untenable, it has been claimed from time to time that human remains exhibiting characters other than those of *Homo sapiens* have been discovered; but invariably closer examination of the evidence has failed to support this interpretation. One of the latest discoveries of this nature is that of a fragment of a skull found by Dr. Earl H. Pell, of the Nebraska University, in a large mound of unknown age near the site of a prehistoric village in Nebraska. The skull was that of a middle age man which showed abnormally highly developed eyebrow ridges, intermediate in degree between Neanderthal man and 'modern' man. On the evidence of these supra-orbital ridges it was at first thought that the skull might be included in the Neanderthal group. It has now been subjected to a close analysis by Dr. Hrdlička, whose decision is not only adverse to any close affinity with Neanderthal man, but definitely rules that it comes within the 'modern' group, on the evidence that in all its characters, excepting the eyebrow ridges, it belongs to the type of the modern Indian. In discussing the skull (*Amer. J. Phys. Anthropol.*, 20, 2), Dr. Hrdlička goes on to point out that while the high development of these ridges may be regarded as evidence of "an ancestral connection with Neanderthal Man somewhere outside America" it does not show uninterrupted filiation, nor can it serve as an index of antiquity.

Recent Acquisitions at the British Museum, Bloomsbury

AMONG the recent additions of archaeological interest, which are described in the *British Museum Quarterly*, 10, 1, is a striking example of the artistic ability of the early Maya in the form of a cup with painted ornament, which has additional claim to attention in the fact that it comes from so far south as San Salvador. Especially important for students of early Buddhist art in India is a series of stucco figurines, twenty-five pieces in all, of which eighteen are heads, obtained by the French Archaeological Delegation in Afghanistan in 1926-28, at Hadda, about five miles south of Jalalabad. In accordance with the policy, foreshadowed at the time of the acquisition of the Eumorfolpoulos collections, of devoting space in the *Quarterly* from time to time to descriptions of especially important examples of the art and culture of the Far East, two notes with illustrations deal respectively with a bronze of the Chou dynasty (1123-249 B.C.) and painted bricks of the succeeding Han dynasty. The bronze bowl or *tui* for holding cereals on ceremonial occasions,

such as the worship of ancestors, is one of the finest of the few which exist outside the Peiping Palace collections, and is otherwise remarkable in that it has four handles. It is highly ornamented with conventionalised designs including elephant heads and, possibly, stylised tigers. It has an inscription of sixty-nine characters, which is perfectly legible, though interpretations vary. The bowl would appear to commemorate a grant of land, for services rendered, to the Marquis Hsing by an emperor, conjecturally identified as Ch'êng (1115-1078 B.C.) The group of three painted bricks form a pediment which comes from a Han tomb. On them is a free and spirited symbolical design which is here interpreted as expressing the form taken by the Taoistic belief in life after death under that dynasty.

The Typhoon of September 21, 1934, in Japan

WHAT is described as the greatest typhoon on record struck the southern coast of Japan early on September 21. A week later, the Earthquake Research Institute sent several of its members to the district, and their reports on various features of the typhoon are included in a special volume of the Institute's *Bulletin* (Suppl. vol. 2, 302 pp. and 34 pls.). All the nine memoirs are written in Japanese, but, with two exceptions (mainly in tabular form), they are followed by summaries in English. The typhoon was generated at sea, in about lat. 11° N., long. 141° E., on September 13. It was then weak, and travelled slowly towards the north-west. A week later, near the Ryukyu Islands, its course changed to north-east. When it reached Sikoku, on the southern coast of Japan, its centre showed a pressure of 22.4 in., probably a record for land stations. The typhoon then passed over the adjoining districts, causing much damage to houses and trees, but it is worthy of notice that some earthquake-proof school buildings withstood a gale of 134 miles an hour. The main damage occurred in the coastal districts, and was due partly to the sea-waves, or kaze-tunami, raised by the typhoon and partly to a sudden rise of the sea that at Osaka ranged from 9.5 to 18.7 ft., and at Kobe from 5.8 to 6.5 ft. Among the causes of this abnormal rise, Mr. R. Takahasi includes a suction-like action on the sea-water due to the low pressure in the centre of the typhoon-path and the drift of the water to the coast by the force of the winds. Farther on, the typhoon passed over Lake Biwa, generating seiches with amplitudes of 10 in. and a rise of the same amount in the northern half of the lake, due again to the drift of the water. Even in the neighbourhood of Tokyo, the sea-level rose by about 4 ft.

British Association Seismological Committee

DURING the past year, the Committee has lost two of its members, Sir Horace Lamb and Prof. H. M. Macdonald. Two former members, Sir Alfred Ewing and Sir Arthur Schuster, also died since the last report was issued. The year has been marked by the publication of some important memoirs by members of the Committee. Two of them are on microseisms

by Mr. A. W. Lee, who has shown that the average amplitudes of the east and vertical components of the microseisms recorded at Kew in 1932 were equal, and that microseisms usually approach England from the north-west, and are associated with storms in the Atlantic. A valuable memoir on the times of transmission of earthquake waves by Dr. H. Jeffreys and Mr. K. E. Bullen has been published by the International Seismological Association (*Trav. Scie.*, Sec. A, Fasc. 11; 1935), the inclusion of the summaries for individual earthquakes having been rendered possible by a grant from the Gray-Milne fund. A new catalogue of earthquakes, for the years 1925-30, has been prepared by Miss E. F. Bellamy from the International Seismological Summary. The form is the same as in the earlier number for 1918-24, edited by Prof. Turner, of which it is a welcome and very useful continuation. The International Seismological Summary for the first quarter of 1931 is in the press.

River Dee (Aberdeenshire) Flow Records

THE private organisation under the direction of Capt. W. N. McClean, known as River Flow Records, has continued its survey of the River Dee, undertaken in connexion with the British Association meeting at Aberdeen in September last year, and has recently issued two sheets of diagrams covering the period January-June inclusive of this year, together with an explanatory memorandum which states that the diagrams represent readings of water-levels and river flows from a catchment area of 528 square miles, and that they include meteorological records of rainfall, temperature and wind over the same district. As the result of the study of these observations of the Dee area, which have now been kept for a year and a half, it is found that in a comparison of rainfall and run-off, the former is underestimated. There is no actual measurement on the high mountains, and it may be said that rainfall measured in a rain-gauge is generally underestimated; so that rainfall is admittedly only an approximation, whereas the measurement of flow by means of 'the most perfect apparatus existing in the country' is comparatively accurate. In the six months' period, the net aggregate of storage and run-off has reached just less than 19 in. out of a gross rainfall of $22\frac{1}{2}$ in.

Electric Progress in Palestine

LORD READING, the chairman of the Palestine Electric Corporation, said at the annual general meeting on September 5 that electricity has played a leading part in the rapid economic development of Palestine. Last year the Corporation's revenue increased by 64 per cent, and 13,460 new consumers were connected. The generating plant now exceeds 40,000 kilowatts, and the existing transmission line from the first Jordan power house to Tel-Aviv will, at the present rate of growth, soon become inadequate to meet the consumers' load. Hence, a 12,000 kw. turbo-generator with the requisite boiler plant, transformers and switchgear has been ordered, and a second 66,000 kilovolt-transmission line will be

constructed. On the upper reaches of the River Jordan and Lake Tiberias, surveys are being carried out with the view of further hydroelectric development. Lord Reading stated that the demands in the Corporation's area are still far from the saturation point. As the policy of reducing tariffs wherever possible is being continued, the prospects are promising. As Palestine is practically a 'new' country from the economic point of view, it is not surprising that the company is already on a remunerative basis.

Sedimentation

BULLETIN 98 of the National Research Council of America (1935, pp. 246) embodies the report of the Committee on Sedimentation for 1932-34, and indicates the immense activity of investigators in this subject as well as of the members responsible for the report. The latter includes about a thousand references to current literature and in itself represents a commendable example of bibliographic and abstracting work. The topics discussed include European studies and varved sediments (Antevs); German contributions (Becker); studies at Stanford University (Blackwelder); glacial sediments (Leighton and Townley); British researches (Milner); mineralogy of sediments (Pettijohn); hydrologic and hydrographic investigations (Piper); chemical aspects (Steiger); recent sediments and petroleum sourcebeds (Trask); miscellaneous types (Twenhofel); marine bottom deposits (Vaughan); oxidation-reduction conditions in the Gulf of Catalina (ZoBell); and terminology of coarse sediments (Wentworth, with notes by Boswell). The last of these is a contribution of very general interest. The Sub-committee on Nomenclature and Classification of Sediments is studying the terminology of eleven groups, and in his introduction to the present report, Trowbridge holds out the prospect that following up the two reports already issued on volcanic and coarse sediments, others may be expected at the rate of two or more per year. The Committee is to be congratulated on the thoroughness of its work. It is obvious that without such a review geologists could not possibly keep in touch with the widely varied results of current progress in a branch of their science which is fundamental to its main object and to many of its applications.

Mining Legislation in South Australia

WE have received from the South Australian Department of Mines the *Mining Review*, No. 61, for the half-year ended December 31, 1934. After a short preface signed by Dr. L. Keith Ward, director of mines and also Government geologist, whose report appears afterwards, the review contains a summary of mining legislation, etc. A statistical portion which, together with a table at the end of the volume, shows that the total value of the minerals produced in South Australia since 1841 up to the end of 1934 equals 53½ million pounds, taking gold at its old value. They also show a considerable increase both in quantity and value in 1934 compared to 1933, the quantity of iron ore produced in

the former year being practically 1¼ million tons, showing an increase of half a million tons over 1933. Gold has naturally increased both in quantity and in value, and most other minerals show increases, though these in some cases are but slight, and actually show decreases in a few cases. Next comes a statement as to subsidies, from which it would appear that the amount advanced to various mines is nearly £71,000, of which a little more than £18,000 has been repaid. Next we have certain reports of treatment works and Government boring operations, followed by a short report by the Government geologist, and a series of reports by the chief inspector of mines, which give much detailed information about many of the mines of the Province.

Research on Shellac

IN 1925, the Indian Government founded the Lac Research Institute to ensure that the rapid development of rival products, and the high price levels reached in the post-War period, did not cause lac to meet the same fate that indigo had suffered previously. The results obtained during the first nine years work of the Institute and the present trend of the investigations have recently been published as an illustrated booklet in concise, interesting and non-technical form ("Lac and the Indian Lac Research Institute", by D. Norris, P. M. Glover and R. W. Aldis. Nankum: Lac Research Institute. Rs. 2.8). The lac insect yields both a colouring matter and a resin, and it was for the former product that it was originally cultivated. With the discovery of aniline dyes, however, the lac dye industry came to an end and the resin in unmanufactured form as lac, or the manufactured form as shellac, became the important feature of the industry. The uses to which shellac can be put are numerous, but the greatest proportion is adsorbed by the gramophone, electrical and varnish trades. The increasing use of synthetic resins such as bakelite inevitably threatened the industry, but as new methods have now been discovered whereby the natural product may be used in combination with the synthetic, the situation has improved. Research work is carried out on entomological, chemical and biochemical lines, many problems naturally occurring with regard to the insect and its host plant as well as the secretion of lac and its preparation for the market.

All-India Institute of Hygiene and Public Health

IN the annual report of the All-India Institute of Hygiene and Public Health, Calcutta, for 1934, the first to be issued, the events which led to the foundation of an All-India Institute of Hygiene are first recapitulated. The conception of providing courses of post-graduate training in public health originated with Sir Leonard Rogers, and as a result of his efforts the Calcutta School of Tropical Medicine was founded and opened in 1920. It was realised that there was also need for the training of an Indian personnel in public health, but circumstances prevented the realisation of this object until the Rockefeller Foundation offered to provide funds for a site, and for the

building and equipment of an institute, provided the Government of India undertook its maintenance. A site was acquired in 1930, and the building erected adjacent to the Tropical School, which was opened in 1932. The work of the Institute is carried on in six sections, and a representative staff has been appointed under the directorship of Lieut.-Col. A. D. Stewart, who is also the professor of hygiene. A description of the building is given, together with an account of the work of the sections, and of the research work that is in progress.

Food Poisoning

THE Ministry of Health has issued a memorandum on the steps to be taken by medical officers of health (outside London) in suspected cases of food poisoning (Memo. 188/Med.). The two classes of food poisoning are dealt with—contamination of food by poisonous chemicals and bacterial infections of food, which are far more frequent. Directions are given outlining the methods of investigating outbreaks, the collection of material for chemical or bacteriological examination, and method of packing and transmission to the Ministry, with hints on the chemical or bacteriological examination. In an appendix, a scheme is outlined for the routine inquiry into outbreaks of poisoning by meat foods, and in a second appendix valuable details are given for the isolation and identification of the bacteria (*Salmonella*) concerned in bacterial food poisoning.

International Congress on Soil Science

THE papers presented to the third International Congress on Soil Science, held recently at Oxford, embody work that is representative of most aspects of soil science; these are issued in two volumes (London: Thomas Murby and Co., 1935). The first volume contains those presented to the several commissions, and the second includes papers read at the plenary sessions, together with the address of the president, Sir John Russell. The papers are in English, French or German. The president, in his address, dealt with the contribution of soil science towards improving economic conditions, mentioning in particular the value of the surveying and mapping of soils as a preliminary to all schemes of agricultural development. As interesting examples of such contribution, those mentioned by Hardy, in his paper on "Some Aspects of Tropical Soils", may be quoted; these dealt more particularly with quantitative soil profile investigations. In the Caribbean region, for example, studies of this nature have rendered possible the exact definition of soil best adapted to the growth of several important orchard and field crops, and have made manifest certain soil factors that are definitely harmful to those crops. This aspect of soil work was dealt with by the commission on soil genesis, morphology and cartography and by that on the application of soil science to land amelioration.

No part of soil science stands to gain more from a Congress of this nature than that represented by those two commissions, since work in this field

would lose much of its value without uniformity in methods of approach and expression of results. Studies on the composition and structure of the soil, divided for the purpose of the Congress into four commissions, namely, soil physics, soil chemistry, soil microbiology and soil fertility, reflect the progress that has been made in recent years in this aspect of soil work. Schofield made a contribution in which soil moisture relationships are regarded from a new point of view based on energy considerations, and introduced a scale to specify the degree of wetness or dryness of a soil; it was shown that by carefully distinguishing wetting from drying conditions, a more rational interpretation could be applied to data on plant wilting and field moisture capacity.

Cooke's Illustrations of British Fungi

A MAGNIFICENT series of eight volumes of "Illustrations of British Fungi" appeared towards the close of the last century. They were the work of Dr. M. C. Cooke, and served as a very pleasing and facile reference for naming the larger fungi. More recent advances in the scientific nomenclature of the Basidiomycetes, however, have shown that the names attached to the plates were not always correct. A great deal of confusion has resulted, and has somewhat diminished the usefulness of the work. Mr. A. A. Pearson has largely remedied this state of affairs, by publishing a modernised index to the "Illustrations" (*Trans. Brit. Mycol. Soc.*, 20, Pt. 1, 33-95, Aug. 1935). This was originally based on notes prepared by Dr. Quélet, but Mr. Pearson also obtained the opinions of Prof. René Maire and Mr. Carleton Rea. These authorities concur upon a large number of species, but are by no means agreed upon others. The student of mycology will, however, be able to find the highest common factor between them where necessary, and will be able to use his Cooke's "Illustrations" again, with reasonable accuracy.

Fossil Elephants in Eldorado

A NOTABLE discovery of the remains of the extinct Columbian elephant, one of the largest of elephants, is recorded from Eldorado, Oklahoma, by Science Service, Washington, D.C. The University of Oklahoma and Kansas State College have united in excavating certain mounds in which casual digging had revealed fossil bones, and the first results include seven skulls and many bones, tusks and teeth of the species referred to. The elephant remains range from those of mature individuals to young ones, five to seven years old. In addition to these remains, bones of extinct species of camel, horse and bison have been excavated. It appears that the area of the discoveries was an ancient water-hole which had a bottom of very soft mud in which the animals had become bogged.

Guide to Statistics

THE "Guide to Current Official Statistics of the United Kingdom", for 1934 (H.M. Stationery Office, 1s.), has recently been published. This guide, now in its thirteenth year, has become almost indispensable

to all workers who have to deal with blue books and other official papers. It is so arranged that with a minimum of delay it is possible to find what statistics are available on any given subject. The degree of analysis of the figures, the dates and places to which they apply, and the price of the volumes containing them can be readily found. There is also given a list of the publications of various Government departments arranged under the departments.

National Radium Commission

THE new National Radium Commission has been elected and consists of the following members: the Earl of Donoughmore (Chairman), Sir Cuthbert Wallace (Vice-Chairman), Dr. T. Carnwath, Dr. T. Ferguson, Dr. Rupert Hallam, Dr. G. W. C. Kaye (appointed by the Department of Scientific and Industrial Research), Prof. J. C. G. Ledingham (appointed by the Medical Research Council), Mr. J. J. M. Shaw, Mr. G. F. Stebbing, Prof. Beckwith Whitehouse, Prof. James Young; *Joint Secretaries*, Dr. G. W. C. Kaye and Mr. G. F. Stebbing; *Office Secretary*, Miss K. Griffiths. The Commission will meet as heretofore at 5 Adelphi Terrace, Strand, W.C.2.

The Sky in October

ALL the naked-eye planets are now absent from the evening sky except Saturn, which is conspicuous and fairly well placed for evening observation: the stellar magnitude will decline from $+0.8^m$ to $+1.0^m$ during the month, but the planet is rather far south, as also was Jupiter this summer, Saturn's declination being $-11^\circ 50'$ on October 15. Venus is now an early morning object, and will attain its greatest brilliance on October 15. Mars and Jupiter are both near the sun. Uranus will be in opposition on October 27, and there will be a conjunction of Neptune with Venus on October 25, Venus being $2^\circ 6' S$. The minor planet Vesta is now in the evening sky, not far from Saturn. Intensive observations on the minor planets have been started at Greenwich, in pursuance of a plan for making greater use of these small objects for determining the position of the equinox. They just show a disc in the 8-in. transit telescope, but resemble a star far more closely than does Venus (and *a fortiori* the sun), so that the minor planets are very suitable objects to observe in order to tie up the right ascensions and declinations of the solar system with the fundamental right ascensions and declinations of the stars. The principle involved is that the observation of a planet from the earth is equal and opposite to an observation of the earth from the planet, so that besides observing the planet's orbit we observe our own, and find the point where our orbit cuts the equator, that is, the equinox.

Announcements

THE opening lecture of a series on "Scientific Progress" organised by the Sir Halley Stewart Trust will be given by Sir James Jeans in the Memorial Hall, Farringdon Street, London, on Tuesday, October 22. The subject will be the new world

picture as seen by the modern physicist. Other contributors to the series are Sir William Bragg, Prof. E. V. Appleton, Prof. E. Mellanby, Prof. J. B. S. Haldane, and Prof. Julian Huxley. Free reserved tickets are obtainable from the Trust, 32 Gordon Square, W.C.1.

THE Robert Koch medal has recently been awarded by the City of Berlin to Dr. Ferdinand Sauerbruch, professor of surgery in Berlin, the Emil Fischer medal to Dr. Adolf Butenandt, professor of organic chemistry and technology in Danzig, and the Liebig medal to Dr. Walther Roth, professor of physical chemistry at Brunswick.

A LECTURE on the work of the expedition of the Egypt Exploration Society (2 Hinde Street, W.1) to Tell el-Amarna 1934-5 will be given by the field director, Mr. J. D. S. Pendlebury, on Monday, October 7, at 8.30 p.m. in the rooms of the Royal Society, Burlington House, Piccadilly, London, W.1.

THE sixtieth series of free lectures at the Horniman Museum, Forest Hill, S.E.3, will begin on October 12 at 3.30, when Mr. E. C. Stuart Baker will lecture on "Wild Men and Wild Beasts in India". Further information can be obtained from the Curator of the Museum.

IT has come to the notice of the National Institute of Agricultural Botany that a Danish 're-selected' stock of Resistance Oats is being offered on the English market. The Institute desires to state that no seed of this variety was distributed prior to the autumn of 1934.

THE Electrodepositors' Technical Society, which has been responsible for the organisation of the Electrodeposition Exhibition in the Science Museum at South Kensington, will hold a Soirée in the Museum on October 18. The Exhibition will be open from 6.15 until 10.30 p.m., during which time a lecture will be given by Mr. S. Field on progress in electrodeposition and a film will be shown dealing with commercial applications of electro-deposits. Admission to the Museum will be by ticket. The Society welcomes applications from members of kindred societies and institutions and from others interested in the theory or practice or applications of electro-deposition. Applications should be made immediately to the assistant hon. secretary, Capt. A. I. Wynne-Williams, 12A, Raleigh House, Larkhall Estate, London, S.W.8.

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

An assistant in the London Museum, St. James's, S.W.1—The Keeper (Oct. 28).

A secretary for the Society for Cultural Relations with the U.S.S.R., 21 Bloomsbury Square, London, W.C.1—The Chairman.

A woman lecturer in geography and mathematics in St. Hild's College, Durham—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. 554.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Physical Units and their Dimensions

HAVING an interest in astrophysics, and chemistry, and telegraphy, for each of which some knowledge of electrical quantities and relations is required, more than I can carry in my head, a problem arises where to find it. It has been solved for my case by use of a single page appendix to a treatise on astronomy, which I keep handy with the page turned down, and which provides all that I need. I would not dream of remembering the complexities of nomenclature of an electrotechnical handbook. I observe that all this is now in the melting pot again, with its 'gilbert, gauss, oersted and maxwell' and so on, under new international auspices of some kind, to judge by letters in NATURE which I do not comprehend even by guesswork. Do the technicians of the great industrial corporations really desire to cut themselves off from the general sciences, or do they merely ignore this activity as a play of professors?

I am old enough to remember the beginnings of standard technical units, first in Kelvin's laboratory owing to the needs of submarine telegraphy, extended later to marvellously precise measurements mainly in the Cavendish Laboratory under Rayleigh's guidance, with results in values and nomenclature adopted into a universal practice mainly through Kelvin's international diplomatic gift. Once the now familiar c.g.s. unitary frame was adopted, the relevant electric unitary quantities followed, from their mutual relations in terms of one of them, thus forming a linear system, their dimensions as deduced from illustrative examples relative to the frame presuming that their relations are for all such examples of mutually consistent mechanical type.

It appears that the electrotechnicians are now invited to inhabit a world of their own in which c.g.s. are replaced by m.k.s., one moreover in which even the classical electrodynamic equations may be replaced by new ones peculiar to them. The standard units on the original c.g.s. frame were indeed in like manner too small for practical electric purposes, and were changed by the original founders to a secondary system affected by powers of 10, for example, a secondary unit concisely specified as 10^8 c.g.s. being named out of international compliment a volt, and so on. This correlation by factors that are powers of 10 appeared to be simple and universally acceptable. But these secondary units must also be bound together by a basic system of their own, to replace cm., gr., sec. I find on consulting § 620 of the relevant chapter (not too lucid) of Maxwell's "Treatise", a book now almost as obsolete as the "Principia", that this necessary basic system is 10^9 cm., 10^{-11} gm., sec. Thus the secondary unit of mechanical force would be 10^{-2} dyne, and so on: on the m.k.s., namely, 10^2 cm., 10^3 gm., sec. frame now apparently proposed, it would be 10^5 dyne. These extensions into mechanics have, however, hitherto been scarcely thought of: while the concise device of powers of

10 as ratios of the units of the same entity that arise has proved precise and adequate without divorce of electrotechnic theory from the scheme of general science. Why cannot it be let alone? But, by the way, on the other side of this account, may not the use by theorists, now introduced into Britain, of the hybrid electric unitary system favoured by Helmholtz, be a cause of dimensional inconsistencies as possibly felt by practitioners?

A deeper analysis in this regard, indicating a wider significance, is suggested. To secure unambiguous dimensions, the units must be a linear scheme with freedom of transformation backwards and forwards. This can be so, because there is presumed to be a unique ultimate theory which has to be on a mechanical basis as resting on length, mass, time, a presumption which might be called the Kelvin postulate. But regions of this final connected map of phenomena are concealed, and the partial effective theories, for example, the familiar electrostatic and the electromagnetic developments, are built up by working round these blank regions in different ways, establishing contacts where feasible while *ex hypothesi* they cannot show mutual contradictions. Thus, the test that every term in a summation formula must have the same dimensions is an indirect probe that the formula conforms to this unique ultimate foundation scheme. The assignment of dimensions to K or μ , after Rucker, promotes this unification of all systems of units virtually by adding a fourth variable to the c.g.s. three. The deeper significance for dimensions thus indicated has its origin historically with Gauss and Weber, rather than with Newton or Fourier; for they explored and compared the two widely removed paths of experimental entry into what proved to be the same range of phenomena of electrics, and identified them as far as might be; as is illustrated by Weber's recognition that the two resulting modes of measure of charge must be connected in terms of a velocity, while his experiments indicated, almost before its time, in advance of theory, that the velocity of light is here involved.

JOSEPH LARMOR.

Holywood,
Co. Down,
N. Ireland.
Sept. 11.

Magnetic Storms and Upper-Atmospheric Ionisation

Now that measurements of upper-atmospheric ionisation can be made, using methods of radio exploration, it is of interest to see whether abnormal values of ionisation density are associated with periods of magnetic activity. We have conducted such an inquiry using the measurements of ionisation density in Region F_2 of the ionosphere made at the Radio Research Station, Slough, together with the daily magnetic character figures from the Abinger Observatory supplied to us by the Astronomer Royal.

Since magnetic activity is, in this latitude, most pronounced just before midnight, we have taken the midnight values of the critical penetration frequency of Region F_2 , which is a measure of the maximum electron density, as the daily index of ionisation, and compared it with the magnetic character figure for the preceding twenty-four hours. In order to allow for the seasonal variation of ionisation, the daily departure of the critical penetration frequency from the appropriate value on a smooth curve drawn through the monthly means has been used as expressing whether a particular daily value was abnormally high or low.

The results of this examination show that when there is a small amount of magnetic activity the ionisation is above normal, but that when the activity is more severe the critical frequency is much depressed, indicating a reduced value of the maximum electron content. The correlation factor for the two quantities, (1) departure of midnight critical frequency from normal, and (2) magnetic character figure, has been found to be -0.247 for the year 1934, thus showing the slight preponderating influence of the negative correlation with large storms.

Now an increase of ionisation density would receive a ready explanation in terms of current theories of the production of magnetic storms by the injection in the upper atmosphere of ionising particles from the sun, but a decrease of ionisation density seems more difficult to explain. It has, however, been recently shown¹ that the abnormally low daytime ionisation densities observed in summer for Region F_2 are to be attributed to the influence of atmospheric heating by solar radiation. It seems possible to explain the low value of night-time maximum ionisation density associated with marked magnetic activity in a similar manner. If the agency responsible for magnetic disturbances heats the upper atmosphere so that it expands, the maximum electron density will be correspondingly reduced.

A study has also been made of the connexion between magnetic activity and noon values of maximum ionisation in Regions F_1 and F_2 , but here the results obtained are not quite so simple. It is true that intense storms are often accompanied by marked reductions in the critical frequencies of both regions, and especially is this found to be the case at the equinoxes, but we have noted a number of cases where the critical frequencies are actually markedly increased when a large storm is in progress. More often than not, the departures of the critical frequencies for the two regions from the appropriate mean curves are in the same sense, though they are much greater for Region F_2 than for Region F_1 . An inverse correlation between earth currents and Region F_1 ionisation has already been noted by Schafer and Goodall², but they were unable to find any connexion in the case of Region F_2 ionisation.

This work has been carried out as part of the programme of the Radio Research Board of the Department of Scientific and Industrial Research.

E. V. APPLETON.

Halley Stewart Laboratory,
King's College, London.

L. J. INGRAM.

Radio Research Station,
Slough.
Sept. 24.

Hydrogen in the Upper Atmosphere

ONE of the most striking characteristics of both auroral and night-sky spectra is the absence of hydrogen lines. So far as I am aware, not even a trace of the atomic or molecular spectra of hydrogen has ever been observed in either of the above spectra. The question is immediately raised, does this absence prove that there is no hydrogen in the upper atmosphere at the heights at which night-sky and auroral spectra have been photographed? It is the purpose of this note to discuss briefly the answer to this question.

In order to do this, it is necessary to recall some of the recent experiments carried out by me on the laboratory production of auroral and night-sky spectra. In order to produce either of these spectra, it is necessary first to prepare an uncondensed electrical discharge in nitrogen which is accompanied by a strong afterglow. It must be pointed out here that the best known nitrogen afterglow is the one which accompanies a condensed discharge in nitrogen, and that it was not until 1931 that the afterglow accompanying uncondensed discharges was discovered. It is much more difficult to prepare a tube which will show an afterglow when an uncondensed discharge is passed through it than one which will show the afterglow with a condensed discharge. In fact, the former afterglow was discovered in a tube which had been run for about two weeks during which all the impurities such as oxygen, carbon compounds and hydrogen were cleaned up. After many trials it was found that the preparation time could be greatly shortened if hydrogen were not present in the initial gas. Thus, in preparing tubes at the present time, whenever the tube fails to show an afterglow immediately, it is pumped down, say, from 10 mm. to about 10^{-3} mm. and in every case H_α and H_β are present in the light emitted by the tube. Repeated experiences show that a very small amount of hydrogen completely changes the spectrum and behaviour of nitrogen tubes. When it is present, no afterglow accompanies the uncondensed discharge, and when it is absent the discharge is accompanied by a strong afterglow the spectrum of which is that part of the auroral spectrum that is emitted by nitrogen.

The hydrogen may inhibit the afterglow by being adsorbed on the walls of the tube, thus preventing the adsorption of nitrogen atoms and their subsequent recombination to form the metastable molecules which seem to be necessary for the existence of nitrogen afterglows. The effect of the hydrogen may, however, be a space, rather than a surface, effect. If this should be true, then one must conclude that there is so little hydrogen in the upper atmosphere that it does not prevent the production of the auroral spectrum. In fact there should be a steady change of the auroral spectrum with the amount of hydrogen present in the region where it originates.

Before it will be possible to use the effect of hydrogen on the nitrogen afterglow, to study the hydrogen in the upper atmosphere it will be necessary to distinguish between space and surface effects. Experiments are now in progress to achieve this. Should it turn out to be a space effect it will be necessary to study the changes in auroral spectra with height.

In closing, it should be pointed out that several authors have identified certain night-sky spectra in

¹ Appleton, *Phys. Rev.*, **47**, 89; 1935. Appleton and Naismith, *Proc. Roy. Soc. A*, **150**, 685; 1935.

² Schafer and Goodall, *Proc. Inst. Rad. Eng.*, **23**, 670; 1935.

the red as water-vapour bands. While this identification is not certain, it at least suggests that the hydrogen in the upper atmosphere is present as part of the water molecule. While this may be reasonable for the light of the night-sky, one would expect water-vapour to be dissociated during auroral displays. Furthermore, no water-vapour bands have been observed in auroral spectra.

Although the present evidence is not conclusive, it was thought worth while to direct attention to this remarkable effect of hydrogen on the nitrogen afterglow and to its possible relationship to the question which was put at the beginning of this note.

JOSEPH KAPLAN.

University of California at Los Angeles.

Aug. 30.

Statistical Tests

PROF. FISHER¹ is an apt controversialist, but he knows as well as I do that what I understand by *graduation* is not confined to *curves*; that I should term graduation the fitting of a binomial to a series of observations, or the determining whether a system of correlation coefficients could be reasonably supposed to have arisen from samples of material drawn from a population with a given correlation coefficient. The difference between Prof. Fisher and myself lies in the use (and abuse) of the acceptance and rejection of 'hypotheses'. There is only one case in which an hypothesis can be definitely rejected, namely, when its probability is zero. He cites a case which I criticised in the paper he refers to, in which two recessives (say) had produced a dominant, and theory was absolutely contradicted. It did not require an *application* of the (P, χ^2) test to assert that either theory or observations must be rejected! I merely showed that the (P, χ^2) test did not fail in this case. But let us look into what actually happens, and I cannot do better than illustrate it on some statistics provided by Sir James Jeans in NATURE of September 14, 1935 (p. 432). He is comparing the eccentricities of visual binaries, 116 in number, against a theory of equipartition (not a *curve*, but frequencies are considered). His data expressed by a frequency series run as follows:—

Eccentricity.	Observed.	Theory for 116 stars, $e < 1$	Theory for 83 stars, $e \leq 0.06$.
0.00-0.01	0	} 4.5	} 9
0.01-0.02	11		
0.02-0.03	9	6	12
0.03-0.04	14	8	16
0.04-0.05	24	10.5	21
0.05-0.06	25	13	25
0.06-0.07	6	15	—
0.07-0.08	13	17	—
0.08-0.09	7	20	—
0.09-1.00	7	22	—

If the P, χ^2 test be applied to the total 116 binaries, we have $P < 0.000,0005$. On the other hand, if it be applied to the 83 stars of lowest eccentricity, $P = 0.79$. In neither case can you say the hypothesis is true or false. You reject it in the former case because it is a poor graduation, you say in the latter case that it is a reasonably good graduation because 79 per cent of random samples would, were the 'hypothesis' true, give a worse result than the observations do. But in accepting it as a working graduation, you do not assert its truth any more than you assert the falsity of the hypothesis applied to the whole 116 stars; you merely say the latter is a bad graduation, and try for a better. Had Sir James Jeans taken all

stars with eccentricity ≤ 0.07 , instead of ≤ 0.06 , he would have found $P = 0.105$, and if he had proceeded to $e \leq 0.08$, the result would have been $P = 0.00001$, that is, he might have got a worse sample in 100,000 trials. Actually he gives his reasons for cutting off the higher eccentricities. With them I am not concerned, although the exact cutting off at $e = 0.06$ is not discussed; the difficulty of detecting high eccentricity binaries and of then determining their orbits may account for the irregularity of the last four frequency entries, as he holds, or there may be other reasons why the falling-off occurs at $e = 0.06$. *Hypotheses non fingo!*

Now Prof. Fisher refers to rejecting hypotheses as a function of the P, χ^2 method, and of accepting them as a logical fallacy. I have in my letter of August 24 stated that the tests are there to ascertain whether a reasonable *graduation* has been reached; not to assert whether one or other hypothesis is true or false. We should accept Sir James Jeans's equipartition as a reasonable graduation for the observed binaries $e \leq 0.06$ ($P = 0.79$) and reject it as a graduation for the observed binaries $e \leq 0.08$ ($P = 0.000,01$). It is not for statisticians to say whether an hypothesis is false except when $P = 0$. All that they can legitimately say is that it gives a poor *graduation*. In particular, it is very unwise in my opinion to form tables which provide only the values of $P = 0.01$ and $P = 0.05$, and consider 'hypotheses' which give a value of $P < 0.01$ as 'false', and those with a value between 0.01 and 0.05 as 'doubtful', and for the rest of the scale of P have no descriptive category, for you must not say that such values prove hypotheses to be true. Hence I repeat my assertion, in the face of all the authority of Prof. Fisher and his followers, that all the P, χ^2 test ascertains is goodness of graduation, and I hold that 'goodness' of graduation is relative to the nature of the material investigated, our experience of similar material and the purpose to which we intend to put our graduation. The value of P at which we consider goodness or badness of graduation starts cannot be fixed without regard to the special problem under consideration.

There seems somewhere a logical fallacy in the position of both Prof. Fisher and Mr. Buchanan Wollaston. They both apparently assert that the P, χ^2 test enables one to say an hypothesis is false, yet never to say that an hypothesis is true, but if an hypothesis be *false*, its reverse must be true. If you assert that the hypothesis that a sample is drawn from a normal curve is false, the reverse hypothesis that it is *not* drawn from a normal curve must be true. As a matter of fact, the P, χ^2 test has only measured its 'goodness of fit' by a probability coefficient, and it is as idle to say as a result of it, that the hypothesis is 'false', as that the reverse of it is 'true'. The only exception to this rule is when the observations show the existence of individuals in a frequency class which the hypothesis asserts cannot exist.

The 'laws of Nature' are only constructs of our minds; none of them can be asserted to be true or to be false, they are good in so far as they give good fits to our observations of Nature, and are liable at any time to be replaced by a better 'fit', that is, by a construct giving a better graduation.

KARL PEARSON.

Biometrika Office,
University College,
London, W.C.1.

¹ NATURE, 136, 474, Sept. 21, 1935.

Stereoscopic Photography

IN "A Note on Stereoscopic Photography"¹ Dr. John R. Baker refers to different methods of making stereoscopic photographs of near objects. There are two possibilities: the axes of the cameras can be parallel to each other, or they can be convergent to the object. Dr. Baker concludes: "The convergent camera gives the proper representation of the object". I think this conclusion is not right. Let us consider a moment a photograph made by a camera in an arbitrary position. It always represents reality if we look at it in the right manner. It is necessary to put the eye in the place occupied by the lens in making the photograph, and the different points of the image will be seen under the same angles as the corresponding points of the object. In Fig. 1 of Dr. Baker's article both photographs have to be seen from *D* and so *A'* and *A''*, *B'* and *B''*, and *C'* and *C''* are seen in the same direction.

In choosing the right lenses for the stereoscope, it is possible to look at both photographs in the right manner. So each eye gets the same impression it should get in reality, and there is only left the possibility that both eyes, in looking to some detail, should have a position to each other different from that which they should have in reality. It is here there is a real difference between both methods. With convergent cameras we get the images of the object in the centre of the plate and in looking at them in the stereoscope the axes of the eyes will be parallel. With parallel cameras the images come more to the border, and in looking at them the axes of the eyes will be convergent. Here the effect of the parallel cameras is more according to reality, but the eyes are very insensitive to the difference. So the impression is the same in both circumstances.

It may be mentioned that one real advantage of the method of convergent cameras is a relatively big field of view, as only the common field of view of both cameras contributes to the stereoscopic impression.

J. VAN ZUYLEN.

Utrecht.

¹ NATURE, 136, 193; August 3, 1935.

In looking at a near object, the eyes are turned inwards. Therefore to procure a really natural stereoscopic view of two photographs of a near object, the eyes should be turned inwards at the same angle. To achieve this, the two photographs should be mounted in such a way that the corresponding points in them are nearer than the interpupillary distance. With this arrangement, it is true that proper stereoscopic views may be obtained with photographs of near objects taken with parallel cameras; but if the corresponding points in the two photographs are separated by approximately the interpupillary distance (as in normal stereoscopic photography), a wrong impression is conveyed to the eyes.

Convergent vision with the stereoscope presents two difficulties. First, most people (as I have found by painful experience at conversaciones) are unable to fuse the images with a convergent stereoscope: when a person holds a stereoscope to his eyes, he reflexly directs his eyes for parallel vision. Secondly, the placing of the corresponding points in the two photographs nearer together than the interpupillary distance narrows the possible field of view.

For these reasons I nowadays keep to the standard stereoscope and use parallel vision, insisting only that to each eye there shall be presented exactly the view that would be obtained if one were looking at the object with one's eyes in the positions of the lenses of the cameras when the photographs were taken. This can only be achieved by using convergent cameras (or by using the equivalent, the tilting stage method, in stereo-photomicrography).

If the convergent stereoscope did not present the two disadvantages mentioned above, the ideal method for the stereoscopic photography of near objects would be the following. The photographs would be taken by convergent cameras (or by the use of the tilting stage). A convergent stereoscope would be used for viewing, and the two photographs would be arranged in the stereoscope in two different planes at right angles to the two lines of vision.

I wish to acknowledge the benefit of discussions on this subject with Prof. F. A. Lindemann and Mr. S. J. Baker.

JOHN R. BAKER.

University Museum,
Oxford.
Sept. 2.

Raman Spectrum of Heavy Water

THE Raman spectrum of heavy water was first studied by Prof. R. W. Wood¹, who obtained a strong band at 2517 cm^{-1} . For the vapour of heavy water, Rank, Larsen and Bordner² found a line at 2666 cm^{-1} , while Wood has reported a line at 2601 cm^{-1} . These results are evidently incomplete. In view of the great interest attached to this substance, it appeared worth while to re-examine the matter, using 50 gm. of 99.2 gm./100 gm. D_2O (d_{40}^{20} 1.1049) supplied by the Norsk Hydro-Elektrisk Kvaestofaktieselskab. The Raman spectrum of the substance was photographed with a Hilger two-prism spectrograph with about 72 hours exposure, and is reproduced as Fig. 1.

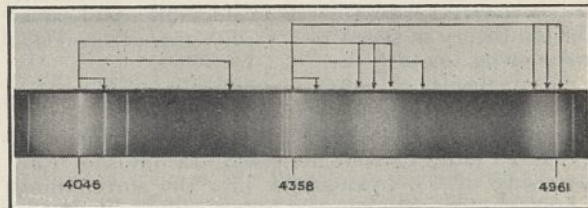


FIG. 1. Raman spectrum of heavy water.

The spectrum shows a number of interesting features which have not been noticed by the previous workers.

1. The principal band is seen to consist of three imperfectly resolved components of frequency shifts 2646 cm^{-1} , 2500 cm^{-1} and 2366 cm^{-1} . These correspond to the components 3630 cm^{-1} , 3435 cm^{-1} and 3200 cm^{-1} reported for ordinary water, and indicate that heavy water is polymerised in a very similar way to ordinary water.

2. A new band with a frequency shift of 1231 cm^{-1} is very clearly seen with both the 4358 A. and 4046 A. excitations. Careful examination of the plate reveals faint components to this on either side, the central component of the triplet being by far the brightest. The position of this band compares

very favourably with the frequency 1250 cm.^{-1} calculated from the theory of the molecular vibrations of three-particle systems put forward recently by Van Vleck and Cross³. It is interesting to note that a similar, but very feeble, band of frequency shift about 1650 cm.^{-1} has been reported in the case of ordinary water⁴.

3. A third band with a much lower frequency shift of 178 cm.^{-1} is also noticed with both the 4358 Å. and 4046 Å. excitations. This frequency is far too low to be attributed to the internal vibrations of the D_2O molecule, and hence is presumably due to some sort of rotation or vibration of the molecule as a whole. The Raman spectrum of ordinary water also shows a band at approximately the same position. This band is evidently to be ascribed to the frequency of hindered rotation or oscillation of the liquid molecule, of which independent evidence is forthcoming from studies of dielectric constant⁵, infra-red absorption⁶, viscosity, etc.

A detailed paper on the subject will appear in the *Proceedings of the Indian Academy of Sciences*.

R. ANANTHAKRISHNAN.

Department of Physics,
Indian Institute of Science,
Bangalore.
Aug. 10.

¹ R. W. Wood, *Phys. Rev.*, **45**, 392; 1934.

² D. H. Rank, K. D. Larsen and E. R. Bordner, *J. Chem. Phys.*, **2**, 464; 1934.

³ See B. Topley and H. Eyring, *J. Chem. Phys.*, **2**, 217; 1934.

⁴ M. Magat, *J. Phys.*, **5**, 347; 1934. G. Bolla, *N. Cimento*, **10**, 101; 1933.

⁵ P. Debye, *Phys. Z.*, **36**, 100, 193; 1935.

⁶ C. H. Cartwright, *NATURE*, **135**, 872; 1935.

Diffusion of Heavy Water into Ordinary Water

W. J. C. ORR and D. W. Thomson¹ have found the velocity of diffusion of HDO into H_2O to be abnormally large, the diffusion constant D being $9 \times 10^{-4}\text{ cm.}^2\text{ sec.}^{-1}$ at 15° C. , whereas for all simple substances in water, diffusion constants are of the order of magnitude $10^{-5}\text{ cm.}^2\text{ sec.}^{-1}$. Since this result, if it were true, would be of considerable significance for the theory of the structure of water, experiments were made to verify it.

The velocity of diffusion was measured with a micropycnometer of E. S. Gilfillan and M. Polanyi²; the orifice was made larger than usual (namely, about 0.1 mm.) to make noticeable the diffusion from the body of the pycnometer into the surrounding water.

The method of carrying out the experiments was as follows:

At the beginning the difference $(\Delta P)_1$ in equilibrium hydrostatic pressure for the solution and ordinary water was measured. Diffusion from the pycnometer was allowed to occur, in a separate vessel at constant temperature and for a given length of time t , and the measurement of the difference in the equilibrium hydrostatic pressure was repeated, giving $(\Delta P)_2$.

From Fick's law, the following equation can be easily obtained:

$$\lg \frac{(\Delta P)_1}{(\Delta P)_2} / Dt = K,$$

where K is a constant.

Constant K was obtained from observations of the diffusion of potassium chloride solution, employing

data of the International Critical Tables for the diffusion constant. All experiments were duplicated, results agreeing within 5 per cent.

The following values of D were obtained for the diffusion of heavy water from ~ 3 mol. per cent solution into ordinary water.

$$D = 1.1 \times 10^{-5}\text{ cm.}^2\text{ sec.}^{-1}\text{ at } 0.0^\circ\text{ C.}$$

$$D = 2.5 \times 10^{-5}\text{ cm.}^2\text{ sec.}^{-1}\text{ at } 28.0^\circ\text{ C.}$$

Hence the constants are of the usual order of magnitude, contrary to the result of Orr and Thomson.

My thanks are due to Prof. M. Polanyi for the use of the micropycnometer apparatus and for much valuable discussion.

M. TEMKIN.

Physical Chemistry Department,
University, Manchester.

¹ *NATURE*, **134**, 776; 1934.

² *Z. phys. Chem.*, A, **166**, 254; 1933.

Identity of Natural Vitamin D from Different Species of Animals

BILLS, Massengale and Imboden¹ have found that one rat unit of blue-fin tunny liver oil in chicks has only 15 per cent of the antirachitic effect of one rat unit of cod liver oil, whence they conclude that the two forms of vitamin D are different. However, Dols² demonstrated that the antirachitic effect of these two forms of vitamin D in chicks is the same, the necessary dose being about 80 international D units a day for each chicken. Before the results of Dols were known to us, we had running a great number of tests to investigate whether there is any difference between the vitamin D of different species of animals. (The fact that there is another form of natural vitamin D found in green plants and accompanying the free fatty acids³ is not discussed here.)

From the different fats under investigation the unsaponifiable fraction was first isolated, the vitamin A eliminated and the vitamin D to some degree concentrated by a method reported by us⁴. We have examined the liver fat as well as the body fat of the following species: coalfish (sei, *Gadus virens*), cod (torsk, *Gadus morrhua*), cusk (brosme, *Brosmius brosme*), dogfish (hå, *Squalus acanthias*), dorn (piggrokke, *Raja clavata*), Greenland shark (håkjerring, *Somniosus microcephalus*), haddock (kolje, *Gadus aeglefinus*), halibut (kveite, *Hippoglossus hippoglossus*), herring (sild, *Clupea harengus*), mackerel (makrel, *Scomber scombrus*), pollack (lyr, *Gadus pollachius*), redfish (uer, *Sebastes marinus*), salmon (laks, *Salmo salar*), shark (håbrand, *Lamna cornubica*), sprat (brisling, *Clupea sprattus*), tunny (makrelstørje, *Thunnus thynnus*), wrasse or 'Old Wife' (berggylte, *Labrus berggylta*), blue whale (blåhval, *Boleina musculus*); we also had specimens of vitamin D from the liver and body fat of a cow and of a human female. We found no difference between the antirachitic effect in chicks of all these fats, the daily dose required being in all cases 70–80 international D (rat) units per chicken.

We were thus able to confirm Dols's results but not the results of Bills *et al.* with tunny liver fat. None of the preparations investigated by us showed a maximum of absorption in the ultra-violet spectrum at $260\text{--}270\text{ m}\mu$ nor any rotation of the plane of polarisation in alcoholic solution, and the degree of

esterification with phthalic anhydride and pyridine after 10 days was 100 per cent. Maleic anhydride had no effect upon the present vitamin D⁴. There is thus no evidence that the vitamin D in all the fats investigated is not the same. A detailed report will appear in the near future.

OTTAR RYGH.

State Vitamin Institute,
Skøyen, Oslo.
Sept. 7.

- ¹ *Science*, **80**, 596; 1934.
² *Diss. Wageningen*, 1935.
³ *NATURE*, **133**, 533; 1934.
⁴ *NATURE*, **136**, 396; 1935.

Effect of Low Temperature upon Trypanosomes (*Trypanosoma equiperdum*) in Mammals

THE study of dormancy and under-cooling of animals has shown that the process of cooling sharply slows down all physiological functions. Yet the decrease in the rate of different functions is not the same^{1,2}. In connexion with these observations a new question has arisen: In what way will the fall of temperature of the body of an animal influence micro-organisms infecting it?

Experiments were made with two species of bats, namely, *Nyctalus noctula*, Schr., and *Pipistrellus nathusii*, Keys. et Blas, which were infected with *Trypanosoma equiperdum*. For inoculation, blood was taken from the tails of white mice when the number of trypanosomes in the blood attained 9-10 in the field of vision. Into the skin of the abdomen of bats 0.01 c.c. of blood was introduced. A group of these animals was kept in an active state at a temperature of + 20° to 25° to study the normal course of infection. The second group of animals was placed immediately after the inoculation into cold boxes with a temperature of + 10° and + 3°. Every day from the vein of the membrane of the 'wing', blood was taken and the number of trypanosomes was counted in the dark field. The temperature of the bodies of bats was determined by means of a thermopile as described previously².

Trypanosomes multiplied very quickly in the blood of bats in the active state. During the period of 4-5 days the number of parasites in the blood reached 10-20 in a field of vision, on the 6-7 day the trypanosomes were abundant, and on the 9-13 day the animals died.

In experiments with animals placed immediately after infection into ice-boxes with a temperature of + 10° and + 3°-4° it could be seen that the infection in the organism of bats does not develop during a period of 8-15 days. Having raised the temperature after the expiration of this period and having kept the bats in this condition for about 3-5 days, we were still unable to detect any traces of infection. Subsequent infection of them with a new virus was quite successful, which showed the absence of immunity. In other words, the absence of blood parasites was retained from the first infection.

We also conducted experiments by cooling the animals after infection had already developed. For this purpose, a group of active (control) animals, at the moment when the number of trypanosomes in their blood reached a high level, that is, 1-10 trypanosomes per field of vision, were transferred to ice-boxes. After a cooling period of 3-8 days (at temperatures of + 3° and + 10°) the parasites com-

pletely disappeared from the blood of the bats. 2-4 days after the disappearance of trypanosomes from the blood, the animals were warmed, and placed in the same conditions as those under control (with a body temperature of 33°-37°).

The blood of the bats during 2-5 days after their being warmed was also without any parasites. Experiments with repeated infection have shown the absence of immunity in the animals, in other words, the absence in their organisms of trypanosomes from the first inoculation.

N. KALABUCHOV.
L. LEVINSON.

Laboratories of Ecology and Histology,
Institute of Zoology,
University of Moscow.

- ¹ N. Kalabuchov, *Zool. Jahrb. Abt. Physiol.*, **53**, 4; 1934.
² N. Kalabuchov, *Zool. Jahrb. Abt. Physiol.*, **55**; 1935.

Parexocetus, a Red Sea Flying Fish in the Mediterranean

FLYING fish from the eastern part of the Mediterranean are very little known, and most identifications have not been controlled by comparison with material from the Atlantic.

Dr. E. Liebman, of Jerusalem, has recently sent me two specimens from the Palestine coast, both of which are adults (standard lengths 95-103 mm.) of the primitive genus *Parexocetus*, Bleeker. *Parexocetus* has not been recorded from the Mediterranean before. They belong to the species *P. mento*, C. and V., as defined in my recent revision of the Atlantic Exocoetids¹; but whether they are derived from the Atlantic subspecies *atlanticus*, Bruun, or are of Red Sea origin may be questioned. Klunzinger's species *gryllus* from the Red Sea is certainly a *Parexocetus*, and most likely a subspecies of *P. mento*. The numerical characters of the two specimens received (*D.* 9-10, *A.* 11, *P.* 13-14, vert. 36-37, gill-rakers 28-29) indicate closer relationship to *P. m. gryllus* than to *P. m. atlanticus*, which is only known from the Cape Verde region.

Therefore it seems very possible that *P. mento*, one of the neritic flying fish, has passed through the Suez Canal and found a new breeding place in the innermost, warmest part of the Mediterranean.

It would be of great interest to study closely the racial characters of the Mediterranean and Red Sea populations of this flying fish and the eight or nine other species of fish, which Liebman² has recently recorded as Red Sea immigrants into the Mediterranean. Naturally, equal interest would be connected with immigrants in opposite direction. If no investigator is available to take up this question at present, it is suggested that museums and biological stations of that region should take immediate steps to secure abundant material for a future study. The life-conditions in the two seas are so different that environmental influence, sooner or later, will almost certainly be traced in the immigrated stocks. In any event, this large-scale experiment on geographical differentiation deserves to be followed very closely.

ANTON FR. BRUUN.

Marinbiologisk Laboratorium,
København V.

- ¹ Bruun, Dana Report, No. 6, 1 (Copenhagen, 1935).
² Liebman, *Rapp. Proc.-Verb. Réunion. Comm. Intern. l'Expl. Scient. Mer Méditerranée*, **8**, n.s. 317 (Paris, 1934).

Organic Soils and Epinastic Response

CONSIDERABLE interest is being shown at the present time in plant auxinones and the chemical regulation of plant growth. Traces of many substances have been found to influence growth profoundly. Such substances range from complex or as yet chemically unidentified bodies produced in the growing regions of plants to quite simple chemical substances produced by plant tissues or in the laboratory.

Among the latter is the gas ethylene which, when present in the air in amounts of the order of one part per million, produces characteristic effects on tomato, potato and other plants specially sensitive to it¹. In the case of tomato, the most obvious reactions to traces of ethylene are: (1) stimulation of growth on the upper sides of petioles inducing characteristic epinastic curvatures, (2) stimulation of the formation of root primordia associated with inhibition of root growth—copious root growth occurring as soon as the treated plant is removed from the ethylene atmosphere. These reactions have been used to detect the presence of traces of ethylene and certain other gases, and it appears that the evolution of ethylene is a frequent accompaniment of plant metabolism, particularly during the ripening of many fruits¹.

In view of these facts it may be of interest to place on record some results of recent experiments of my own with certain infertile organic soils. Without entering into details, the following facts appear

to be established. (1) A gas may be extracted from such soils (by aeration, centrifuging or heating) which produces on tomato plants epinastic curvatures of the petioles similar to those brought about by traces of ethylene. (2) Extracts from such soils when added to water culture solutions produce similar epinastic curvatures on cuttings and influence the rooting of cuttings and the manner of root growth of cuttings and seedlings. There are indications that the intensity of these effects is seasonal.

Comparison with soils of other types in relation to these effects is being carried out, and the results of the work will be published in due course.

In view of the known effects of gases such as ethylene in stimulating the formation of root initials and controlling the growth of roots, it seems not improbable that failure or success in the establishment of a root system on the part of seedlings in some soils may be influenced by the presence in the soil atmosphere of varying amounts of ethylene (or other gases producing similar reactions), the origin of which doubtless may be sought in the decomposition changes taking place in the organic constituents of the soil following upon biological activities.

W. NELSON JONES.

Bedford College,
University of London.
Sept. 17.

¹ Contributions from Boyce Thompson Institute, 7, 1935.

Points from Foregoing Letters

SIR JOSEPH LARMOR expresses his disapproval of the introduction of the new meter-kilogram-second system of units. He considers that the c.g.s. units, expressed in powers of ten, are adequate; he inquires, on the other hand, whether the Helmholtz system of electrical units may lead theorists astray.

Measurements of the ionisation in the F_2 layer of the upper atmosphere (at a height of about 300 km.), by means of radio-waves reflection, indicate that during magnetic storms there is often a reduction in the electronic content of the layer. Prof. E. V. Appleton and Miss L. J. Ingram suggest as a possible explanation that the agency responsible for magnetic disturbances heats and expands the atmosphere, thus reducing the electronic density.

Prof. J. Kaplan describes the experimental production of the light of the aurora and the night-sky by means of uncondensed electric discharges through nitrogen. Slight traces of hydrogen prevent the characteristic nitrogen afterglow with auroral spectrum. This fact, together with the absence of hydrogen lines in the spectra of the aurora and the night sky, suggests that hydrogen is absent in the upper atmosphere at the level where those phenomena occur.

Prof. Karl Pearson states that, in general, laws of Nature are neither true nor false, but merely more or less good 'fits' to our observations of Nature. He maintains that statisticians can only state that a hypothesis is false when the P , χ^2 square gives $P = 0$. As an example, he applies the P , χ^2 test to the data recently given by Sir James Jeans for the observed and calculated eccentricity of binary stars, and shows that the theory of equipartition gives a poor fit, if all the binaries are considered.

Contrary to Dr. Baker's view, J. van Zuylen considers that when making stereoscopic photographs

the axes of the cameras can be either parallel or convergent to the object. The convergent method does give, however, a larger stereoscopic field of view. Dr. Baker admits that true stereoscopic views may be obtained with parallel cameras if the photographs are mounted so that corresponding points are nearer than the inter pupillary distance; otherwise, as is usually the case, a wrong impression is conveyed.

Three new bands in the Raman spectrum of light scattered by heavy water are described by R. Ananthakrishnan, who infers that heavy water is polymerised in a similar way to ordinary water.

The velocity of diffusion of heavy into ordinary water has been measured by M. Temkin, and the diffusion constant is found to be of the usual order of magnitude, contrary to results previously announced by W. J. Orr and D. W. Thomson.

The antirachitic effect in chicken of vitamin D obtained from liver and body fat of various (mostly marine) animals has been compared by Dr. Ottar Rygh. No differences were observed between them.

Experiments with bats infected with *Trypanosoma equiperdum*, a parasitic organism causing venereal disease in horses, carried out by N. Kalabuchov and L. Levinson, show that if the animals are kept in ice boxes at 10° C. or 3° C. for 3-5 days immediately after the infection, the micro-organisms disappear from the blood and the animals recover. Infected controlled animals kept at ordinary temperature die within 9-13 days.

Prof. W. Nelson Jones records experiments pointing to the presence of chemical regulators of plant growth, such as ethylene, in certain organic soils. Such constituents of the soil atmosphere may exercise an important influence on the rapid acquirement of an effective root system on the part of seedlings.

Research Items

Culture Sequence in Nebraskan Archaeology

MR. WILLIAM DUNCAN STRONG, in a survey of the archaeology of Nebraska (*Smithsonian Misc. Collect.*, 94, 10) puts forward a chronological classification of the indigenous cultures of that state and of northern Colorado, in which the primary basis of division is historic, protohistoric and prehistoric. The evidence, apart from documents and European associations in the historic period, is based on the evidence from stratified sites or association with an extinct fauna or geological deposits of pre-recent date. The *Historic Period* covers the occupation by Pawnees, sedentary Sioux, Dakotas, Arapaho and Cheyennes. The Pawnees' occupation is the oldest known of these, extending back into the *Proto-historic Period* (1540-1682). This is the period of highest Pawnee cultural development. The *Prehistoric Period* (1541 back to an undefined past) in its latest phase is characterised by two main cultures, the Nebraskan and Upper Republican, which exhibit certain affinities, but at the same time appear to have maintained their integrity. The Nebraskan covers the area later occupied by the intrusive Siouan. The Upper Republican may be ancestral to the Pawnee, which would thus bridge the gap between historic and prehistoric. Stratigraphical evidence suggests that the Stern Creek culture is older than either Nebraskan or Upper Republican; but it may be an intrusive trans-Missourian culture. Of stratified sites, that at Signal Butte exhibits three phases, of which the third and last appears to be a sub-type of the Upper Republican. Phases ii and i have no pottery; but, throughout the three phases, the development of the projectile stone point, and in a lesser degree other stone implements such as the knife, can be followed in a cultural and chronological progression, which affords argument for linking Signal Butte I, though later, with the Folsom point and recent discoveries on the Lindenmeier site in northern Colorado (see p. 535 of this issue). At present, palaeontological evidence is scant and the associations of implements with extinct fauna are culturally too meagre to afford ground for inference.

Stone Implements from South Australia

MR. WALTER HOWCHIN, who went to Australia in 1881 with an interest in prehistoric archaeology inspired by association with Canon W. Greenwell, began to collect and study the stone implements of the extinct Adelaide tribe, which previously had been entirely neglected, in conditions which have now vanished. A paper prepared by him in 1893, but not then published in full, has now been completed and brought up to date ("The Stone Implements of the Adelaide Tribe of Aborigines now Extinct." By Walter Howchin. Gillingham and Co., Adelaide, South Australia. Pp. viii+94. 7s. 6d.). The implements of the Adelaide tribe were found on the sand dunes of the coastal region near Adelaide and southward to the River Onkaparinga, the most prolific region being comprised within the ancient estuarine limits of the River Torrens. They occur in the recent drift, none having been found in the older formation of the sandhills. In one instance only, at Fulham, have they been found below marine deposits; but

these implements must also be described as 'recent'. All stand in a different category from the stone implements of the tableland of Central Australia, with their characteristic desert glaze and ferruginous impregnation. The material most commonly employed for the Adelaide implements is quartzite; but various other rocks were in use, including even the intractable quartz. Flint appears sparingly, some of it being of European origin, imported as ballast. For certain implements, such as 'choppers', a volcanic rock, such as basalt, was employed. Characteristic forms are knives, falling into five classes, chisels, gouges and adzes, hatchets, scrapers (of which eleven varieties are distinguished), points, graters, borers, etc., as well as a number of microlithic forms. Examples of the magical stones, which figure in aboriginal belief, some of curious form and unknown significance, are included in the collection. As a geologist, Mr. Howchin finds no evidence of a stone culture in any other than 'recent' conditions.

Life-History of the Organism of Pleuropneumonia

IN A former issue of NATURE (Feb. 24, 1934, p. 296), Dr. J. C. G. Ledingham's researches upon the causal micro-organism of pleuropneumonia of cattle were summarised. The matter has been carried a stage further by A. W. Turner (*J. Pathol. and Bacteriol.*, 41, No. 1, 1). He has studied the life-cycles and morphology of this organism in the living state by means of dark-ground observation of macro- and micro-cultures in a new fluid medium, which consists essentially of a peptic digest of ox liver and muscle, enriched with ox serum, and sterilised by filtration instead of by heat. The microbe is not filterable in the strict sense, though there is constant and early production of filter-passing forms ('conidioids'). It typically and constantly forms a relatively enormous branching mycelium, filaments of which may reach a length of 190 μ . It possesses at least five methods of reproduction, for which the term 'genethodes' is suggested. A new order *Borrelomycetales* to include it and the closely related organism of agalactia is proposed. The suggested terminus is *Borrelomyces* (nov. gen.) *peripneumoniae*.

Morphology of the Wheat Joint-worm Gall

THE morphology of the stem galls produced on wheat by the chalcid wasp *Harmolita tritici* forms the subject of a paper by Messrs. W. J. Phillips and F. F. Dicke (*J. Agric. Res.*, 50, No. 4; 1935). It appears that the female insect selects for oviposition the upper side of a node, in tissue that will later form an internode. The ovipositor is inserted slightly below the meristematic region, at the union of a leaf base with the stem. The egg is actually deposited in or near the phloem of the vascular bundle. The gall tissue arises partly from the phloem, but mainly from the parenchyma. There is no pith cavity in the part of the internode within the gall area, this section of the internode being filled with gall cells. Practically all the vascular tissue is destroyed in this region, and this inhibits the normal functions of the plant. The entire galled region lignifies and becomes hard by the time the larvæ are fully grown. The gall stimulus seems to be the products of larval

metabolism together with, perhaps, mechanical irritation. Unhatched eggs remain inert, a fact which strongly indicates that no stimulating substance is injected into the tissues at the time of oviposition to initiate gall-formation. The absence of the insect over the immense wheat area of Kansas and western Missouri seems to be due to the fact that the meristematic zone at the node of the wheat in this region is too tough and hard for oviposition. It is suggested that by fertilisation, or otherwise, the growth of the wheat might be brought to a stage unsuitable for the insect at the normal time of attack.

Refrigerated Gas Storage of Apples

LEAFLET No. 6 on Food Investigation, by Drs. Franklin Kidd and Cyril West, issued by the Department of Scientific and Industrial Research, 1935, shows how completely scientific investigation has now established suitable conditions for winter storage of the apple crop. It is now clear that if both the atmosphere surrounding the apples and the temperature are controlled, very adequate storage conditions can be provided when certain precautions are taken. Control of the atmosphere enables the oxygen supply to be cut down, and the carbon dioxide supply, released by the respiration of the apples, to be maintained at a suitable level. Whilst the slower respiration doubles the lifetime of the apples in store, the carbon dioxide has further influence in retaining the original green colour and hardness of the fruit. The temperature of the store is cooled as rapidly as possible to about 40° F. and kept about this level—too high for the development of the low-temperature breakdown conditions which so frequently follow when the fruit is released from stores at freezing temperatures. One of the most significant lessons learnt in recent years is the influence of the volatile products released from ripening fruit in producing further and deleterious changes in the fruit. They are controlled largely by their absorption by wrapping the fruit in paper soaked in mineral oil; it is also now clear that varieties with different ripening periods should be stored separately, as these substances are released in greatest quantity just as the apples begin to ripen. Practical details as to the construction and management of gas storage containers are given in this very concise publication.

Problems of Cacao Cultivation

1935 marks the close of the five year Cacao Research Scheme which has been carried out at the Imperial College of Tropical Agriculture, Trinidad, and a summarised account of the present situation has been published by Sir Geoffrey Evans in *Tropical Agriculture*, 12. The work, financed jointly by the producers and manufacturers themselves, was launched as the first organised attack on the botanical and soil problems that arise in the cultivation of the crop. The aim of the botanical researches has been defined as "the collection of information necessary for improvement of both yield and quality", a uniformity of production, at least locally, being specially desirable. Improved yield will then justify intensive cultivation, which in its turn will be limited to the more productive areas. Selection and propagation studies have, therefore, been the chief lines of work, the development of good methods of vegetative propagation being of particular importance as only by this means can uniformity be obtained, cacao-being subject to cross-pollination. As regards

chemical and ecological researches, systematic studies of 'good' and 'bad' cacao soils have been made and detailed surveys of soils in representative cacao-growing districts carried out. From such investigations, it is now possible to state whether or not a particular soil will prove suitable for profitable cacao production, fluctuations in soil and atmospheric moisture being a factor of some importance. Further, manurial studies have shown that both the quantity and quality of the product may be greatly improved by the addition of suitable fertilisers. For a more detailed account of the scientific side of the work, reference should be made to the four annual reports on cacao research already issued and obtainable on application to the editor, *Tropical Agriculture*, Imperial College of Tropical Agriculture, Trinidad, B.W.I.

Research at the Bose Research Institute

PAPERS recording the biological and physical researches, under the direction of Sir J. C. Bose, at the Bose Research Institute, Calcutta, have recently been published collectively ("Transactions of the Bose Research Institute, Calcutta", 9, 1933-34: Biological and Physical Researches. Edited by Sir Jagadis Chunder Bose. London, New York and Toronto: Longmans, Green and Co., Ltd., 1935. 18s. net). Further work on the physiology of *Mimosa pudica* has been carried out, during which the effect of flowering on diverse internal activities, especially of that of the pulvinus, were examined. The appearance of the inflorescence induces a depression in the moto-excitability of the pulvinus. This investigation, together with others, such as a study of variation in longitudinal and diametric growth in *Helianthus*, and the determination of the actual moment when germination commences inside a seed, together with the measurement of the rate of growth of the embryonic radicle, makes use of the continuous automatic record method which is so closely associated with the Bose Research Institute. By automatically recording the rate of oxygen consumed during respiration, a respirograph devised at the Institute is claimed to be very accurate and sensitive. This apparatus is fully described and illustrated. An investigation has been carried out on the physico-chemical and physiological nature of fat-soluble vitamins of *Cicer arietinum*, a pulse commonly used throughout India as an article of diet. The oil of certain varieties approaches cod liver oil in vitamin efficiency. Other researches at the Institute during the year under review include an anthropological study of the primitive Oraons of the Ramhi district, the continuous emission spectra of the hydrogen halides, and the flame spectrum of HCl.

Geology of Ceylon

So little has been published about the geology of Ceylon, that a monograph on the subject, accompanied by an excellent geological map, by J. S. Coates, who until recently was Government mineralogist of the Island, is particularly welcome (*Ceylon J. Sci.*, B, 19, 101-187; 1935). In order of age the formations described are as follows: Bintenne Gneisses are specially developed in the low country of the south-east. Khondalite series of granular quartzites and other metamorphic rocks, including garnet-sillimanite schists, form the central mountain system of the Island. Charnockites are extensively developed as sills in the Khondalite series and also occupy the whole of the south-western part of the

Island. There they are associated with garnetiferous leptynites that are regarded as sheared portions of charnockitic rocks. In the north and north-west a later series of Wannai Gneisses and granulites occur. The younger Pegmatites are of two types: a white variety (Balangoda group) remarkable for its variety of accessory minerals, including zircon and radioactive minerals; and a red variety poor in these accessories. Dykes of dolerite, peridotite and pyroxene-sapolite rocks also occur. Nine-tenths of the Island are occupied by the above crystalline rocks. The remaining deposits include the Jurassic Tabbowa Series; Miocene and related Tertiary beds; and Pleistocene and Recent coastal deposits and river alluvium, the last of which include the gem gravels for which Ceylon is famous. Gem-coriundum has been traced only to the white pegmatites which are also the source of beryl, chrysoberyl, topaz, tourmaline and zircon. Moonstone occurs in bands of a sheared quartz-felspar rock probably related to the pegmatites.

Ionisation of the Upper Atmosphere

E. V. APPLETON and R. Naismith (*Proc. Roy. Soc.*, A, July) have published the results of a long, systematic investigation of the reflection of wireless waves in the ionosphere. The method employed is to vary the frequency of a wave sent upwards, and to plot automatically the delay time of the reflected wave observed at vertical incidence against the frequency. At critical frequencies, the wave breaks through a lower reflecting layer and is reflected at a higher one, and the critical frequency for a given layer is connected with the maximum electron concentration in the layer by a formula which is now well established. The investigation was mainly concerned with daytime conditions, which are more complicated than those observed at night, for instead of the simple E and F regions of ionisation there is frequently an intermediate region E_2 lying above E_1 and a region F_1 lying below the main F_2 . The F_1 region is prominent only in summer. The seasonal variations of the noon values of ionisation in regions E and F_1 agree with a theoretical calculation based on the assumption that direct solar radiation is the ionising agent and recombination of ions the predominant dissipative process. The diurnal and seasonal variations of region F_2 are quite different, the critical frequency for summer noon being slightly less than for winter noon. The authors reject the conclusion of some of the American workers, that critical-frequency determinations do not give a true measure of the electron concentration; and explain their results on the assumption of a high molecular temperature for the upper atmosphere at summer noon. This causes a reduction in the electron concentration. The temperature required is of the order of 1,200° K., and could be due to molecular dissociation, or to collisions of excited molecules. The anomalies connected with region E are less fully considered, but examples are given of a special type of region E condition, common in summer, in which a thin stratum is formed which reflects strongly at both upper and lower surfaces, and which may give good reflection and hence very favourable transmission conditions for quite short waves.

Interaction of Neutrons with Matter

T. BJERGE and C. H. Westcott (*Proc. Roy. Soc.*, A, July) have investigated the production of 'slow' neutrons by the passage of neutrons through hydrogen-

containing substances. Their main experiment consisted in surrounding a radioactive neutron source with cylindrical vessels of water of varying diameter, and measuring the artificial radioactivity induced in a specimen placed outside the vessel. The curves show a maximum effect for a thickness of water of about 10 cm., and further experiments show that the 'fast' neutrons coming from the source are reduced to half-value in about 7 cm. of water while the 'slow' ones only have a half-value distance of about 1.6 cm. The scattering cross-section of several atomic nuclei for 'slow' neutrons was estimated ($3 \cdot 10^{-23}$ cm.² for hydrogen, 3×10^{-24} cm.² for carbon and oxygen). The cross-section for absorption varies very much from element to element—it is about 4×10^{-25} cm.² for oxygen and 1.2×10^{-21} cm.² for boron. J. R. Dunning, G. B. Pegrum, G. A. Fink and D. P. Mitchell (*Phys. Rev.*, Aug. 1) have also studied these neutrons. Their results agree approximately with Bjerger and Westcott in giving a halving-distance in water for fast neutrons from a radon-beryllium source of about 8 cm., and a maximum production of slow neutrons by spheres of 10 cm. radius. These workers have also studied the production of slow neutrons in heavy water, and they find that it is about 5.5 times less effective than ordinary water. They conclude that there is a smaller probability of interaction between a neutron and a deuteron than between a neutron and proton, and this is borne out by absorption experiments. The collision cross-section of a number of elements was measured for fast and for slow neutrons—the former shows a fairly regular increase with atomic number, while the latter varies violently from element to element, and attains a value 3×10^{-20} cm.² for cadmium. The high absorption of cadmium for slow neutrons was found to be nearly exponential when measured with a parallel beam, and was also found to be a true absorption associated with very little scattering.

Structure of Keratin

ASTBURY and his co-workers have shown that the molecular structure of keratin is such that the 'extended' form β -keratin consists of flat grids of atomic chains bound together by side chains. A number of such grids piled on one another form the β -keratin crystallites, and a characteristic spacing of about $4\frac{1}{2}$ A., found from the X-ray photographs of keratin structure, is supposed to represent the distance between the grids, while a spacing of $9\frac{1}{2}$ A. represents the distance between main chains in the plane of the grid. In the normal unstretched α -keratin, the main chains are regularly folded in planes perpendicular to the grid. In a recent paper (W. T. Astbury and W. A. Sisson, *Proc. Roy. Soc.*, A, July 1), this view receives rather direct confirmation. Specimens of horns and hair were squeezed laterally in the presence of steam. The α -keratin was first changed to the β -form and the β -keratin crystallites then took up a definite orientation, X-ray examination now revealing directly that the $4\frac{1}{2}$ A. spacing and $9\frac{1}{2}$ A. spacing were respectively normal and parallel to the flat surface of the squeezed specimens. The sharpness of the X-ray diffraction spots shows that the keratin grids are not very wide, but that many of them are piled on top of one another to form the β -keratin crystallite. The end of the paper contains a short discussion of the evolution of fibrous proteins, and speculates on the condensation of these from the globular protein structures.

Association of Special Libraries and Information Bureaux

THE twelfth annual conference of the Association of Special Libraries and Information Bureaux, held at St. John's College, Cambridge, on September 20-23, was of more than usual interest to those concerned with the use and dissemination of scientific and technical information of all kinds. In his presidential address on "Interpretation of Science" Sir Richard Gregory referred to the neglect of scientific material to-day by writers of all kinds, as compared with writers of the nineteenth and earlier centuries. Science needs, he pointed out, not only writers to make its achievements intelligible to general readers, but also poetic and other interpreters who will expound its intent and influence by artistic representation or performance. Poetry, like other forms of art, should follow on the heels of knowledge, and Sir Richard quoted examples of the expression of observations of Nature and science in classical literary style, as well as of the poetic interpretation even of mechanised science. Literary genius has as yet rarely found inspiring themes in the great achievements of modern science, and, until this is done, the full appreciation of science and its achievements by mankind would be wanting.

This appeal for the creation of a new school of poets of science who employ their genius to interpret scientific truths with accuracy and genius was fully in harmony with the two major themes of the Conference. The first of these was a symposium on "Special Libraries and Their Problems", covering questions concerning the recruiting, training and future possibilities of special library staff. The discussion was opened by a paper by Mr. J. D. Cowley, on "Training for Special Library Work", who described the training given at the London University School of Librarianship, of which he is director, and the modification of its syllabus to overcome the practical difficulties experienced. Regarding librarianship as including "sympathetic and informed aid in the interpretation of material for study and research", the training aims at providing men and women who are not only trained in the technicalities of handling the material of research, but are also sufficiently informed in the subject of that material to interpret it and pass on the information gained in an acceptable form to others. The question whether training in librarianship should precede or follow training in research has yet to be decided, and some difference of opinion on this point was revealed in the subsequent discussion. Mr. Cowley's remarks about deficiencies in linguistic ability in graduates seeking admission to the course were endorsed in the subsequent discussion from experience in recruiting for information service. Mr. Cowley remarked that the School of Librarianship has so far failed to attract the really first-class science man.

Mr. Cowley's paper was followed by others on the "Functions of a Technical Information Bureau", by Dr. E. S. Hedges and Dr. C. E. Homer, who described the work of the Bureau of Technical Information of the International Tin Research and Development Council, and by Mr. F. H. Smith. Mr. B. Fullman, information officer of the British Non-Ferrous Metals Research Association, discussed "Information

Work as a Career for the Scientist" and pointed out the possibilities in such work for a man of first-class training and originality. The success of information work and the rewards accruing from it are largely dependent on the personality of those engaged in it, and a similar view was expressed in a paper by Mr. T. M. Herbert, research manager of the London, Midland and Scottish Railway.

The second major theme of the Conference related to co-operation between industry and the public library services. Opening this discussion on September 22, Mr. R. Brightman, of Imperial Chemical Industries, Ltd., pointed out that the possibilities in this direction are only just beginning to be appreciated with the growth of special libraries in industry itself. The organisation of such internal library services is an essential preliminary to co-operation with external organisations, and Mr. Brightman then indicated some of the ways in which co-operation has already proved possible and further possibilities in which co-operation would lead to the more effective use of existing resources. Other constructive suggestions were made by Miss E. W. Parker, of the Mond Nickel Co., Ltd., in a review of the use made by industry and commerce of the public libraries in the London area, while Mr. J. P. Lamb described the progress of co-operation between local industries and the public library services in Sheffield. The value of personal contact between industry and the public librarian was emphasised both in these papers and in the discussion which followed.

Following on a paper on the new University Library on September 21, by Mr. H. C. Stanford, secretary of the library, members of the Conference visited the new University Library building. In the afternoon, Sir Stephen Gaselee gave a valuable paper on the "Libraries and Sources of Information in Government Departments", including descriptions or notes on the chief libraries represented in the 'Circle of State Librarians'. Sir Stephen Gaselee testified to the willingness of the Foreign Office library and other departmental libraries to deal with private inquiries, so far as facilities permit.

The annual report of the Council presented to the annual meeting indicated a slight increase in membership, but the necessity for an augmented income, if the work is to be developed adequately, was emphasised. Reference was made to the inauguration of a scheme for the issue of a quarterly list of recently published scientific and technical books, each book recommended by an expert qualified to judge the book in question. The list is intended mainly for the guidance of public and general librarians. During the year, a London and Home Counties branch was inaugurated, several meetings of which have already been held.

Other papers read before the Conference included one on reference books and their use, by Mr. B. M. Headicar, which dealt particularly with lesser-known books of this type, an account of the work of the Council for the Preservation of Business Archives by Mr. A. V. Judges, its hon. secretary, and an admirable analysis by Mr. R. S. Lambert of the response to information of all kinds supplied in the broadcasting services.

Possible Bearing of a Luminous Syllid on the Question of the Landfall of Columbus

By L. R. Crawshay, Marine Biological Association Laboratory, Plymouth

IN a paper by Lieut.-Comdr. R. T. Gould on the "Landfall of Columbus"¹ the author, after reviewing the whole subject, follows Murdock (1884) in placing the landfall at Watling's Island, the second island, Santa Maria de la Concepcion, being identified as Rum Cay, and the third, Fernandina, as Long Island, with Clarence Harbour as the harbour of entry on the east side of it. In the course of the discussion, he refers to the unexplained incident of the mysterious 'light' recorded by Columbus, as seen by him and others from the poop of the *Santa Maria* at about 10 p.m. on the night of October 11, 1492, "i.e., about four hours before making the landfall, and an hour before moonrise". The light was seen "some distance away in the darkness. It is described as looking like the flame of a small candle, alternately raised and lowered. It seems to have gone out of sight again not long after". The author proceeds: "Judging by the speed of the ships, as given in the journal for the night, the light must have been some 35 miles or so eastward of the landfall, and well to windward of it".

At such an estimated distance eastward of Watling's, the position of the light would be well out into the Atlantic, in some 3,000 fathoms of water, where the presence of a native canoe accounting for it, as suggested by Markham, seems inconceivable. Scarcely more credible is the view expressed by Mackenzie (1828), who makes the landfall at Cat Island, assuming the light to have been a shore light at Watling's, the island itself, however, being missed by Columbus in the darkness. Murdock disposed of the difficulty by the extreme course of suggesting that the light was non-existent and imaginary. Against the latter surmise is the definite record, not only of the light, but in such detail and in such circumstances as strongly to support the view that it was due to a surface display at the time of luminous marine annelids of the genus *Odontosyllis*.

In the case of *O. enopla*, Verrill, of which the habits and structure were described by Galloway and Welch², the times of the luminous displays, associated as they are with the reproductive process, appear to have some relationship with the lunar phases, and in one case observed definitely with the third phase, though the whole causes controlling the time of occurrence are somewhat obscure, with approaching dark and low tides apparently two chief contributing factors.

In the Bahamian species of *Odontosyllis*, frequently observed by me through past years, while engaged on the Sponge Fishery Investigations for the Colonial Office, the date of occurrence of the displays, though variable, was always closely associated with that of the moon's last quarter. In a single case, among seven definitely recorded occasions, a maximum interval amounting to about 3½ days was probably explainable by approaching disturbed weather, at the time occasioning premature appearance of the females at the surface. In other cases, the time was usually within about twenty-four hours of the moon's last quarter, the average being about eighteen hours.

Examination of some preserved material remaining of this species, though at present undetermined, and possibly not yet described, shows it to be clearly distinct from the Bermudian species, and especially, among other features, in respect of its fusiform-clavate and articulated swimming setæ of the parapodia. Further, unlike the Bermudian species, as likewise also to some extent a British Honduras species, structurally similar to, if not identical with *O. enopla*, the time of appearance does not coincide with approaching dark, but may be long after darkness has closed in, the latest definitely recorded time being 8.30 p.m. The period of illumination is always very brief, usually not exceeding 5-10 minutes from first to last, and often so short as barely to allow time for a specimen to be captured. It may perhaps be repeated on a following night, but more usually will not recur until the same phase of a subsequent lunation. The illumination does not occur in all months, but has been definitely noted by me, between 1921 and 1923, in January, April, May, July, October and December.

The purpose of these luminous displays, in the species concerned, is wholly associated with the reproductive process. In his description of the swarming of *O. phosphorea*, Moore, observed by him at Nanaimo, British Columbia, Potts refers³ to somewhat indiscriminate mixing of males and females, and the regularity of the times of mustering, and in increasing numbers, of both sexes, about half an hour before sunset. He expresses surprise concerning the difference of habit in *O. enopla*, in which the whole circumstances show a direct attraction of the males, through the illumination, by the females individually, for fertilisation of the ova as extruded. This is precisely what occurs in the Bahamian species. 'Swarms', strictly speaking, cannot be said to occur. But a varying number of mature females, ranging on occasions from perhaps half a dozen to twenty or so in a given location, will appear suddenly and almost simultaneously; a stream of brilliantly luminous matter is emitted by each one of them with the extruded ova, probably two or three times repeated at short intervals; and with this as a signal a number of males rush in, with short intermittent slight flashes, towards the light for fertilisation, partly with attachment to the female, partly darting rapidly to and fro through the luminous trail. Thus the whole process is concentrated within a brief interval of time, and more usually, as it seems, completed on one night, for a particular moon. This period of the lunar month is no doubt particularly favourable for the darkness it affords at a suitable time of day within a few hours after sunset. Whether directly influenced by the moon or not, it is very remarkable that, so far as I am aware, the displays on the part of the females never occur through the long and dark period immediately following the last quarter, or until the next lunation, which again may be missed until the same phase of a subsequent one.

With respect to the comparison of the light, in the journal of Columbus, with "the flame of a small candle alternately raised and lowered", and its disappearance soon after, the illuminating display of a single *Odontosyllis* female will at such times usually show this feature of separate short periods of excessive and declining brilliance, repeated two or three times over, or more. From the poop of the *Santa Maria*, it is easy to believe that this light would be visible on a dark night up to 200 yards, or even farther, away. As probably as not, the strange and unaccountable light would disappear almost as soon as there was time to report it.

As observed at Abaco, and within a limited area, the species concerned ordinarily frequents grounds of shallow water, and up to about 2 fathoms in depth, though probably extending much outside this. The displays, though variable in time, usually occur about the time of low water, or within an hour, or occasionally as much as 2½ hours, on either side of this. If the light was seen by the *Santa Maria* about 10 p.m. on the night of October 11, and the moon rose an hour later, as recorded, the moon was then presumably about one day before the last quarter. The time of low water, probably about 7.30–8.00 p.m., is comparatively unimportant, considering the variability in the time of appearance of the syllid in this respect. The latest time of display definitely noted by me in examples at Abaco was 8.30 p.m.

Murdock in his chart, followed by Lieut.-Comdr. Gould, shows the course of Columbus passing round the south side of Watling's Island. Mackenzie, who makes the landfall at Cat Island, shows it on the north side. In the latter case, there is a large shallow bank, with rocky heads, extending out for some 3½ miles from the present low-lying northern shore of the island; a position near the northern point of

this bank, as shown in the chart of Mackenzie with indication of the position of the light, would leave little difficulty in explaining not only the presence of the Syllid as the source of the light, but also the passing of the island unobserved in the darkness at such a distance. At or near the extreme northerly point of this inner bank, there is little cause to doubt that the ships may have passed without striking or even sighting any submerged reef head, if then here existing.

As against the estimated distance of the position of the light at some thirty-five miles or so eastward of the landfall, and considering the frequent difficulty found in reconciling distances recorded with those existing between positions, as interpreted in the itinerary, it is on the whole a remarkable coincidence in the present connexion that the distance from the northern bank of Watling's to the south-east point of Cat Island is about 43 miles.

The primary purpose in the present discussion is to direct attention to a very probable explanation of the mysterious light observed on the night before the landfall was sighted, hitherto without any satisfactory explanation suggested, and thus leaving inevitably a weak point in the data employed for conclusions so reached regarding the identity of the landfall. The inference that it was Cat Island has its own difficulties, the greatest of these being, as it seems, its distance as recorded, about 18 miles, from the second island, while assuming the latter to have been Rum Cay. In any circumstances, I am unable to see how the incident of the recorded light can be regarded otherwise than as a point of evidence of first importance towards settlement of the problem.

¹ *Geographical J.*, May 1927.

² *Trans. Amer. Micro. Soc.*, 30, No. 1; 1911; republished in the *Con. Bermuda Biol. Sta.*, June 1916.

³ *Proc. Camb. Phil. Soc.*, 17, Part 2; 1913.

National Water Resources

THE joint committee of Lords and Commons, appointed to consider and report on measures for the better conservation and organisation of water resources and supplies in England and Wales, held an inquiry during the month of July last, and completed it for the time being. The evidence given before the committee with a report of the proceedings, after being tabled in the Houses of Parliament, has been published*. The findings of the committee are set out in six resolutions, the first of which, affirming that the aggregate available supply of water is ample for all anticipated requirements of the country is, at least, reassuring, and should dispel whatever doubts (if any) have been entertained on this score; though it is little satisfaction to those who have experienced the serious inconveniences of the recent drought to know that, while locally there has been scarcity and restriction, elsewhere supplies have been plentiful and even running to waste.

The real crux of the situation is contained in the second resolution, which admits that a number of problems of distribution, compensation and similar

matters are outstanding, and should be dealt with without delay. Taken in conjunction with the third finding, that sufficient material and experience is possessed by the Ministry of Health to enable the legislation necessary to deal with the problems to be drafted, there is a distinct implication that the Ministry of Health has been remiss in not coping with the difficulty before. Indeed, the main trend of examination by the committee of a departmental witness went to show that the former considered it was being called upon to discharge a duty which was superfluous, and the reason put forward by the secretary of the Ministry in support of the appointment of the committee was that it was for the purpose of getting the advice of an "impartial and competent" body on points of conflict which were known to exist, but which the Ministry, apparently, had made no direct effort to ascertain or define. Sir Arthur Samuel, a member of the joint committee, expressed himself pointedly if colloquially, when he asked Sir Arthur Robinson, "Are you not asking us to hold the baby for you and do the work which you yourselves ought to do, to shield you?"

It is scarcely surprising, therefore, that the remaining resolutions of the committee should call for the

* Joint Committee on Water Resources and Supplies (Session 1934–35). Vol. I, Proceedings of the Committee, 2d. net.; Vol. II, Minutes of Evidence, together with an Appendix, 3s. 0d. net. (H.M. Stationery Office.)

preparation by the Ministry of Health of a preliminary memorandum on matters of controversy, to be circulated to all parties likely to be interested, in order to enable evidence in criticism to be heard after the recess, the committee feeling that, until the issue of such a memorandum, no useful purpose could be served by hearing further evidence on the subject-matter before them. The absence of any

witnesses to speak on the industrial side of water user was, in fact, the outstanding feature of the inquiry, so far as it has gone, and it rather seems to indicate that trade and industry have been ignored by the Ministry in the prosecution of its plans. The unwisdom of such a step is surely obvious in connexion with "a question which raises interests very much wider than the interests of the Ministry of Health".

Road Width and Accidents

THE cause of road accidents is a topic which gravely concerns every class of the community, and each attempt to determine the degree to which any one factor operates in promoting road safety deserves general attention. From the point of view of safe driving, it is probable that there is an ideal width of road for each set of traffic conditions and that, at a certain traffic density, the division of the roadway into separate 'up' and 'down' tracks becomes advisable.

It is of interest, therefore, to read in *Roads and Streets* (Chicago, July 1935) a paper submitted to the Highway Research Board by Prof. R. L. Morrison, of the Department of Highway Engineering at the University of Michigan, entitled "Effect of Pavement Widths upon Accidents". The main object of the author's investigation was to find evidence bearing upon the desirability of building 20 ft. roadways instead of the smaller widths which had been adopted as adequate to allow of the passage of two vehicles. It is obviously difficult to make a rigid comparison in figures between any two roads, equal or unequal in size, and this is intensified by the uncertain data obtainable regarding many accidents, and by the absence of figures relating to minor unreported accidents which might yield valuable evidence.

In this investigation, several portions of roads are

dealt with, and figures are given regarding (a) 34 miles of 20-ft. roadway and (b) 19 miles of 18-ft. width. After eliminating those unrelated to road width and found to occur at the rate of (a) 1.06 and (b) 0.90 accidents per mile, the author finds that those which are affected by road width occur at the rate of (a) 1.00 and (b) 1.70 per mile. This last figure on being adjusted in order to obtain a comparison on a common basis is increased to 2.20, but here the reasons given are not quite convincing, though they may be justified by a personal knowledge of the roads and their conditions. If, however, we take from the detailed analyses given in the paper the figures for accidents which can be accounted to grossly careless driving—the main cause of preventable accidents—the rates are (a) 0.53 and (b) 1.10.

These figures strikingly support the final comparison ratio deduced by the author, whose conclusion is that, on the grounds both of the accident rate and on the relative costs, of which figures are adduced, the 20-ft. roadway is justified. The author agrees that his data are not sufficiently extensive for general conclusions to be drawn, but suggests that the method of analysis might be adopted as a general approach to the problem. The figures dealt with are understood to relate to the accidents occurring in one year.

Biological Effects of Different Regions of the Spectrum

AT the red edge of the invisible in the spectrum there is a narrow band of light waves which have a powerful and hitherto unsuspected biological inhibitory effect. This is reported by Lewis H. Flint, of the Department of Agriculture, and E. D. McAlister, of the Smithsonian Institution (*Smithsonian Misc. Coll.*, 94, No. 5, June 24, 1935), as a result of further studies of the germination of dormant lettuce seeds when exposed to radiation.

Previous studies by Dr. Flint had demonstrated that such seeds could be made to germinate by exposure to red, orange and yellow light; and inhibited from germinating by irradiation with green, blue and violet light. The inhibitory effect was general for this upper end of the visible light spectrum, but reached its greatest intensity at wave-lengths of about 4200 and 4800 Å. in the blue-green region.

The discovery of an inhibitory wave-band at the red end of the spectrum which, so far as the germination of lettuce seeds was concerned, was more powerful

in its effects than the entire green-blue-violet end of the spectrum, came as a complete surprise. This band lies around the critical wave-length of 7600 Å., at just about the point in the red where light ceases to be visible to the human eye.

Ordinarily its effect would be masked by the stimulating effect of the wave-lengths surrounding it, especially in sunlight. Perhaps fortunately for vegetation—although the inhibitory influence has been demonstrated only with lettuce seeds—the solar radiation in this neighbourhood is greatly reduced, owing, it is believed, to its absorption partly by oxygen in the atmosphere of the sun and partly by water-vapour in the atmosphere of the earth. Notwithstanding this absorption, however, the energy of solar radiation at this point is large.

Further studies of the possible effectiveness of this region in respect to the germination of other seeds and in respect to other phases of light sensitivity are now in progress.

Educational Topics and Events

ABERDEEN.—The King has been pleased, on the recommendation of the Secretary of State for Scotland, to approve the appointment of Prof. E. W. Henderson Cruickshank, professor of physiology in Dalhousie University, Halifax, Nova Scotia, to be regius professor of physiology in the University of Aberdeen, in succession to the late Prof. J. J. R. Macleod.

For London school-teachers, the London County Council offers an extensive and attractive programme of winter evening lectures and classes designed to bring them into touch with the latest developments in educational methods and to give them opportunities of hearing leading authorities in various branches of learning and on current questions of public importance. A glance through the recently issued handbook for the session 1935-36, giving full particulars of nearly a hundred items, leaves the impression that this scheme, which is self-supporting and obtained last year 13,000 entries, cannot fail to raise the standard of liveliness of school teaching in the metropolis. Of the courses grouped under the heading Science, nearly all deal wholly or in part with the science of life. They include a Saturday morning series at the Zoological Gardens on "Animals at the Zoo", lecture-demonstrations at the London School of Hygiene on "Fundamentals of Biology", a series on the conduct in the school of observations and experiments on plant and animal life, lectures on food and food values, on the teaching of hygiene and on science for senior schools. The last-mentioned course will direct attention to the desirability of framing science syllabuses on a wider basis than that traditionally employed, and will include an exposition of schemes of work which have been found suitable for senior children of both sexes in a London school.

SECONDARY schooling for all is an ideal towards the realisation of which the United States has made notable advances. That the ideal is a mischievous one, and that advances towards it have had devastating results, is the gist of a lively diatribe by one of the staff of a Pennsylvania High School published in *School and Society* of April 13. The public school is declared to have become, to a large extent, a "racket". A large proportion of the students who are promoted willy-nilly into the secondary schools will not and cannot profit by further schooling in any form. This is the opinion not only of teachers of academic subjects but also, emphatically, of shop teachers, whose energies are largely devoted to making the best of the subnormal pupils for whose benefit money is lavished on special apparatus, special textbooks and individually supervised study. If the material is thus unpromising, the quality of the staff available for processing it suffers from the dominance of the doctrinaire in the direction of the teacher training institutions. Here students are being compelled to spend so much of their time learning how to teach that they have little left for mastering the subject matter they are to handle. They are bewildered by the multitude of their courses, many of them obscured with metaphysical subtleties; and they are practically obliged to accumulate further 'credits' by attending vacation courses remote from utilitarian or cultural values.

Science News a Century Ago

London and Edinburgh Philosophical Journal

THE contents of the October, 1835, number of the *London and Edinburgh Philosophical Journal* consisted mainly of reprints of papers read before various societies. These included one by Sir David Brewster on the structure and origin of the diamond, one by Apjohn on a formula for inferring the dew-point from the indications of the wet-bulb hygrometer, a part of C. B. Rose's sketch of the geology of West Norfolk and a paper by Encke on Olber's method of determining the orbits of comets. There was an original communication from C. L. C. Rumker (1788-1862), the director of Hamburg observatory who had served in the British Navy, to Sir Thomas Brisbane on a new method of reducing lunar observations for the determination of the longitude. The number, however, was of more than special interest as it included the first of a series of official reports communicated by the Council and Secretaries of the British Association on the Dublin meeting.

The Entomological Society

At a meeting of the Entomological Society, held on October 5, 1835, "Various donations of entomological works were announced, including the first number of the splendid 'Fauna Japonica' by Drs. Siebold and De Haan, presented by the authors. Various new members were elected, including Count De Jean and M. Boisduval, of Paris. A communication was received from Mr. E. Doubleday, containing an account of the total destruction of a beehive by a small moth, *Galleria cereana*, the larvæ of which had completely devoured the comb—portions of which were exhibited. Several living cane plants, greatly infested by the cane fly, were exhibited by Mr. J. C. Johnstone, by whom an account was given of the rapid and alarming progress of this minute insect, its ravages extending over two-thirds of the island of Grenada, to so great an extent that plantations which originally made 300 hogsheads did not now make more than eighty or ninety. . . ." (*Athenæum*.)

Sir Charles Bell at the Middlesex Hospital

ON October 7, 1835, Sir Charles Bell wrote to his brother George, "I don't think I have written to you since I began the lectures, establishing a school in the old Middlesex. At least my spirit and devotion to the art and to the institution to which I am attached will not be denied. I have delivered six lectures, such as only long experience and study could have produced. I lecture to some sixty pupils—which for a beginning is as much as we could expect. N.B.—I have received not one guinea from these lectures and expect none. On the contrary I have subscribed £50 as one of the hospital surgeons, £30 as a lecturer. Nevertheless, the main object will be gained—the preserving the hospital respectable. . . . I now return to the cheap and complete edition of my 'Nervous System'."

The Tortoises of the Galapagos Archipelago

ON October 8, 1835, Darwin records: "We arrived at James Island; this island as well as Charles Island, were long since thus named after our kings of the Stuart line. Mr. Bynoe, myself, and our servants were left here for a week, with provisions and a tent,

whilst the *Beagle* went for water. We found here a party of Spaniards, who had been sent from Charles Island to dry fish and to salt tortoise-meat. About six miles inland, and at the height of nearly 2,000 feet, a hovel had been built in which two men lived who were employed in catching tortoises, whilst the others were fishing on the coast. I paid this party two visits and slept there one night. . . . While staying in the upper region we lived entirely on tortoise-meat: the breastplate roasted (as the Gauchos do *carne con cuero*), with the flesh on it, is very good; and the young tortoises make excellent soup; but otherwise the meat to my taste is indifferent."

Societies and Academies

PARIS

Academy of Sciences, August 12 (*C.R.*, 201, 413-436). The President announced the death of Antoine Guntz, *Correspondant* for the Section of Chemistry. HANS SCHWERTFEGGER: Functions of matrices. BORIS KAUFMANN: The infinitesimal properties of closed ensembles of arbitrary dimension. RICHARD BRAUER: The integral invariants of varieties representative of simple closed Lie groups. GEORGES BOURLON: The limit functions of the partial sums of an integral series at the frontier of the circle of convergence. MARCUS BRUTZCUS: The appreciation, *a priori*, of the value of a commercial combustible for motors. RENÉ DUBRISAY: The action of sulphur on silver. The blackening of silver can be produced by sulphur without the intervention of a sulphur compound. The increase in the rapidity of the action caused by a high vacuum may be partly due to the increased rate of diffusion of the sulphur vapour, and partly to the removal of a layer of protective gases on the silver. JEAN CALVET, JEAN J. TRILLAT and MILOSLAV PAIČ: The recrystallisation of pure aluminium. Application of the X-ray method to the study of the velocity of crystallisation of aluminium containing 99.9986 per cent of the metal. At 0°C., slight traces of crystallisation appear after 12 hours, and this is still incomplete after 336 hours. At 100°C., recrystallisation is complete after one minute, and at higher temperatures is practically instantaneous. CHARLES DUFRAISSE and MARCEL GÉRARD: Dissociable organic oxides and the anthracene structure. The existence of a photo-oxide of anthracene: its thermal decomposition. According to the theory developed from the study of the rubenes, anthracene should absorb oxygen rapidly under the action of light, forming a compound decomposing on heating but without emitting oxygen. The results of experiments with anthracene are given, fully confirming these views. RENÉ SALGUES: Erythrocytes, hæmoglobin and the globular value in the course of cancerous affections in birds. LÉON VELLUZ: The comparative action of the bile acids on the tetanus and diphtheria toxins: the special properties of lithocholic acid. For the same polycyclic structure, the neutralisation of the diphtheria toxin depends on the number of alcohol groups, whilst this substitution is without influence on the neutralisation of the tetanus toxin. Lithocholic acid is the most energetic agent known as regards neutralisation of the toxin of diphtheria. RAYMOND-HAMET: The non-modification of the sympatholytic activity of yohimbine by the introduction of a double bond in the molecule of this alkaloid.

August 19 (*C.R.*, 201, 437-460). LOUIS BLARINGHEM: The fertility of *Hemerocallis flava* and of its hybrid (*H. flava* × *H. fulva*). HARALD CRAMÉR: The asymptotic properties of a class of chance variables. G. PÓLYA: Integral series satisfying an algebraic differential equation. PIERRE LEJAY and TSAN HUNG CHI: Gravity map of the south-west of China. REZA RADMANÈCHE: Influence of temperature on the electrical conductivity of quartz. PHILIPPE WAGUET: Light emission of mercury arcs under high pressure. From measurements with a photoelectric cell of the light intensities of a mercury arc at varying incidences it is concluded that the colour of the mercury arc varies according to the direction from which it is observed. This complicates the problem of heterochrome photometry when the mercury arc is used as a light source. GEORGES FLUSIN and CHRISTIAN AALL: The study of the system calcium carbide, calcium oxide. G. DEDEBANT, PH. SCHERESCHESKY and PH. WEHLÉ: The theory of the general circulation of the atmosphere. The law of the rotation and the field of pressure. FERNAND ARLOING, ALBERT MOREL and ANDRÉ JOSSELAND: The action on tumours, in intravenous injections, of soluble chemical products in which iron is associated with vitamin C (ascorbic acid).

LENINGRAD

Academy of Sciences (*C.R.*, 2, No. 9, 1935). L. G. MAGNARADZE: The problem of the elastic oscillation of the semiplane. G. M. BAVLI: A generalisation of the boundary problem of Poisson. N. A. SLIOSKIN: Discontinued two-dimensional movement of an ideal gas round a curved obstacle. N. A. DOBROTIN: Distribution in angle of protons projected by neutrons. M. DIVILKOVSKIJ and M. FILIPPOV: Measurement of the intensity of magnetic fields of very high frequency. W. FRÉDERICKS and V. ZVETKOV: Orientating action of an electric field on the molecules of anisotropic fluids. M. P. VOLAROVITCH and A. A. LEONTJEVA: (1) Determination of the specific volume of molten diabase at high temperatures. (2) Determinations of the specific volume of molten salts at high temperatures. P. P. PORFIROV: Determination of the capacity of a polarised mercury electrode. N. P. SMIRNOV: The stimulus to precipitation. N. N. VOROZHCOV, Jun. and A. T. TROSCHENKO: Morphine content in the latex of *Papaver somniferum*. A. E. FERSMAN: The *ek* system (see *NATURE* of August 31, p. 349). S. N. SIMAKOV, N. A. SCHWEMBERGER and O. S. VJALOV: Silurian naphtha in central Asia. N. A. SCHWEMBERGER: Contribution to the problem of the silurian naphtha in Central Asia. M. N. IVANTISHIN: Contribution to the problem of the geochemical zonation in the distribution of metallic elements on the territory of the Far Eastern region. A. G. EBERZIN: The Tchauda layers in the Taman peninsula. O. NIKIFOROVA: The Upper Silurian of Podolia. S. F. CEREVITINOV and L. V. METLICKIJ: Effect of an electric field of high frequency on the keeping qualities of fruit and vegetables. A. V. POPOV: Note on secondary dormancy of *Taraxacum megalorhizon* seeds. T. S. RASS: Some regularities in the structure of eggs and larvæ of fishes in northern seas.

(*C.R.*, 3, No. 1, 1935). I. M. VINOGRADOV: Some rational approximations. I. D. ADO: Representation of Lieschen groups by linear substitution. S. TCHUNKHIN: A generalisation of the theorems

of G. Frobenius and of V. Turkin. A. P. DIETZMANN and A. A. KULAKOV: Some criteria of non-simplicity of finite groups. W. FEDOROV: Uniform functions. S. SHUBIN: Application of the method of the Dirac density matrix to the theory of metals. G. LIANDRAT: Utilisation of a selenium photoelement for the measurement of the ultra-violet solar radiation in the region of 3200 Å. A. M. STEFANOVSKIJ, E. S. TATARSKIJ and N. V. ZELIAKOV: Dependence of the structure of ammonia catalyser upon the conditions of its reduction. V. G. FESEKOV: Photometric analysis of the luminosity of the night sky. N. S. FILIPPOVA: Isotopes of hydrogen in petroleum. P. LAZAREV: Ionic theory of the physiological action of short waves. A. N. PARSHIN: Extracts from the muscle tissue of dog and rabbit. V. P. NEKHOROSHEV: A find of Upper Palæozoic marine deposits in the Zaisan basin. M. E. NEUHAUS: Data concerning crossing-over between the X and Y chromosomes in females of *Drosophila melanogaster*. B. K. STEGMANN: Distribution and geographical variation of *Saxicola torquata*.

ROME

Royal National Academy of the Lincei, April 28. G. ROVERETO: The Montenotte series as a constituent element of the Western Alps and of the Apennines. M. RENATA FABBRI: Differentials of higher order. L. ROTH: The regularity of algebraic surfaces. E. CIANI: A sizigetic bundle of cubic surfaces (1). A. DE MIRA FERNANDES: Compound tensorial derivation in non-point spaces. TH. MOTZKIN: Some characteristic properties of convex ensembles. N. W. AKIMOFF: Considerations on propulsive efficiency. C. TOLOTTI: Typical case of dynamic universes endowed with complete symmetry about a centre. The field-equations of a universe showing complete symmetry about a point have been derived previously, the only hypothesis made being the existence of suitable co-ordinates with respect to which the propagation of light is isotropic. Further assumptions now made are that such isotropy holds with respect to substantial co-ordinates (connected with the moving matter) and that, in such co-ordinates, the velocity of light is independent of position. Under these conditions, the gravitational equations are shown to relate necessarily to a completely homogeneous universe. G. PICCARDI: The atmospheres of the planets. A hypothesis is advanced to explain the fact that the atmospheres of the planets near the sun are characterised by oxygen compounds and those of the more distant planets by carbon-hydrogen compounds. T. FRANZINI: The diffusibility of deuterium into metals. The displaceability of occluded hydrogen by an electric field is confirmed, and the absence of a similar effect with deuterium is shown. Further work is necessary to decide whether deuterium is adsorbed, but not absorbed, by palladium; or neither adsorbed nor absorbed; or absorbed, but not displaceable. R. MANZONI ANSIDEI: The Raman spectra of the isomeric nitrotoluenes. The measurements made confirm those published by Kohlrusch, Dadiou and Jele in 1931. G. PICCARDI: (1) The spectrum of neodymium oxide vapour. (2) The spectrum of samarium oxide vapour. C. ACQUA: The nature of ultra-viruses. From a review of the evidence available, the conclusion is drawn that filterable viruses have an auto-catalytic action. A. MESSERI: The organising power of wood and of the primary phloem.

WASHINGTON, D.C.

National Academy of Sciences (*Proc.*, 21, 507-516, August). E. C. MACDOWELL, M. J. TAYLOR and J. S. POTTER: The dependence of protection against a transplantable mouse leukaemia upon the genetic constitution of the immunising tissue. Two strains of mice were used. Embryonic tissue from one strain induced resistance in all cases; that from the other failed to induce resistance in its own strain; embryonic tissue of hybrids of the two strains are as successful as the first. J. W. ALEXANDER: (1) On the chains of a complex and their duals. (2) On the ring of a compact metric space. ALFRED J. MARIA and ROBERT S. MARTIN: On the representation of positive harmonic functions. M. H. ELLIOTT and W. C. TREAT: Hunger-contractions and rate of conditioning. Hunger-contractions, visible in rats with stomachs transplanted to a position just below the skin, were found to coincide with periods of activity. Rats with such hunger-contractions were able to learn to respond to a conditioned stimulus (an electric light) more quickly than animals which had received food.

Forthcoming Events

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

Sunday, October 6

BRITISH MUSEUM (NATURAL HISTORY), at 3 and 4.30.—Miss M. R. J. Edwards: "Animals and Man".*

Monday, October 7

BRITISH MUSEUM (NATURAL HISTORY), at 11.30.—J. Ramsbottom: "Fungi and their Mode of Life".*

Official Publications Received

Great Britain and Ireland

Department of Scientific and Industrial Research: Food Investigation. Leaflet No. 6: The Refrigerated Gas-Storage of Apples. By Dr. Franklin Kidd and Dr. Cyril West. Pp. 12. (London: H.M. Stationery Office.)

Sixteenth Annual Report of the Ministry of Health, 1934-35. (Cmd. 4978.) Pp. xii+350. (London: H.M. Stationery Office.) 5s. 6d. net.

Transactions of the Royal Society of Edinburgh. Vol. 58, Part 2, No. 17: The Endodermis in Light-grown and Etiolated Shoots of the Leguminosae—A Contribution to the Causal Study of Differentiation in the Plant. By Dr. G. Bond. Pp. 409-425+1 plate. 2s. 6d. Vol. 58, Part 2, No. 18: Rare and New Ostracoderm Fishes from the Downtonian of Shropshire. By Prof. Leonard J. Wills. Pp. 427-447+7 plates. 5s. (Edinburgh: Robert Grant and Son; London: Williams and Norgate, Ltd.)

Other Countries

Veröffentlichungen des Geophysikalischen Instituts der Universität Leipzig. Serie 2: Spezialarbeiten aus dem Geophysikalischen Institut und Observatorium. Band 6, Heft 3: Temperaturverhältnisse und Windsystem eines geschlossenen Waldgebietes. Von Horst Günther Koch. Pp. 121-175+2 plates. Band 6, Heft 4: Die physikalische Arbeitsweise des Gallenkamp-Verdunstungsmessers und seine Anwendung auf mikroklimatische Fragen. Von Katharina Dörfel. Pp. 177-222. Band 6, Heft 5: Instabile Schichtungen der Atmosphäre und ihre Bedeutung für die Wetterentwicklung im Königsberger Gebiet. Von Gerhard Seifert. Pp. 223-379+34 plates. (Leipzig: Geophysikalisches Institut der Universität.)

Zakład Astronomii Praktycznej Politechniki Warszawskiej (Institut d'Astronomie pratique de l'École polytechnique de Varsovie). Publication No. 13: Pomiar mikrofoto-metryczne gwiazdy zmiennej SU Draconis w latach 1931-1934 (Mikrophotometrische Messungen des veränderlichen SU Draconis in den Jahren 1931-1934). Napsali F. Kępiński i M. Kowalczewski. Pp. 18. (Warszawa: Politechniki Warszawskiej.)

Annales de l'Institut de Physique du Globe de l'Université de Paris et du Bureau central de Magnétisme terrestre. Publiées par les soins de Prof. Ch. Maurain. Tome 13. Pp. iii+144. (Paris: Les Presses universitaires de France.)

Report on the Zoological Survey of India for the Years 1932 to 1935. Pp. iii+lx. (Delhi: Manager of Publications.) 1.2 rupees; 2s.