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Industry and Research Endowment

IT was formerly a matter of some concern in Great Britain that scientific research, both pure and applied, had not that liberal endowment which it enjoys in the United States, and this is still very often the subject of rather invidious comparison ; although, from the point of view of Government grants, scientific research has recently suffered perhaps even more drastic cuts in the United States than in Great Britain. An investigation of the real position in regard to post-graduate scholarships recently undertaken by the Society of Chemical Industry—the results of which have just been published in the Society's *Journal*—show, however, that so far as scholarships are concerned, the youth of Great Britain is fairly well served. Whatever may be thought of the Government's action in withdrawing a few thousands from the vitally important endowment of research, one may still find some hope and stimulation in the long and growing list of private endowments.

It is not claimed for the lists issued by the Society of Chemical Industry that they are complete, but even so they are sufficiently impressive, and represent an annual value of nearly £30,000. Two tables are given, the first showing particulars of those scholarships of fairly wide and general scope and open to any graduate with the necessary qualifications, and the second relating to those of more restricted and local interest. The first includes many that are tenable at foreign universities, of a total annual value of about £2,500, the most important being the Commonwealth Fund fellowships, each of an annual value of £600 for three years, available up to the age of thirty years. The largest section in this first table is that dealing with grants not limited to special subjects, of which the most valuable is one of £800 a year for four to eight years, granted by the Royal Society. Here also are to be found many grants by British universities, the Institute of Chemistry, the Leverhulme research fellowships (£12,000), the Salters' Company fellowships and many others, the whole totalling £16,800 a year. In the section comprising those which are limited to special subjects, the Armourers and Brasiers' Company is well represented, together with other London livery companies, and the Gas Light and Coke Co. and so on. The total value in this section is about £2,600 a year.

Table 2 is made up mostly of purely local grants by universities, including those of the Carnegie

Trust for the Universities of Scotland, and one or two by the London Companies, such as that of the Goldsmiths' Company, a senior studentship worth £250 for one or two years. The total value per annum is more than £6,000.

The Society of Chemical Industry quite rightly points out that there was never a time when greater opportunities for higher education and research were presented to candidates in Great Britain possessing qualifications adequate for their proper use. The primary schools are free to all, scholarships available at secondary schools and at the universities abound, and for the graduate the provision made is not meagre, although—in view of the intimate connexion between training and practice in scientific research and the future state of industry—many would gladly see it increased out of all recognition.

This point cannot be too strongly emphasised. Admittedly the provision is not meagre, and appears to be slowly getting better; but such are the complexities and difficulties of modern industry, that more and more of the best trained minds must be encouraged to enter its ranks and qualify for leadership, and the portals of this great realm of industry must be opened still more widely and invitingly, through the paths of education and scholarship. Those who have the interests of trade and industry at heart cannot do better than support these endowments in every possible way. The training and research needed are not those devoted to the service of production only, such as chemistry, physics and engineering, but rather those of the organiser and director, especially in the complex field of distribution.

Psychology at Oxford

IT is gratifying to note that Dr. William Brown, Wilde reader of mental philosophy at Oxford, has (in two recent articles contributed to the *Oxford Magazine*) raised a protest against the virtual exclusion of psychology from the list of studies pursued at that University. For many years, Oxford has been practically the only important seat of learning which has refused hospitality to that young but vigorous branch of science, and in the course of its consistent opposition it has been instrumental in causing Great Britain to lose two psychologists of the first rank—Edward Bradford Titchener, an Oxford man, who after studying at Leipzig with Wundt in the pioneering days of psychology as an experimental

science, found that he was unable to arouse any enthusiasm for the subject in his own University and was compelled to take up a position in the United States, where for many years he was professor at Cornell; and William McDougall, who, after being himself Wilde reader at Oxford, was tempted to leave that position by the far greater facilities for teaching and research offered by a chair at Harvard.

Pupils of McDougall some few years before the War, believe that the 'peak' of psychology teaching at Oxford was then reached. At that time McDougall was given temporary use of six good rooms in a new extension of the Physiology Department. In addition to his official lectures, he would meet a very small group of some half-dozen students in these rooms for discussion and experimentation, and some research was done in this 'psychophysics' laboratory, as it had then to be called, in deference to the objections to psychology. Largely through McDougall's efforts, one imagines, the important (post-graduate) John Locke scholarship was awarded several times to students whose chief interests were psychological rather than philosophical—and all these students have justified the award, inasmuch as they have made psychology their life-work and are now among the recognised British exponents of this science. Since that time, however, the scholarship has been given only to philosophers. Unfortunately, moreover, the rooms occupied by McDougall for this brief period were taken over for other purposes during the War and were never restored, nor was any adequate accommodation elsewhere provided, so that to-day the opportunities for study and research are inferior to what they were twenty-five years ago.

As Dr. William Brown points out in his articles, the Wilde reader of mental philosophy in the University of Oxford is prevented by the conditions of his post from teaching that ever-growing part of his subject to which the more precise methods of scientific experiment are applied, so that the field within his purview is tending to become more restricted as time passes. Provision for informal supplementary instruction, such as McDougall used to give, therefore becomes all the more important (pending the creation of more satisfactory arrangements for official teaching), and it must surely be a matter for regret to many friends of Oxford that even such small opportunities for teaching the more exact methods of the science, as formerly existed, have been lacking now for nearly twenty years.

Classical Gaseous Discharge Phenomena

Conduction of Electricity through Gases. By Sir J. J. Thomson and Prof. G. P. Thomson. Third edition. Vol. 2: *Ionisation by Collision and the Gaseous Discharge.* Pp. viii+608+6 plates. (Cambridge: At the University Press, 1933.) 30s. net.

CAN a new garment be made out of old material? This is the problem which the authors have set themselves; and it must be admitted that they have not succeeded. They have produced an interesting and valuable work, but it is not a new book. It is a patched garment, not a new creation. The original volume was inspired. A master unfolded before our eyes a new picture, much of it his own handiwork, of the nature of electricity and the mechanism of electric conduction in gases. The charm and clarity of this picture were preserved in the amplified second edition, and to a large extent in the first volume of the present, third, edition, which appeared in 1928. In this volume the original text was incorporated, practically unchanged, and the new cognate material added in separate, decimally numbered paragraphs. The second volume, on the other hand, containing less than fourteen per cent of the original text, has insufficient to carry the spirit of the old work, yet enough to mar the continuity of the new. At times the book attains pace, especially when dealing with elastic collisions of electrons and atoms, where the fire of the pioneer's zeal flashes brightly. Most of the chapters, however, are collections rather than narratives; and it is inevitable that they should leave the reader with a certain sense of confusion rather than a clear picture.

In spite of this criticism, the book has much to recommend it. It is very readable, being descriptive in outline rather than analytical. In this respect the authors have followed the maxim expressed in their preface to the first volume, that "Perhaps after all Science is more easily digested when it is lightened by something less formidable than mathematical analysis or the precautions which must be taken to get the greatest accuracy in the determination of physical constants". At the same time it is a reliable and accurate scientific account of the major discoveries in this important field. In the twenty-seven years that have elapsed since the second edition, only two summaries of importance have appeared: the "Gasentladungen" of Seeliger (Barth, Leipzig, 1927), and the unfinished "Electrical Discharges in Gases", by

Langmuir and Compton, in *Reviews of Modern Physics* (2, 123-242, April, 1930; 3, 191-257, April, 1931). In view of the enormous scientific advances in this line, the present volume will be welcomed by all scholars and students, as well as by technical workers.

The subject matter of the third edition of the whole work is so divided that its two volumes correspond to the first and second halves, respectively, of the original edition. The first volume, published five years ago, contained the mathematical theory of conduction in ionised gases; measurement of recombination and mobility; determination of e/m and e ; and ionisation by incandescent solids, flames, and light. The ten chapters of the second volume cover the collision methods of producing ionisation, including the related phenomena of excitation, scattering, and secondary emission; ionisation by X-rays and chemical action; a detailed discussion of the glow discharge; and one chapter each on the spark and arc discharge.

It is significant that the book begins, after a brief historical sketch, with a description of the wave properties of cathode rays, which is made the basis of the following chapters on scattering and reflection. The discussion of these phenomena is essentially non-mathematical, clear, comprehensive, and up-to-date. Data are analysed and compared with theory where one exists. The same characterisation applies to the treatment of ionisation by positive ions and X-rays.

Nearly one third of the book is devoted to the glow discharge. This long chapter, which is divided into twelve sections, is a non-homogeneous mixture of old and new, pure description and mathematical analysis. Here the amateur may find all kinds of glows described and explained. But the chapter is rather unsatisfactory, and from the scientific point of view much of it seems irrelevant. In this and the following two chapters the reader is given an embarrassing choice of good and bad data; and the emphasis, when expressed, is frequently on the old and unreliable. Thus, on p. 398, a whole page is devoted to the old pioneer measurements of electron density in the glow discharge. This is a subject that has been much studied during the past few years; yet only a single line is accorded the measurements of Compton, Turner and McCurdy, by the most up-to-date methods, and equal weight is given, in the next sentence, to a very questionable method leading to an opposite conclusion.

A major omission of the volume, which cannot pass unnoticed, is the important subject of low pressure arcs. The omission is conspicuous for two reasons: first, because of the technical importance of this field, which is at present greater than that of any other type or phase of electric conduction in gases. Perhaps it was for this reason that the authors avoided it, though such an attitude seems unnecessarily academic. The second reason, a still more important consideration, is that this is the one branch of gaseous discharge in which intensive research during the past ten years has resulted in a fair scientific understanding of the processes involved, and reliable methods of measurements. The theory of the correct use of probe electrodes, for example, should find a place in any treatise on gaseous discharges. But perhaps the field of low voltage arcs is so large as to merit a separate treatise.

Sir J. J. Thomson's "Conduction of Electricity through Gases" has been a classic authority for thirty years. The new third edition falls somewhat short of this high standard, and it is doubtful if it can occupy such a position. But as a book of the day it is the best available, and satisfies a much-felt need.

ALBERT W. HULL.

Modern Pharmacy

- (1) *The Science and Practice of Pharmacy*. By R. R. Bennett and T. Tusting Cocking. Vol. 1: *Pharmaceutical Operations and the Manufacture of Pharmacopœial Substances*. Pp. viii+385. 18s. Vol. 2: *The Physical and Chemical Examination of Pharmacopœial Substances*. Pp. viii+339. 18s. (London: J. and A. Churchill, 1933.)
- (2) *The Chemistry of Drugs*. By Norman Evers. Second edition, entirely revised and enlarged. Pp. 256. (London: Ernest Benn, Ltd., 1933.) 55s. net.
- (3) *Indigenous Drugs of India: their Medical and Economic Aspects*. By Lieut.-Col. R. N. Chopra. Pp. xxii+655. (Calcutta: The Art Press, 1933.) n.p.

(1) **T**HE principles involved and the apparatus used in the various pharmaceutical processes are simply explained in the first part of vol. 1 of "The Science and Practice of Pharmacy". Change of state, solution, osmotic pressure, etc., are treated with the minimum of reference to the physico-

chemical principles upon which a proper understanding must be based. In fact, the whole work has been written on the assumption that students receive adequate training in the cognate sciences. In view of the undoubted difficulty that students experience in correlating various parts of knowledge, it is a moot point whether it is wise to dissociate the 'pure' from the 'applied' to such an extent.

Practical pharmacy, as interpreted in this volume, is largely the concern of the manufacturer, the emphasis throughout being placed on large-scale operations. Part 2 is devoted to the preparation of the official galenicals and also includes certain of the more important unofficial preparations. The explanations offered are simple and, in most cases, adequate. Part 3 treats the principles of sterilisation and the preparation of medicaments for parenteral administration. This section would have been improved by a slight amplification of the biology of bacteria.

The second volume is devoted to the explanation of the physical and chemical examination of official substances and its scope is limited by that of the "British Pharmacopœia". When considered as a simple explanatory commentary on the "Pharmacopœia", this volume achieves its object and should prove useful as a reference book for students. On the other hand, its suitability for use as a textbook in practical pharmaceutical chemistry is more doubtful. Such a book should deal with general principles illustrated by reference to official substances (or substances in frequent use in medicine), whereas this volume applies the general principles to the explanation of individual monographs. The methods of treatment and classification are those of a work of reference rather than those of a textbook.

There are many examples in the "Pharmacopœia" where the details of the methods of analysis require amplification for the student, and there are a few cases where the methods are either inapplicable or yield inaccurate results. Vol. 2 could have been made more valuable if the authors had offered more assistance in the practical application of the quantitative work—it contains little more information in this respect than can be found in the pages of the "Pharmacopœia" itself.

The information contained in these volumes is dependable, though conventional, and mistakes are practically non-existent. It is untrue, however, to state that all carbon compounds containing an asymmetric carbon atom have the power of rotating

a ray of polarised light, and a wrong impression is created by the statement that the hydrolysis of salicin yields lævo-glucose. Lævo-glucose might be interpreted as the mirror image of *d*-glucose.

These volumes offer the qualified pharmacist an opportunity to gain an understanding of the new edition of the "Pharmacopœia". The subject matter is presented in a very readable form and the illustrations are many and more than adequate.

(2) The first edition of "The Chemistry of Drugs" was published in 1926 and achieved success, as it served the useful purpose of presenting in one volume information which previously was widely dispersed through the literature. The new edition contains about the same number of words and the plan of treatment remains as before, but many additions are to be found amongst the hypnotics and antiseptics—particularly with respect to medicinal dyes. The revision has also included a careful pruning of unimportant matter and the whole has been thoroughly overhauled. Thus the information concerning the opium alkaloids, strychnine, ergot, etc., has been brought up to date and the section on ureides rearranged and extended. Throughout the work there are occasional and slight incursions into the relationship between chemical constitution and therapeutic action. This aspect of the subject should either be amplified or excluded as the present treatment is several degrees less than half-hearted.

Only two mistakes have been found, namely, the formula for β -eucaine on p. 25 and the use of the butylene-oxide-(furanose-) structure for the normal glycosides and for α - and β -methylglycosides. The chapters on the vitamins and hormones are new and, although not exhaustive, summarise adequately the information which is at present available. Throughout the book, sufficient references to the most important work on the various subjects are given to enable anyone to compile complete bibliographies.

(3) Prof. Chopra and his collaborators have been working for many years on the chemical, pharmacological and clinical examination of drugs indigenous to India, and the volume under review contains their results in a summarised form. It constitutes a plea for the recognition of the undoubted importance of India as a source of crude drugs and for an immediate and extensive growth of the manufacture of pharmaceutical galenical preparations in India. In both these respects the book should go far to achieve its aims, as a very strong case is formulated.

Some eighty-seven official drugs, or closely allied drugs, are indigenous or can be easily grown in India. The species allied to the official drugs have been compared and contrasted with the official drugs. An interesting section of this work deals with the results obtained by the examination of those drugs which are used in indigenous medicine. Often the findings belie the reputation possessed by the drug, but hope remains that one or more of these drugs may yet contribute something to modern medicine.

It is not possible to criticise the details of the practical results quoted as this would necessitate a critical examination of a large number of original papers; but there is no doubt that the book will serve a useful purpose in directing attention to the resources of this part of the Empire and should prove stimulating to further research along similar lines.

Fruit Cultivation

Orchard and Small Fruit Culture. By E. C. Auchter and H. B. Knapp; Second edition. Pp. xix + 584. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1932.) 31s. net.

THE modern tendency in agricultural research of whatever kind is towards improvement in quality rather than quantity. It is true that improvements in cultural practice aimed at improving quality may often show their most striking effects in increased yields, but if they do not succeed in their primary object they may well be uneconomic. In the present position of over-production, or, as some economists insist, under-consumption, a smaller quantity of a high-grade product, commanding a good price, is far more desirable to the grower than a large crop which can only be sold at a very low price because it is only at or below the general level of quality. Particularly is this true in the case of fruit production.

In recent public correspondence, a writer has even gone so far as to say that the growing of dessert apples in Great Britain is uneconomic, since we cannot produce an apple of this type equal to imported varieties. Sir Daniel Hall demonstrated the falsity of this and declared that we can and do produce dessert fruit as good as, or better than, the highest grade of imported American or South African products. It is true, however, that a great deal of the English-grown fruit that finds its way to the small fruit shops is

of poor or even lamentable quality. In the United States the quality of the fruit is of paramount importance, the value varying from 3.50 dollars per barrel for the higher grades to 1.74 dollars for the poorer, excluding culls and fruit only suitable for cider-making, which may bring in only 60-70 cents a barrel. This demand for and resultant improvement in quality is reflected in the United States official production figures. In the five years 1917-21, the commercial production, that is, the part of the crop sold for consumption as fresh fruit, averaged 48 per cent of the total crop, while for the five years 1927-31 the average was 57 per cent, without any appreciable increase in total production.

In Messrs. Auchter and Knapp's book emphasis is laid throughout on this factor of quality. The book is intended primarily for use by students in American colleges of agriculture, but there is much that might usefully be learnt from it by anyone interested practically, financially, or scientifically in the art and science of fruit production. Part I of the book begins with a long chapter on harvesting, storing, and marketing, a somewhat unusual opening for a textbook of this kind, but very appropriate in view of the stress on quality. A

clear understanding of what is required in the final product is surely needed before one can follow the steps taken in its attainment. Thereafter the book proceeds on orthodox lines through establishment of the orchard and a consideration of the elementary biology and physiology of the tree, to control of pests and diseases, propagation, and general cultural practices. Part I ends with a chapter on exhibiting and judging fruit. Part 2 deals more briefly but still adequately with the cultivation of small fruits. Throughout the book, long lists of references to books and scientific papers are given. Although the book is primarily intended for use in the United States, it is perhaps unfortunate that these references are almost exclusively American. After all, work on fruit cultivation has been done in other countries and some part of this is worthy of consideration even in the United States.

The book, first published in 1929, is already in its second edition, which demonstrates its value as an educational textbook. Misprints are rare, but even so, such a misprint as "*Heteridera radicola*" for "*Heterodera radicolica*" on page 487 should not have been allowed to persist into a second edition.

R. H. STOUGHTON.

Short Reviews

Die Tierwelt der Nord- und Ostsee. Herausgegeben von G. Grimpe. Lieferung 22. Teil 6.a: *Archiannelida*, von A. Remane; Teil 7.c₂: *Phoronidea*, von Carl I. Cori; Teil 10.g₂: *Euphausiacea*, von C. Zimmer; Teil 12.k₁: *Cetacea*, von Ludwig Freund. Pp. 36+101-132+9-28+64. (Leipzig: Akademische Verlagsgesellschaft m.b.H., 1932.) 13.60 gold marks.

THE present issue of "Die Tierwelt" contains the Archiannelida by A. Remane, Phoronidea by Carl I. Cori, Euphausiacea by C. Zimmer and Cetacea by Ludwig Freund. With all these well-known authorities, it is not surprising that we have an unusually valuable addition to this work which is now fairly on its way to completion.

There are four species of *Phoronis* in the area, *Actinotrocha branchiata* being the larva of *Phoronis mülleri*. As the archiannelids have not been collected exhaustively in the North Sea and Baltic, the author deals with all European forms. Both monographs include the anatomy, biology and life-histories so far as they are known and are well illustrated. The six species of Euphausiacea are adequately described, information on the larvæ of most of them being available and included.

The Cetacea are described in great detail and the sixty-four pages are full of facts condensed

into a wonderfully small space. Besides the anatomical, biological and systematic part with simple but good figures which enable one to identify the species, the food in all cases is given, chemical analyses of those parts which are of commercial importance and lists of parasites both external and internal. There is a key for the identification by their external features of the whales of this area; moreover, an unusual feature is a long and excellent list of literature, well chosen and carefully classified, morphological, physiological and systematic, which gives a special value to this monograph.

Myth and Ritual: Essays on the Myth and Ritual of the Hebrews in relation to the Culture Pattern of the Ancient East. By A. M. Blackman, C. J. Gadd, F. J. Hollis, S. H. Hooke, E. O. James, W. O. E. Oesterley, T. H. Robinson. Edited by Prof. S. H. Hooke. Pp. xix+204+6 plates. (London: Oxford University Press, 1933.) 10s. 6d. net.

It will be gathered from the sub-title of this book that the method of approach is anthropological rather than theological. The authors of these essays, originally delivered as public lectures in the Universities of Oxford and London, are neither 'fundamentalists' nor members of any

school of Higher Criticism, at least in so far as their contributions to this volume are concerned.

A semi-popular, but thoroughly scholarly account is given of myth and ritual, or rather of that part of it of which the Isis-Osiris-Horus myth may be taken as the type, in the ancient East—Egypt, Babylonia, Canaan—and the Hebrew evidence, archaeological as well as Biblical, is examined to show how far the traces therein of ancient myth and ritual conform to the pattern. The Biblical texts were so thoroughly worked over by later generations for the purpose of eliminating traces of earlier beliefs, that it is surprising to find that there is so much, rather than so little, that lends itself to reconstruction. Reference in this connexion may be made to the chapter on "The Sun-Cult and the Temple at Jerusalem" by Dr. F. J. Hollis.

This little book will serve an admirable purpose if it stimulates interest in Biblical studies from what, to most readers, will be a new point of view; while the anthropologist who is not a specialist in the fields here surveyed will find in the various chapters good summaries of current knowledge and theory.

The Underworld of India. By Lieut.-General Sir George MacMunn. Pp. 284+16 plates. (London: Jarrolds (Publishers) London, Ltd., 1933.) 12s. 6d. net.

SIR GEORGE MACMUNN knows his India from end to end in an intimate work-a-day fashion that has provided material for a life-like picture of the depressed classes, and will probably give the general reader a clearer idea of the real India than would have been gathered from a more formal treatise. The 'underworld', of which he writes, includes all untouchables and outcastes—the castes of menial occupation, the mendicants, dancing girls, temple and other courtesans, and jungle tribes, as well as the classes whose normal occupations are criminal. Apart from the interest of this description of these characteristically eastern social groups, Sir George's book has the merit of bringing out clearly the place of caste in social relations—a very real foundation of opposition to the political claims of Hinduism—and the place of sex in Hindu religious thought and social life—a constant and deep-rooted pre-occupation, which gives them an orientation fundamentally divergent from that in a European society.

It is unfortunate that in a book, in which so much is excellent, a little care was not given to the revision of the text. Some of the author's remarks on ethnological points require more precise statement or some qualification, misprints are frequent—"polygynny" in its context is almost humorous—the punctuation is erratic and the meaning often obscured by the omission of a word or words not always easy to supply.

Plant and Animal Ecology. By J. W. Stork and Prof. L. P. W. Renouf. Pp. ix+197. (London: John Murray, 1933.) 5s.

THIS is the first attempt we have seen at combining plant and animal ecology. It is clear that a work of this sort is required now that we are sensibly tending away from the old-fashioned natural history and the too well-established separate botany and zoology courses towards a broader study of biology—the only truly scientific examination and appreciation of the fundamentals of life.

The material is conveniently classified (plant and animal together) into the various familiar 'associations'. Though the authors disclaim any attempt at completeness, much useful information is packed into a small volume; and the material is well chosen, clearly described and well illustrated by some diagrams and many more photographs. A brief survey of plant and animal classification is appended, as also are useful hints on collecting and, even more important, a bibliography.

The book may be recommended to students of elementary biology and to all field naturalists. Both authors are well-known biologists and teachers with plenty of practical experience to their credit, which makes one all the more sure of a useful addition to elementary biological literature.

Le Leggi di Mendel e i cromosomi. Opera premiata dalla Pontificia Accademia delle Scienze i Nuovi Lincei. Per Paolo Enriques. Pp. ii+225. (Bologna: Nicola Zanichelli, 1932.) 25 lire.

THIS volume by the late Prof. Enriques is a text covering the field of Mendelism from the cytological point of view. Although dealing mainly with zoological material, there are numerous references to plants as well. The book contains eleven chapters and a bibliography. The results of modern genetic cytology are clearly set forth in the form of nine 'laws', a separate chapter being devoted to each. These include, for example, the laws of heterozygosis, segregation, independence in variability, sex determination, synapsis and interference of the genes. The work will no doubt be useful in spreading a knowledge of the cytological bases of Mendelian heredity among Italian biologists.

Elementary Chemical Arithmetic. By R. H. Gibbs. Pp. 96. (London: Edward Arnold and Co., 1932.) 2s.

THIS small manual is characterised by the care which the author has taken to make clear all matters which give difficulty to beginners. The descriptive text and definitions are very concise and accurate, and the worked examples are set out in a very satisfactory fashion. The examples for exercise are both numerous and well chosen, and the book can be recommended strongly to School Certificate and Matriculation candidates as well as to junior students in the universities.

Insect Fauna of the Seychelles*

THE insect fauna of the Seychelles is one of exceptional interest, and the general conclusions arrived at by Dr. Hugh Scott in his recent paper on the subject, who himself collected much of the material on which these were based and has since been working at it for many years, are of great importance.

The Seychelles are small islands, their land area less than 160 square miles, the Hawaiian group, with which, for certain purposes, their fauna is compared, being forty-three times as large. We are told that only about five square miles of unbroken areas of endemic forest remained at the time when Dr. Scott was collecting there in 1908-9 as a member of the Percy Sladen Trust Expedition to the Indian Ocean, the three larger islands which held these patches of forest having an area of nearly ninety square miles.

As might be expected, nearly all the endemic insect fauna is now to be found in these small patches, and it is impossible to conjecture how many species may have been exterminated since the islands were first discovered and the lower forests were destroyed. In spite of this destruction, no less than 215 endemic genera and 1,366 endemic species of insects have been collected, showing that the existing fauna is much richer than might have been expected.

As well as the fauna of the Seychelles those of the neighbouring islands and archipelagoes of the Western Indian Ocean are also considered, and in the introduction Dr. Scott remarks: "The problem presented by all these islands and their faunas may be thus stated: What do the isles and submerged banks of the Western Indian Ocean betoken? Do they indicate a former land connexion between Southern Asia and Africa, either by way of Madagascar or independently? Are their faunas relics of the animal life of such a vanished land? Or if not—if the islands have always been remote specks of land, populated by immigrants from across the ocean, whence come these immigrants? Are the granite mountains of the Seychelles, rising out of the sea, but the worn-down remnants of a much vaster country, and if so, was it part of the above-mentioned Africa-Asia land connexion? How far is the fauna of the endemic forests itself endemic, and with what regions has it affinities? All these questions, and more, arise, and the attempt to answer them is made in the following pages."

A very interesting and detailed comparison is given between the insect fauna of the volcanic Hawaiian group, as representative of oceanic islands, and that of the Seychelles. Very great differences are shown to exist, the Hawaiian fauna (excluding obvious importations by man) being much more highly endemic, but much less varied in the forms of which it is composed. In this investigation the

Coleoptera are specially considered. It follows that the comparatively insignificant remnant of forest in the Seychelles yields a much greater variety of endemic beetles than would be found in any similar area in Hawaii. There are fifteen families of this order occurring in the Seychelles that are absent from the Hawaiian group, though Dr. Scott says that he sees no *a priori* reason why they should not occur there. Without doubt some of the endemic Seychellean beetles are such as one would not expect to occur naturally in remote oceanic islands. Such differences between the faunas are believed to indicate the continental or subcontinental nature of that of the Seychelles, this fauna being characterised by large numbers of families and genera, though now but a remnant. In some respects, however, the Seychellean insect fauna approximates to what one would expect if the islands were oceanic or at least had originated from a land not easily populated from other countries. One is surprised at the poor representation of groups of insects that flourish in all sorts of climates and at the total absence of families that are ubiquitous and more or less dominant in continental lands.

In the five great orders of insects, the great preponderance of the Coleoptera in both the Seychelles and Hawaii is noted. In the case of the latter, this is probably due to the fact that Coleoptera, or at least such forms as originated the Hawaiian fauna, can be transported across great expanses of ocean more successfully than other insects. Certainly the ancestors of most of the existing Hawaiian beetles could only have reached the islands in driftwood, and the arrival and establishment of an immigrant species would very rarely happen, the position of the islands being notably unfavourable for receiving drift from other lands. Even such widely-spread tropical plants as *Calophyllum*, *Barringtonia* and *Terminalia* have failed to reach the group by natural means, though the first-named was brought there by the natives, before the arrival of the white man. In more favourable circumstances, Hawaii might have possessed as varied a Coleopterous fauna as the Seychelles.

While the latter islands have an insect fauna with Oriental or Indo-Australian affinity overwhelmingly strong, yet important elements show Madagascan, African and Mascarene affinities. Similarly, the Hawaiian fauna is made up of elements derived from all sides, from America, the Oriental region and the Australian, but with such important elements from each that one can scarcely say that the affinity with any is overwhelmingly strong.

Dr. Scott gives us much information of general interest concerning the Seychellean insects, their generally small size and inconspicuousness, the reduction of wings and eyes—both of which are much less remarkable than is the case with the

*"General Conclusions regarding the Insect Fauna of the Seychelles and Adjacent Islands," by Dr. Hugh Scott (*Trans. Linn. Soc., Zoology Ser. 2*, vol. 19, Pt. 3, pp. 307-391, Pl. 17-23, March 1933).

Hawaiian—and on other subjects. He made an intensive study of the species that live between the leaf-bases of palms and *Pandanus*, these yielding an extensive fauna, comparable with that found in connexion with the bromeliaceous plants of the neotropical region. This Seychellean fauna consists of representatives of 6 orders, 28 families, 54 genera and 76 species, only six of the latter being known outside the islands. In Hawaii, the *Pandanus* grows only below the range of endemic beetles, as now existing, and the endemic palms of the genus *Pritchardia* are found in few localities and have not been specially investigated, but the climbing *Freyinetia* of the wet forests and the

liliaceous plant *Astelia* take the place of the *Pandanus* and palms of the Seychelles and probably have a microfauna of their own at least as rich as the others. This fauna has never been enumerated, but consists of many beetles, Carabidæ, Nitidulidæ and cossonid weevils, with highly endemic bugs and Orthoptera, Diptera, Lepidoptera and hymenopterous parasites of some of these. But, as one would expect, this fauna is largely made up of a number of species of few genera. Most interesting of all these are the several endemic dragon flies, which are not represented in the palm and *Pandanus* fauna of the Seychelles.

R. C. L. P.

The Study of Weather Cycles

THE complaint is sometimes made that meteorologists are piling up more routine observations than they can find leisure to discuss. This is but a half-truth; in some matters discussion has outrun observation, and meteorology, having insufficient material of its own, has to requisition the data of other sciences. This is particularly so in the study of periodicities; instrumental readings are mostly of too recent a date to provide adequate material, but fortunately Nature herself has provided several long series of autographic records which show the variation of the seasons over many centuries. The deciphering of these natural records is not always simple, and they need to be expounded by their experts, who in turn may be glad of the guidance of meteorologists. To assist discussion, the Carnegie Institution in Washington has on several occasions organised a "Symposium on Climatic Cycles", and the report of the third of these has recently appeared.*

The most promising material is provided by the annual rings of growth in trees, especially in the great sequoias of the western United States of America, some of which are more than 3,000 years old, and A. E. Douglass, who has made this subject particularly his own, presented a paper on "Evidences of Cycles in Tree Ring Records". The amount of material at his disposal is now so great that it cannot be handled by the usual mathematical methods, and Dr. Douglass has devised a special 'cyclogram' which enables all important periodicities to be distinguished by optical methods. The new instrument has been tested and found to be thoroughly reliable in separating real periodicities from accidental sequences.

The general result of the investigations carried out up to the present is that a number of periodicities have been found in the tree rings, most of which are very nearly simple fractions of small multiples of the sunspot cycle—a result which also came out very clearly in the analysis of the Nile floods. Very important is the 'Hellmann cycle' of about 5·6 years, while European trees

near the Baltic show a pronounced parallelism with the sunspot cycle itself. Other important periodicities are those of about 23 years and 34 years; the former is often divided into five sub-cycles of 4½ years each. Closely as these cycles are related to solar phenomena, however, they are not stable, but come and go in a fashion which hitherto has proved completely bewildering. Fortunately, the tree ring record is so long that Dr. Douglass is now on the track of the laws governing the 'succession of cycles', which, once grasped, will make possible a real step forward towards a theory of climatic change.

For final success, still longer series of data are required, and the best hope of obtaining these appears to be in the succession of annual layers in lake sediments. De Geer's studies of late-glacial clay 'varves' seemed hopeful, but much work still remains to be done before they are fully intelligible, and the 'tele-connexions' between distant regions offer great difficulties. Hence I. Bowman, in a paper on the correlation of sedimentary and climatic records, regards the lakes of the Great Basin of the western United States as more promising, especially in the matter of connecting the tree ring records from the same region with the climatic variations of late-glacial times. Here again a special technique will be required, but owing to the recent great retreat of all the lakes, present conditions are exceptionally favourable.

The obvious relationships between variations in the growth of trees and the sunspot cycle demand inquiry into the nature of the latter. W. S. Adams and S. B. Nicholson point out that sunspots are only an indication of some pulsation in the sun, which is repeated throughout the eleven-year cycle at intervals of six to fifteen months. Variations in the total solar radiation, on the other hand, must come from changes in the sun's average effective temperature, which is not necessarily closely related to the number of spots. Hence the final criterion must be the measurement of the solar radiation itself, after allowing for absorption by the earth's atmosphere, and C. G. Abbot's researches into the variations of the so-called

* *Proc. Nat. Acad. Sci.*, 19, pp. 346-383, March 15, 1933.

'solar constant' are of fundamental importance. His measurements do not yet cover a sufficiently long period to show with certainty whether the eleven-year cycle is clearly developed, but it is significant that, of the shorter periods already determined, several are simple fractions either of $11\frac{1}{4}$ years or of $33\frac{1}{2}$ years. Further, Dr. Abbot and Mrs. Bond find that most of the solar periodicities also occur in the temperatures of widely distant stations in the United States. These minor periodicities may be the 'pulsations' which make up the sunspot cycle, but here again further data are wanted, which only future observations can supply.

The ultimate possibilities of these combined studies seem almost unlimited. In the first place, a successful search for annual layers which can

be identified and dated will extend our accurate chronological knowledge of terrestrial events continually further back into geological history. A foretaste of the latter possibility was given us by Dr. Douglass when he accurately dated certain ancient villages from the annual rings of the trees used in building them. Secondly, we have the promise of a much greater understanding of the complex variations of the sun, ignorance of which has greatly hampered the study of climatic variations in the past and of 'seasonal forecasting' for the future. Finally, given sufficient material, we can hope to relate our ever-changing succession of seasons with these solar variations, and reach a decision on the vexed question of how, and to what extent, the sun affects terrestrial weather.

C. E. P. B.

Art and Mythology in Asia*

AN interesting chapter in the history of religions might be written comparing the methods of the great proselytising faiths and the measure of their tolerance towards other forms of belief with which they have come into contact. In such a comparison Buddhism would rank high; but as the price of its tolerance in the countries of its adoption, it has had to pay in the form of many a strange mutation. In China where there is a tradition, though it has been challenged, that Buddhism was introduced in the first century A.D., the faith had become obscured to such a degree that the pious pilgrims who, in the sixth and seventh centuries, made the arduous journey from China to India were animated not merely by their desire to visit the holy places associated with the founder, but also by their zeal to restore the true doctrine to the followers of Buddha in China.

Of these pilgrims, the greatest, though not the earliest, was Hsüan-tsang, the record of whose travels, equally with the travels of Marco Polo, has been almost a guide-book to modern explorers of the Central Asiatic desert. Setting out for India in 629 A.D., in the early years of the T'ang dynasty, Hsüan-tsang returned to China in 645, having travelled so far as the Bay of Bengal, and penetrated so far south as the Deccan, where he reluctantly abandoned his purpose of proceeding to Ceylon to visit the centres of the Hīnayāna, or southern, school of Buddhism. He records that he brought back with him 657 volumes of the sacred books, of which he himself translated 74 into Chinese, and 150 relics of the Buddha, among which were statues of Buddha in gold, silver and sandalwood. It is needless to stress the influence of these treasures in all subsequent endeavour in China to give material form to the conception of the Master.

The influence of India in the art and religion of eastern Asia in the early centuries of the Christian era can be traced as it flows out in two

directions, in each following early routes of trade and conquest. To the north, penetrating to the Kabul valley, it turned eastward from the ancient kingdoms of Gandhara and Bactria to the oases north and south of the Taklamakan and extending to the borders of China; and thence through China it passed to Japan and to Manchuria and Korea. To the south it followed the line of the seaboard to Further India and the Indian archipelago. In the latter field, Angkor Vat in the modern Cambodia and Bوروبудur in Java, without rivals among Asiatic monuments, have been counted among the wonders of the world.

In the countries of the eastward seaboard, Burma, Siam, Cambodia, in which Buddhism is officially the religion of the people, a composite belief passes under this designation, in which are mingled elements of primitive animism, of Brahmanism and of Buddhism of the *hīnayāna* school, although the earliest form in which the doctrine reached these countries was the *māhayāna* teaching. It is in virtue of this composite character that their religious beliefs have helped to mould the peoples of these lands into something approaching cultural unity.

In Siam, the revival of interest in ancient custom which has been fostered by the ruling family has helped to preserve intact a loyalty to the throne which, as has been shown in recent events, is strong enough to survive constitutional revolution. More especially perhaps has this been due to the resuscitation of the ceremonial spring ploughing by the king or his representative, which has brought home annually to his subjects the traditional identification of the monarch, and his actions with the well-being of the country.

The varied racial strain of the peoples of Further India is reflected not only in modern ritual, but also in legend and tradition, as well as in the monuments and other relics of ancient art. Images of Buddha appear side by side with Vishnu, Siva, Lakshmi and other deities; but

* Continued from p. 160.

there are traces of even more ancient beliefs. Nowhere else in Brahmanic art are the Nāga, the snake symbol of the spirits associated with water, and the Garuda bird, usually associated with Vishnu, so prominent as they are in the countries of Further India. According to Cambodian legend the earliest line of their rulers was sprung from an Indian prince who married the daughter of a Nāga king whom he had met on the seashore, where he had been surprised by the tide. His father-in-law endowed him with a kingdom formed from the land which he had made dry by drinking up the sea; and it was in accordance with this tradition—so it was reported by a Chinese traveller of the thirteenth century—that it was popularly believed that the king in his palace was required nightly to re-enact the ritual ceremony with the spirit of the serpent, lest misfortune should befall.

In the light of this legend the prominence of the conventionalised snake would justify its interpretation as the survival of a primitive cult, which on the ground of the position assigned to the Nāgas in Indian story, might be attributed to the pre-Dravidian people of the Mon-Annamese linguistic group who, on one theory, were the earliest immigrants into Further India; while the Garuda bird, which is consistently represented as hostile to the Naga, might be the cult object of a second wave of immigration belonging to the Tibeto-Burmese linguistic group.

It is not without significance that while the general mass of the people were animists, the upper classes were followers of the Brahmanic deities, either before or contemporaneously with the introduction of Buddhism. This would accord with the introduction of Indian culture by a band of conquering warriors, coming, as the legend would indicate, by sea. It is to be noted further that in the numerous ceremonies which are a feature of the modern religion, and in which there is a considerable element of 'primitive' belief, the ceremonial is conducted by a Brahmanic priest.

In the extension of Indian culture to south-eastern Asia, the modification of belief in adaptation to the temperament and genius of the people finds its parallel in artistic manifestation. There is no mechanical adoption of art forms. Much that is harsh or obscene in Indian art disappears. Even the lingam is highly stylised; while the divine figures, especially of the Buddha, are humanised and brought into harmony with the local physical type.

The question of the extent to which a racial element emerges in the artistic representation of divine persons in Asiatic art opens up an interesting field of inquiry. The differentiation of types is one of the most striking features in the collections made by Sir Aurel Stein at Tun-Huang. Not only do the paintings throw much light on the racial types with which the artists were acquainted, but also they serve to indicate how the two very different styles of representation from China and from the west act and react one upon the other. In the oasis of Turfan, where the paintings show

the relatively fair skins, and in some instances the red hair and blue eyes of the Indo-European Tokharians who still held the oasis in the eighth century of our era, A. von Le Coq noted that while the paintings showed racial modification, the statues of the Buddha were of the traditional type and followed the Graeco-Buddhist style. The explanation was forthcoming in the course of his excavations; for he found that the statues were moulded on earlier prototypes, and numerous examples of the moulds were found. It is possible that the statues brought from India by Hsüan-tsang to China may also have been as closely followed.

While it is true, within certain limits, to say that each of the countries in which Buddhism established itself developed the legend and adapted the doctrines of the Master as best suited its needs, it is also true that it is precisely in those countries in which it has suffered the greatest changes that it has proved most enduring. In India, it was the fact, as Hsüan-tsang noted, that in its later days, Buddhism was favoured by monarchs who concurrently were followers of the Brahmanic rites. In this they were not running counter to the views of the Buddha himself. Yet still the faith failed to resist the onslaught of the Brahmanic revival, through its inherent weakness that as a 'way of life' it did not meet the practical needs of the ordinary man, as did the popular or 'primitive' beliefs which the Brahmans were prepared to absorb and assimilate to the worship of their own deities.

As was seen in the instance of south-eastern Asia the retention there of elements of Brahmanism, and the observance of a ceremonial which derived from the popular religion, gave to Buddhism a strength which enables it in Siam at the present day to require that every man at some period of his life shall live for a time, by entering a monastery, the life of contemplation. In those countries where Buddhism still retains its hold—in Japan, in China and in the Lamaism of Tibet—its appeal lies variably in the degree to which it displays its adaptability, rather than in its inherent strength. Thus in Japan it lives partly by its sectarianism, through which its intellectual interest is sustained, partly by its adaptation to Shinto, elements which make of Japanese Buddhism a most intricate study; in China it survives purely as a monastic religion but without adherents except among those who desire a monastic life with its freedom from practical issues; while in Tibet it is monastic and in part a form of magical belief. Such is the price of survival.

In both China and Tibet the lamas, in adopting the monastic life, follow the tenets of Buddhism in so far that, in theory, they live on alms, although in the wealthier monasteries it may be the alms of the past. In doctrine and ritual practice they approximate to a polytheism or polydæmonism which, although in form an exaltation of the Bhoddisatvas (disciples who in a proximate incarnation will become Buddha), is in derivation

largely of popular origin. In modern China these divine personages have become entirely assimilated to the form of popular belief: they appear as the 'Gods of the Place' of the Buddhist temples; and in their artistic representation, as with other popular deities, full rein is given to the Chinese ability in portraying the imaginatively horrific or grotesque with extreme artistic skill. Little heed is given to the classical serenity of the divine prototype.

When Buddhism was introduced into Tibet in the seventh century of our era, the religion of the Tibetan people was a form of crude shamanism something akin to that which has been recorded among the tribes of Siberia and of which certain features, such as the trance and acute hysteric affection, occur in eastern Asia and the Malay Peninsula.

The cults of 'devil worship' as they have been termed, in reality cults of natural forces, still survive in eastern Tibet, where they have

been organised in imitation of and in opposition to Lamaism. Their significance in this connexion, however, lies in the fact of their incorporation in part in the doctrines of Lamaism and the place given, in consequence, in the iconography of Lamaism to this and the cognate elements adopted from Saivistic doctrine in the form of the 'terrible divinities'. Of these there are eight in number, whose appearance is no less terrifying than the attributes and functions attributed to them in story. Thus *Srīdevī*, the protectress of the two Grand Lamas of Lhasa and Tashilhumpo and the most ardent defender of the doctrine of Buddha, was armed by all the gods, and married the king of the ogres. *Hayagrīva*, the protectress of horses, scares away demons with her neighing; while *Yamāntaka* is a terrible manifestation of the *Bodhisattva Mañjusrī*, who in this form subdued the King of Hell, and so forth. Here is indeed material for profitable study in relation to the original doctrine of the Buddha. E. N. F.

Obituary

DR. H. D. ARNOLD

THE death has occurred at the age of forty-nine years of Dr. H. D. Arnold, director of research of the Bell Telephone Laboratories, New York. Upon completion of his graduate studies at the University of Chicago in 1911, Arnold began what was destined to be a most distinguished, and from a practical point of view, a most far-reaching career of research. His initial problem being to develop a satisfactory telephone repeater, he was the first to recognise the wide potentialities inherent in the de Forest three-electrode audion. Not only did he carry through a complete laboratory study showing the importance of a high vacuum and of the space charge effect, but he also developed theories for obtaining proper physical constants for the valve in the way of input and output impedances and amplifying ratios, and adapted this newly conceived electronic tube to the telephonic problem of long-distance communication by wire and radio. Concurrently, he developed a manufacturing technique for producing in quantities a device of much higher order of vacuum than was known in the lamp industry. For his extensive pioneer work on the three-electrode valve, Arnold was awarded the John Scott medal in 1928.

Later, as director of research of the Bell Telephone Laboratories, Arnold planned and directed an exhaustive study of speech and hearing together with the related problems of recording and reproduction of sound. Economically, the most important outcome of this programme has naturally been the increase of exact knowledge as to the requirements and limitations to be placed upon the transmission of speech in telephone systems. It has also resulted, however, in a surprising number of modern acoustical accomplishments among which the electrical picking-up, recording and

reproduction of sound as employed in the modern improved gramophone, in broadcasting, and in talking films, stand out pre-eminently. The discovery of new magnetic alloys, including permalloy with its surprising properties and with the resulting revolution of the submarine cable art, is equally significant though in another field.

An expert organiser and director of the work of others, Arnold yet possessed in rare degree the qualifications for individual research. He was one of the outstanding authorities in telecommunication and acoustics.

DR. MARY BRODRICK

THE death is announced of Miss Mary Brodrick, who was well known as an Egyptologist. Miss Brodrick entered College Hall, London, as a student in 1888, studying Egyptology at University College, where she was under the tuition of Dr. Stuart Poole and Mr. (afterwards Sir) Peter le Page Renouf. This, however, was not her first introduction to the subject, as she had already studied at the Sorbonne in Paris, taking archaeology and Hebrew under G. Maspero and Ernest Renan. In 1894-96, Miss Brodrick held the Pfeiffer fellowship, lectured at the British Museum and travelled in Italy, Greece and Egypt. In Egypt, where Maspero had recently been appointed director-general of antiquities, she did much valuable work under him, translating Mariette Bey's "*Aperçu de l'Histoire d'Égypte*", editing Brugsch Bey's "*Egypt under the Pharaohs*" and revising Murray's "*Guides*" to Palestine, Syria and the Lebanon. She also rewrote Murray's "*Guide to Egypt*".

Dr. Brodrick served as a member of the Advisory Council and of the Committees of Philology and Literary Archaeology at the Columbian International Exposition, and did much valuable work

in the service of Egyptological studies in America while acting as English honorary secretary for the Egypt Exploration Fund in the United States. These services were recognised in 1893 when the University of Kansas bestowed upon her the degree of Ph.D. In 1896 she was elected a life member of the Bibliothèque Nationale of Paris and life member of College Hall, London.

A further period of strenuous work in Egypt caused a breakdown in health from which Dr. Brodrick never completely recovered, although she continued to lecture occasionally and to write, while keeping closely in touch with the work and affairs of the institutions of the University of London, with which she had been connected. The best known of her works in this later period was "A Concise Dictionary of Egyptian Archæology".

By the death, on July 9, of Mr. William Gamble, at the age of sixty-eight years, the world of printing-art has lost one of its most outstanding figures. His long association with the firm of Penrose and Co. (later A. W. Penrose and Co., Ltd.), and his editorship of the well-known "Penrose's Pictorial Annual", witnessed a period

of striking advance in colour photography and its application to printing. In this field, as in photo-gravure and process engraving, he was a recognised leader, and his technical advice was continually sought after until the time of his death. He was the author of a number of important books dealing with colour photography, engraving, lithography, and music engraving. He was a fellow of the Royal Photographic Society and of the Optical Society, and was recently elected to the fellowship of the Institute of Physics.

WE regret to announce the following deaths :

Prof. J. W. Hinton, professor of physics in Ceylon University College, Colombo, formerly lecturer in the University of Otago, New Zealand, on July 15, aged thirty-eight years.

Sir Joseph C. Verco, president of the Royal Society of South Australia in 1903-21, known for his services to medicine in Australia, on July 30, aged eighty-two years.

Sir Emery Walker, Sandars reader in bibliography in the University of Cambridge in 1924, a well-known authority on typography, on July 22, aged eighty-two years.

News and Views

Centralisation of Anthropological Studies

ON p. 208 of this issue we publish a communication from Prof. J. L. Myres in reference to the article "Centralisation of Anthropological Studies" appearing in NATURE of July 22, p. 113, in which he directs attention to the efforts made to bring about an improved organisation in the science of anthropology in Great Britain since 1896 and earlier. Such efforts have been noted from time to time and made the subject of comment in NATURE, nor must it be assumed, if no reference has been made to them on this occasion, that they have been overlooked. Lest any confusion should arise, however, it may be as well to point out that the various movements chronicled by Prof. Myres have by no means had an identical objective. Each has pressed for such measures as the circumstances of the time have seemed to demand. At the turn of the century, both on public and on academic grounds, an Imperial Bureau of Ethnology was deemed the most pressing need: the Joint Committee for Anthropological Research and Teaching, which works in association with the Royal Anthropological Institute, is the form taken by the most recent and successful effort. This latter has provided an effective medium for authoritative pronouncement of anthropological opinion on matters of policy, and for the promotion of concerted action. The 'Joint Committee', however, is not an academic body; and the consolidation of anthropological teaching and research within the universities on some such lines as those suggested in NATURE should strengthen the hand of the representatives of the universities on the Committee, rather than conflict with its functions.

Mechanisation and Unemployment

A PAMPHLET entitled "Unemployment: Its Realities and Problems" issued by the Engineering and Allied Employers' National Federation, Broadway House, Tothill Street, London, S.W.1, contains the result of an inquiry conducted among members of the Federation into the general subject of unemployment and particularly the proposal to establish a working week of forty hours. The pamphlet expresses the belief that the signs are that our civilisation still possesses the urge and impulse to recover from its latest shock and resume its upward march. Stress is laid upon the moral effect of confidence in recovery and part of the world's sufferings are still attributed to the six years' arrested growth caused by the late War. The importance of a growing appreciation of the real causes underlying the present depression is recognised as in itself one of the best hopes of amelioration. There is no royal road to the cure for unemployment and the complexity of the factors involved and particularly the psychological effects make progress inevitably slow and difficult. While the part which international co-operation must play is admitted, sufficient emphasis is scarcely laid on this fact and the pamphlet might easily give the impression that national effort alone is sufficient. Particular attention is directed to the increase in total employment which has accompanied the growth of unemployment and it is considered that the unemployment crisis is not the result of mechanisation, a conclusion which was discussed in the leading article in NATURE of July 29, p. 149. It is also concluded that displacement of male by female labour is not true of industry as a whole, but the arguments presented against the

adoption of the 40-hour week are less convincing and make partisan reading. The whole question is discussed too much apart from the fundamental problems of distribution and social economics to which reference was made in our leading article.

Science and the State in Germany

THE publication in the *Times* of July 24, 25, 27, and 28, of extracts from Herr Hitler's book on the eve of its publication in an abbreviated translation, and the simultaneous account by the *Times* correspondent on July 27 of a Bill approved by the German Government for the compulsory sterilisation of those "considered in the light of medical science as it is understood to-day to be by heredity unfit" give a more illuminating view of the real significance of the Nazi movement than has yet appeared. That the Nazi leader stands self-revealed as ill-balanced, fanatical and otherwise abnormal is immaterial. What is supremely significant is that he has come into power on a wave of popular discontent with present-day social, political and economic conditions which is sufficiently intense to submit to previously unheard of restrictions for which a 'scientific' backing is advanced. Unfortunately, not all the Nazi measures can be supported by argument as sound scientifically as that upon which the sterilisation of the unfit is advocated. Herr Hitler's views of 'Aryans' and Jews and their qualities and character, to accord with which the German race of the future is to be moulded, belong to a 'science' which would be out of date even if it had not failed to justify itself when submitted to the test of scientific analysis. The German people, however, are not alone as victims of the world crisis, and if, as events seem to portend, the world is moving towards a solution of its difficulties through the application of scientific method to its problems by means of a more highly organised form of government than is possible in a pure democracy, it cannot be too widely appreciated outside scientific circles that the science which will provide the solution of our difficulties is not reactionary and does not exclude eminence in any field, whatever its racial origin—in short, it is not the 'science' of Herr Hitler.

Ross Institute and the London School of Hygiene and Tropical Medicine

PROPOSALS for the amalgamation of the Ross Institute and Hospital for Tropical Diseases with the London School of Hygiene and Tropical Medicine have recently been issued. Argument in favour of amalgamation centres around the promotion of work for the good of the Empire and the prevention of overlapping of the activities of the two bodies. As a result of the amalgamation, a permanent memorial to Sir Ronald Ross will be established in the School in the form of a department to be called the Ross Institute of Tropical Hygiene. Laboratory accommodation will be provided for Sir Aldo Castellani, at present director of tropical medicine and dermatology at the Ross Institute. He will also be appointed to the staff of the School with the title of director. Sir Malcolm Watson, at present director of tropical hygiene and principal of the Department

of Malaria Control at the Ross Institute, will be appointed director of tropical hygiene at the School. The India branch of the Ross Institute will become an intrinsic part of the amalgamated body, and Dr. G. C. Ramsay will continue as principal of the India branch. Major Lockwood Stevens, organising secretary of the Ross Institute, will join the School in a similar capacity.

Imperial Standard Measures

THE statutory decennial comparisons of the Imperial standards of length and mass with their Parliamentary copies became due in 1932. On the last occasion, in 1922, they were carried out at the Standards Department of the Board of Trade under the supervision of Mr. J. E. Sears, Jr., the superintendent of the Metrology Department of the Laboratory, who was at that time acting also as deputy warden of the standards. By a subsequent agreement between the Board of Trade and the Department of Scientific and Industrial Research, it was arranged that the National Physical Laboratory should in future undertake the whole of these comparisons on behalf of the Board. The present series of comparisons is accordingly being carried out at the Laboratory. The primary object of the comparisons is the verification of the Parliamentary copies of the Imperial Standard Pound and Yard, any one of which could be used to replace the corresponding Imperial standard should it suffer loss or destruction. There are for each standard five Parliamentary copies; one is immured in Westminster Palace, and one each of the others is in the custody of the Royal Society, the Mint, Greenwich Observatory and the Standards Department.

IN addition to this work, a redetermination of the relationship between the pound and the kilogram will shortly be made, following the scheme which was adopted for the first time in 1922-23. The International Bureau of Weights and Measures, Sèvres, has been invited to undertake a share of the comparisons in this part of the programme. Finally, the principal reference standard pounds at the National Physical Laboratory, together with an auxiliary standard pound belonging to the Board of Trade, will be verified by comparison with one or more of the Parliamentary copies of the pound; a corresponding verification of kilogram standards from the Laboratory and the Board of Trade will also be made. The weighings are being made on a new balance which has recently been constructed at the Laboratory for precision weighings of the highest accuracy. This balance is contained in an inner vault, and all its controls are operated from outside, so that the observer does not enter the vault during any one series of weighings. The indications of the balance are recorded optically on a scale placed some seven metres away.

Empire Cotton Growing Corporation

THE director of the Empire Cotton Growing Corporation, Sir James Currie, stated at the meeting of

the Administration Council on July 26 that it has been decided to ask all the experiment stations in the Union of South Africa and in Southern and Northern Rhodesia to co-operate in a common plan of campaign for an intensive attack on the problems of insect pest control. A first step is to be the recording of the activities throughout the whole season of the different insects that damage cotton crops. A reliable technique for this has been worked out at the Barberton Station. It was also announced that it is intended to hold a conference of workers on cotton-growing problems in London next summer, similar to that which was held at the Shirley Institute in 1930. Mr. H. Niblett, one of the members of the Oversea Mechanical Transport Directing Committee, gave a short description of the work of that Committee. In 1927 the Corporation suggested to the Colonial Office Conference that the problem of motor transport in the cotton fields is so important that the investigations should be extended and the work financed by the Empire governments concerned. The Oversea Mechanical Transport Council and Directing Committee were appointed as a result, and are now testing two motor transport units, each consisting of an 8-wheeled tractor and two 8-wheeled trailers capable of handling a useful load of 15 tons. The report of the Executive Council has recently been published (Empire Cotton Growing Corporation, Millbank House, 2 Wood Street, Millbank, London, S.W.1.)

Improvement of Farm Crops

At the annual general meeting of fellows of the National Institute of Agricultural Botany at Cambridge on July 27 the chairman of the Council, Mr. E. W. K. Slade, presented the John Snell Memorial medal to Dr. Kenneth M. Smith, entomologist of the Potato Virus Research Station, in recognition of his valuable research work on the virus diseases of the potato. Mr. Slade afterwards described some parts of the work of the Institute which particularly appeal to him as a practical grower. Crop improvement work is impossible until agriculturists know the material they are dealing with. Thanks to the Potato and Cereal Synonym Committees farmers are unlikely in future to be misled by a fine new name into buying an old variety which they have already given up. Mr. Slade welcomes the active co-operation which the Institute is receiving from the seed trade; by doing away with fictitious names, and putting on the market pure seed of improved varieties, each under a single name, merchants contribute greatly to the general welfare. The principal part of the Institute's task is to find out which of the new varieties that come to it are best in yield and quality and in which districts they should be grown. This is work which farmers cannot do for themselves. Many crops are being studied and a feature of this season is the inauguration of widespread trials of mangolds and swedes with the help of the seed trade. Mr. Slade finally referred to the assistance given by the Official Seed Testing Station in the scheme for the registration of wild white clover seed.

International Congress for Scientific Management

AN International Congress for Scientific Management is to be held in London in 1935 and the Prince of Wales has consented to be its patron. The subjects for discussion include the introduction of management principles and practice in undertakings of various sizes, methods of controlling production by the comparison of actual results with forecasts, examples of the application of scientific management in problems of distribution, standardisation in agricultural development, methods of selection and training for higher administrative positions, and scientific management in the home. A meeting of the organising council of the Congress, under the chairmanship of Sir George Beharrel, was held recently at the offices of the Federation of British Industries and it was announced that a representative executive committee is being formed. It will be recalled that early in the year a manifesto on "The Management Factor in Industry" was issued over the signatures of many well-known men of science and others (NATURE, January 14, p. 52), in which the field surveyed was similar to that of the forthcoming Congress.

Birds within Cities

SINCE Gilbert White's recording of the house-martins nesting in Fleet Street and the Strand, ornithologists have never failed to interest themselves in birds about cities. A day-to-day census of the birds of the Liverpool Cathedral Wild Birds' Sanctuary, established in 1927 in an old quarry, now a cemetery, in the heart of Liverpool slums and five miles from the nearest trace of open country, has recently been completed by Mr. Eric Hardy. Thirty species are recorded: house-sparrow, starling, robin, blue tit, hedge-sparrow, song thrush, blackbird, wren, greenfinch, domestic pigeon, great tit, missel-thrush, chaffinch, rook, linnet, redwing, herring-gull, common gull, kestrel, jackdaw, cole-tit, yellow-hammer, goldcrest, chiffchaff, willow-wren and whitethroat, the first twelve of which nest. The goldcrest is now a regular spring passage migrant since the establishment of food tables, etc., though the first specimen was recorded in March, 1931 (*Proc. Liverpool Nat. Field Club*, 1931, p. 41), while the willow-warbler soon established itself as a regular passage migrant, spring and autumn (*Liverpool Review*, Annual Report, February, 1933).

FOR London, Mr. A. H. Macpherson recorded a list of 126 species, of which 21 breed regularly, 8 have been known to breed during the present century, the remainder being visitors, 20 of which are regular and 77 occasional, in an area extending 2½ miles due north and south of Charing Cross and 4 miles east and west. In *British Birds*, March, 1933, Mr. Macpherson added the puffin, from Finsbury Gardens 1932, the brambling from specimens seen in Kensington Gardens, April 1932, the pied flycatcher in the grounds of the Natural History Museum, April 26, the green woodpecker in St. James's Park, August to November, and the scap on the Serpentine in February, 1932. The eighteenth

annual report of the Lancashire and Cheshire Fauna Committee added the golden plover to an extensive list of birds recorded in inner Manchester, while in *British Birds* (November, vol. 26, No. 6, 1932), Mr. Eric Hardy added the hoopoe to the birds watched inside Liverpool after recording the same species (*British Birds*, August, vol. 26, No. 3, 1932) in Birkenhead.

Unusual Rainbow Phenomena

A NUMBER of correspondents have added further descriptions of unusual rainbow phenomena to the account by Mr. J. L. Horton of the display of June 26 (*NATURE*, July 8, p. 57). The month of June was unprecedented during at least the past sixty years for the number of thunderstorms, and was at the same time a generally sunny month, so that opportunities for seeing rainbows were unusually frequent. An account from J. O. Ewing, of bows seen from Brandon, Suffolk, on the evening of June 17, described three closely adjacent bows with the red farthest from the sun, of which only the outermost showed the complete range from violet to red, this being the brightest, while another bow much nearer to the sun is said to have shown colours in the reverse order. It appears possible, seeing that the effect was described from memory, that errors have been made over the colour sequences, as the bows corresponding presumably with the ordinary primary and secondary bows have the usual order of colour reversed, but even so the phenomenon was evidently very different from that described by Mr. Horton.

R. N. JONES describes something more similar that was seen from Liverpool on July 8, except that the bow lying just outside the secondary bow was not noted, and asks whether anyone has ever seen the two bows theoretically possible in which the sunlight suffers respectively three and four internal reflections inside the raindrop, which would occur between the observer and the sun. Mr. G. H. Harker writes of having seen the phenomenon noted by Mr. Horton on several occasions, the most recent being at Clifton, Bristol, on July 10. He points out that the supernumerary bow outside the secondary is the rarer; that both depend upon the existence of a sufficient number of uniformly small droplets; and that a mixture of droplets of various sizes tends to produce overlapping systems that may give a bow of varying curvature and with a varying colour sequence in different parts of the same bow. He refers the reader to Airy's theory of the rainbow given more than a century ago and to the extended treatment in Chaps. xvi and xvii of Bouasse and Carrière's "Diffraction".

Early Script in India

AN interesting inscription in a rock-shelter in the Sambalpur District, Bihar and Orissa, is the subject of a note, accompanied by a series of illustrations, by Mr. K. P. Jayaswal in the *Indian Antiquary* for March. It appears to be in a script representing a transition from that of Mohenjo-daro to the Brahmi, and is dated tentatively at about 1500 B.C. The inscription occupies a space of 35 ft. × 7 ft. The

letters, partly painted, partly incised, would appear all to have been painted before being cut. There is no sign of the use of an iron tool. The inscription is unquestionably writing, and Mr. Jayaswal is of the opinion that the hand responsible for the inscription was accustomed to the use of the pen. The writing appears to have reached the syllabary (alphabetical) stage. The script resembles Brahmi more closely than any other, but a number of resemblances to Mohenjo-daro are noted. Notwithstanding the Brahmi cast of the inscription, it does not follow that the language is Aryan, and in view of the locality in which it has been found, it may be a pre-Dravidian Raksasa record, Raksasa being used as a generic term for the peoples dispossessed by the Aryans, now possibly represented by the Gonds.

Archæological Field Work in America

NOTWITHSTANDING the summary character of the reports in the annual "Explorations and Field-Work of the Smithsonian Institution", its publication is always welcome as an early source of information on recent activities in the scientific exploration of America, especially in archæology and ethnology, pending the issue of full reports. The comprehensive character of this publication which, as a rule, covers all the operations of the staff in the field, also serves to indicate the general trend of research. In the issue for 1932 (Publication 3213), for example, the problem of early man in America is attacked from several aspects. Dr. Aleš Hrdlička's archæological exploration of Kodiak Island, Alaska, and Mr. Henry B. Collins's investigations at Point Barrow, Alaska, have advanced the chronological and distributional classification of Eskimo cultures; Mr. Frank Setzler, investigating prehistoric cave-dwellers' sites in Texas, links positively for the first time the culture of the Big Bend area with the south-west; while Dr. Gerrit S. Miller, Jr. and Herbert W. Krieger have investigated the prehistoric cultures of islands in the West Indies with special reference to their early interrelations. Dr. Frank H. H. Roberts, Jr., continuing his excavations of Pueblo settlements in the south-western States, has carried a stage further the elucidation of the development of domestic and ceremonial buildings. Other investigations cover the mound-builders, the Indian tribes of eastern Canada and New York State and of California; and Miss Densmore continues her song-collecting activities among the Seminoles of Florida.

Geo-electric Methods in Search for Oil

RECENTLY geo-electric methods as applied to oil-field exploration have been regarded with some disfavour, but Mr. O. H. Gish in a paper on this subject (*Bull. Amer. Assoc. Petroleum Geol.*, 16, No. 12, Dec. 1932, pp. 1337-1348) maintains that factors influencing this condemnation are subjective rather than objective. Many people still believe that electricity is endowed with a mystical power and thus the impostor has ample scope for his nefarious activities, while the *bona fide* geophysicist has perforce to qualify his statements. The impostor may forecast the number of barrels of oil obtainable from

a given site, while the geophysicist speaks only of indications good or bad. Electromagnetic and resistivity methods have enjoyed a measure of success in the exploration for oil. They are, however, at a serious disadvantage when compared with seismic and gravimetric methods, in that they entered the field relatively late and with inadequate theoretical equipment for the best interpretation of results. It is recognised that only in special cases will electric methods admit of unique interpretation, but, of several consistent interpretations, some may be eliminated as being incompatible with facts known to the geologist and others by employing different survey methods in corroboration or otherwise. In principle, therefore, it seems possible to determine from geophysical surveys, augmented by other available data, the approximate depth and features of petroliferous structures. Although electric methods may be more widely adopted by technologists in the future, there are still many errors in technique which have hitherto vitiated results and must first be eradicated. Moreover, it is not possible at this stage to determine whether the results from these methods compare economically with those obtained from gravimetric or seismic methods.

Electricity Supply and Fuel Consumption

THE Electricity Commissioners have recently issued a return of the fuel consumption and the electricity generated at the power stations of Great Britain during 1932 ("Generation of Electricity in Great Britain"; London: H.M. Stationery Office. 1s. 6d.) The number of steam stations has diminished by four per cent from last year, but the consumption of electricity has increased by about eight per cent, the coal consumption exceeding ten million tons. Although the number of oil engine stations has increased, their total output has diminished. The district showing the highest degree of electrification was south-east England and only in one area, northern Scotland, was the output less than in 1931. The trade barometer indicated by electricity consumption shows that there is little improvement in heavy industries. The advance that has taken place is due to improvement in the lighter industries and particularly to the large use that is now being made of electricity for domestic purposes. The average coal consumption in the steam driven stations per kilowatt hour developed has fallen from 1.82 lb. in 1931 to 1.74 lb. in 1932. As a rule the stations which have the maximum output are the most economical. The Portishead Station of the Bristol Corporation had an average fuel consumption of only 1.15 lb. per kilowatt generated. There were 23 stations the consumption at which was less than 1.5 lb. This compares with 1.7 in 1931. It will be seen that the generation of electricity in British power stations is now being conducted both efficiently and economically but there is still plenty of scope for increasing the efficiency of the methods of distribution.

Aluminium Production

AT the Edinburgh meeting of the Institution of Mechanical Engineers on May 30, Mr. G. Boex read

an interesting paper describing the extensive electrical plant and the processes employed at the various works of the British Aluminium Co. in Scotland. As well as producing the metal electrolytically, the British Aluminium Co. manufactures alumina carbon electrodes. It has alumina works at Burntisland, where a chemical process is employed. At the carbon works at Kinlochleven, the electrodes necessary for three factories in the north of Scotland are produced. The electrolytic works at Foyers, Kinlochleven, and Lochaber are close to large hydroelectric stations where 33,000 kilowatts are already being used. The metallurgist and the physicist have been working for the last twenty years on methods of improving the quality of aluminium and its alloys. Alloys are now produced which, weight for weight, have three times the strength of steel. American manufacturers are laying down rolling mills capable of producing sections made of these alloys comparable with those made of steel. The increase in the first cost is more than offset by the advantage in strength for a given weight or by a definite reduction of the weight of a section. The metal aluminium can be made economically only by the use of electric power. Direct current in bulk is required. A total of about 26,000 kilowatt hours is required for the production of one ton of aluminium from alumina. The Company has routine laboratories at all its works and research laboratories at three of them. The aluminium works in the Highlands of Scotland have been a great help to the inhabitants both during construction and when operating. From the economical point of view it is hoped that the success of these undertakings will encourage the development of the smaller water power resources of the Highlands and that industries will spring up in their neighbourhood.

Commercial Bulb Production

FOR more than two hundred years the bulbs grown in Great Britain have been imported, chiefly from the Netherlands. Commercial flower production, however, has expanded so rapidly in recent years that the sum spent on imported bulbs is now very considerable, £1,470,000 being reached in 1931. There seems to be no reason why bulb-growing should not be successfully developed in England, and to this end the Ministry of Agriculture has issued an illustrated bulletin (No. 62), price 1s. 6d., entitled "Commercial Bulb Production". The term 'bulb' is used in its general sense and although the major part of the bulletin is devoted to the true bulbs of commercial importance (daffodils, narcissi, tulips and lilies) certain other 'bulbs' such as gladioli and irises are dealt with in detail, and much useful information is supplied on a number of miscellaneous 'bulbs' commonly grown in parks and gardens. After some account of the best type of soil, its preparation and manurial treatment, the planting, care of the crop, and methods for its propagation are described. In the case of the more important species, full information is given as to the selection of varieties most suitable for forcing, growing in pots or in the open, together with recommendations as to the best times for planting and lifting. Practical advice is also

supplied with regard to methods for large-scale storage and the grading and sale of bulbs for wholesale or retail trade.

Improvement of Grassland

THE outstanding work on grassland carried out by the Welsh Plant Breeding Station at Aberystwyth is well known to all specialists of the subject. A definite insight has now been gained into the meaning of the agricultural value of hay and pasture, and the methods by which the desired results may be obtained, even if much more knowledge is still required before adequate control is reached. For the student and farmer, however, much of the published work on the subject is perhaps too elaborate to be of immediate practical use, and the booklet by Prof. R. G. Stapledon entitled "Four Addresses on the Improvement of Grassland" will be welcomed by many (Aberystwyth: University College of Wales, 1933. 1s.). The fundamental aims and methods of grassland management are described in a clear, concise and eminently practical manner. Given a good grass mixture, then judicious grazing and the use of the mowing machine are two of the chief factors upon which success depends, the important part played by the grazing animal being clearly brought out. Where the improvement of land in very poor condition is the problem, the necessity of sowing wild white clover is stressed and the use of some form of phosphatic manure advocated. In fact, the proper balance between grass and clover seems to be the central feature of all good grassland, and in the attainment and maintenance of this optimum ratio by wise choice of mixture, judicious grazing and introduction of wild white clover when needed, the secret of success would seem to lie.

Report on the Science Museum

IN the report for 1932 of the Advisory Council of the Science Museum (London: H.M. Stationery Office), special reference is made to the future policy of the Museum, particularly in relation to its utility to industry. With the co-operation of outside bodies, such as the National Physical Laboratory and various research associations, during the past six years special exhibitions have been arranged which have proved attractive not only to the general public but also to technical visitors. At the present time three such exhibitions are being organised annually. A further development of these exhibitions has been suggested in order to afford facilities to an industry or group in an industry, to show informatively its products to other industries, and such exhibitions the Council thinks might be of special service to the minor industries now being encouraged in many parts of Great Britain. It is pointed out, however, that here the Museum is handicapped by the want of space, and the Council expresses the hope that the erection of the centre block will soon be taken in hand. The report deals also with the attendances at lectures, the acquisitions, the publications, and with the activities of the Library. In 1931 a sub-committee was appointed to report upon

the Library and its working, and among its recommendations was that in the interest of the progress in science and technology and their industrial applications, there is need for a National Library of Science in Great Britain.

Catalogue of Educational Films

THE issue of a catalogue occupying 184 pages by the Central Information Bureau for Educational Films, is a notable event ("A Guide to Instructional and Educational Films available for Use by Educational and Social Organisations in Great Britain." Pp. vi+184. London: The Central Information Bureau for Educational Films. 3s. 6d.). In the introduction it is stated that this is the first occasion on which a conspectus of the films available for education in Great Britain has been attempted. The present survey is purely quantitative, but the views of educational and social bodies on films found to be of special value are invited. The range of subject matter is very wide and illustrates the great possibilities of films alike as a means of inspiring interest and conveying information. The main sections comprise art, engineering and industry, geography and travel, history, literature, religion and Bible stories, science, social activities and sport. Science alone, however, comprises seven sub-divisions including astronomy, hygiene, nature study and physiology. One might perhaps single out as of special interest the films produced by various scientific institutions and Government departments (such as the Ministry of Agriculture), certain fascinating summaries of scientific research extending over many years, as in the Canti films, films utilising photomicrography, and the really remarkable range of travel films presented. In general, the titles of films are sufficiently descriptive but, where necessary, explanatory paragraphs are added. Films are classified into 35 mm., 16 mm. and 9.5 mm. to suit the financial resources of schools. In an appendix a list of the names and addresses of Government departments, societies and firms mentioned in the catalogue is given.

A Proposed Marine Biological Station in India

IN *Current Science* (vol. 1, No. 10, April 1933) it is stated that at a joint session of the Botany and Zoology Sections of the Indian Science Congress recently held at Patna under the presidency of Prof. Gopala Aiyer, the desirability of establishing a Marine Biological Station in India was discussed. Col. Sewell opened the discussion. It was suggested that the authorities of the Science Congress should sanction a certain sum of money which would act as a nucleus for private subscription, and the general opinion was in favour of the station being at Bombay, which with its central position and varied coast line offers an ideal site for such a laboratory. It was moved and seconded that a committee of five biologists be appointed by this joint session of Botany and Zoology Sections of the Indian Science Congress to go into the question of establishing a Marine Biological Station in India and the resolution was carried by a large majority. The committee was constituted as follows: Dr. S. B. Setna, of Bombay (convener),

Prof. Gopala Aiyer, of Madras, Prof. George Mathai, of Lahore, Prof. R. H. Dastur, of Bombay, and Dr. S. K. Mukerji, of Lucknow.

Co-operation between Science and History

VOL. 76 of *Memoirs and Proceedings of the Manchester Literary and Philosophical Society* contains the presidential address of Mr. B. Mouat Jones, in which an appeal is made for co-operation between men of science and historians in the production of the histories for use in elementary and secondary schools and in the universities. He has examined a large number of such books and has found that the influence of scientific thought and discovery on the development of civilisation is unmentioned or unappreciated, or that no attempt is made to incorporate the improvements due to science into the history of the people. He contends that the influence of a scientific advance, such for example as that initiated by Faraday, on the history of the world, is at least as great as some of the movements due to politicians to which historians devote ample space, and he asks that in the books from which the great majority of the population get their historical knowledge, science should be given the place due to it as a determining factor in history.

Memorial to Sir Charles Parsons

ON July 28, a memorial to Sir Charles Parsons, who died on January 12, 1931 (see NATURE of February 28, 1931) was unveiled at the works of Messrs. C. A. Parsons and Co., Ltd., at Newcastle-on-Tyne by his daughter, Miss Rachel Parsons. The memorial is formed of a medallion portrait of Sir Charles, in profile, carved in Bianca del Mara stone; this is surmounted by the family coat of arms. At the ceremony Miss Parsons said that the memorial was erected on the site of the room in which her father spent so many hours of his life working at the scientific and engineering investigations which appealed to him above everything else. The memorial was designed by Mr. Maurice E. Webb and Mr. Reid Dick was the sculptor.

Priestley Centenary in France

THE issue of the *Revue Scientifique* for July 8 contains the appreciative address of Prof. C. Matignon, professor of inorganic chemistry in the Collège de France, on the life and work of Priestley, delivered on June 15. In it he reminded his audience that Priestley was elected a foreign associate of the old Royal Academy of Sciences of Paris in 1772, that he was in sympathy with the Revolution of 1790 and that the legislative assembly conferred on him the title "citoyen français" in 1793. Even during the Napoleonic wars, the relations between scientific workers in France and England remained cordial and Davy was awarded the *grand prix* by the Paris Academy of Sciences in 1807.

Awards of the Royal College of Physicians

AT the quarterly comitia of the Royal College of Physicians held on July 27, the following awards, among others, were made: the Baly medal to Dr.

Robert Robison, of the Lister Institute, for his work on the esters of phosphoric acid and the enzyme phosphatase and the part they play in bone metabolism; the Moxon gold medal to Prof. G. R. Minot, professor of clinical medicine in Harvard Medical College, for his work on diseases of the blood; the Weber-Parkes prize and medal for the best work already done in connexion with the etiology, prevention, pathology, or treatment of tuberculosis to Sir John McFadyean. The Leverhulme scholarships held by Dr. J. F. Brock and Dr. S. J. Hartfall have been continued for another year, and the Murchison scholarship was awarded (this year by the University of Edinburgh) to D. M. F. Batty and A. Brown.

Announcements

MR. F. E. MAGARINOS TORRES has been appointed director of the Instituto de Meteorologia Hidrometria e Ecologia Agricola at Rio de Janeiro in succession to Prof. Martins Costa, who has resigned.

AT the annual general meeting of the Museums Association, held at Norwich on July 6, it was announced that Dr. Cyril Fox, director of the National Museum of Wales, has been elected president in succession to Sir Henry Miers, and Dr. W. E. Swinton, honorary editor of the *Museums Journal*. Alderman Chas. Squire, Leicester, and Mr. D. W. Herdman, Cheltenham, were re-elected hon. treasurer and hon. secretary respectively.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—An assistant librarian at the University of Capetown—The Secretary, Office of the High Commissioner for the Union of South Africa, Trafalgar Square, W.C.2 (Aug. 8). A research fellow in glass technology at the University of Sheffield—The Registrar (Aug. 21). An assistant lecturer and demonstrator in electrical engineering at the University of Sheffield—The Registrar (Aug. 25). An assistant lecturer in philosophy at the University of Birmingham—The Secretary (Aug. 28). An assistant lecturer in zoology at the University of Sheffield—The Registrar (Aug. 31). An evening teacher of practical mathematics at the West Ham Municipal College, Romford Road, E.15—The Secretary (Sept. 1). A research chemist at the Long Ashton Fruit Research Station—The Registrar, University of Bristol (Sept. 2). A University reader in civil engineering at Imperial College, City and Guilds College—The Academic Registrar, University of London (Sept. 8). A George Henry Lewes student for research at the Physiology School, Cambridge—Prof. Barcroft, Physiology School, Cambridge (Sept. 20). An assistant chemist for the Rubber Research Scheme (Ceylon)—The Chairman, Rubber Research Scheme, Neboda, Ceylon (Oct. 15). A principal of the University College of Wales, Aberystwyth—The President of the College, 44, Queen Victoria Street, London, E.C.4 (Dec. 1). A principal of the Borough Polytechnic, Borough Road, London, S.E.1—The Secretary. An assistant lecturer in education at University College, Hull—The Registrar.

Letters to the Editor

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, nor to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. No notice is taken of anonymous communications.]

Absorption Spectrum of the Vitamin E Fraction of Wheat-Germ Oil

IN a recent letter to NATURE¹ we described the absorption spectrum of the unsaponifiable matter of wheat-germ oil. Our main conclusions have now been supported by Morton and Edisbury², and by Euler, Hellström and Klusmann³, who in each case had carried out independent work on the same problem before the publication of our results. The latter workers also examined a concentrate from lettuce leaves, in which case the visible absorption

of xanthophyll kindly supplied by Prof. Karrer. The curves are practically identical; both show very heavy absorption in the visible with three maxima at 4770, 4440 and 4180 Å. and a weaker absorption in the ultra-violet with two maxima at 3370 and 2710 Å., followed by continuous absorption. It is apparent from Fig. 2 that it is this pigment which is responsible for the colour of the oil and of the concentrate: the former contains about 0.006 per cent, the latter about 0.4 per cent. At these concentrations the contribution of the pigment to the absorption in the ultra-violet would be very small. The spectra of the free acids and the sterols extracted from the oil are also shown.

(2) The 'vitamin E fractions' prepared from untreated and decolourised wheat-germ oil showed absorption with 'singularities' at:—

Vitamin E fraction 4770, 4440, 4180 Å. (3370), 3200, 2860, 2550, 2400 Å.
Vitamin E fraction from charcoal-treated oil none 3200, 2860, 2550, 2400 Å.

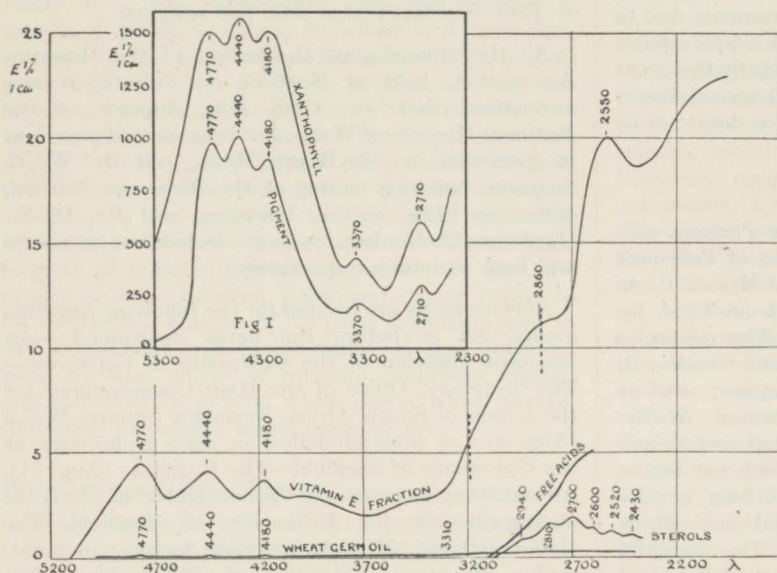


Fig 2

(yellow colour) was found to be relatively more intense in proportion to the ultra-violet absorption than in the case of wheat-germ oil concentrate. From a study of the visible absorption bands, they have concluded that the yellow colour in each case is due to xanthophyll. They suggest that vitamin E may absorb in the ultra-violet.

Working on a more direct line of attack, we have ourselves reached the same conclusion as to the nature of the pigment, and have moreover obtained positive evidence in favour of the composite character of the absorption spectrum previously described for wheat-germ oil concentrate. This has been achieved (1) by separating the pigment of wheat-germ oil in a crude state and comparing its absorption spectrum in the visible and ultra-violet with crystalline xanthophyll, and (2) by examining a concentrate prepared from wheat-germ oil which had been decolourised with absorbent charcoal.

(1) The pigment was separated from the concentrate by crystallisation from petrol ether. In Fig. 1 its absorption spectrum in alcohol at room temperature is compared with that of a specimen

It will be seen that in the concentrate prepared from the decolourised oil, the visible bands have disappeared but the ultra-violet absorption persists practically unchanged.

We have also subjected the concentrate to various chemical treatments in an attempt to find whether any correlation could be established between biological activity and absorption in a particular region. The table below summarises the spectroscopic changes we observed after chemical treatment, and the effect of similar treatment on biological activity as recorded by Evans and Burr in their authoritative monograph⁴, which we have taken as our guide prior to carrying out experiments on our own account.

These experiments show that the absorption of the vitamin E fraction of wheat germ is due to more than one kind of molecule. The substance responsible for

visible absorption can be separated by physical means and is xanthophyll. Although the substance is

Chemical treatment	Spectroscopic behaviour			Biological activity
	Visible 4770, 4400, 4180 Å	Ultra-violet 3200-2860	Ultra-violet 2850-2400	
Untreated concentrate	+	+	+	+
Saturated with HCl gas	-	+	+	+
Heated with acetic anhydride	+	-	+	-
Ultra-violet irradiation	-	±	+	±
Hydrogenation for several hours	-	±	±	+ ?
Oxygen	+	+	+	+

- destroyed + not destroyed ± greatly diminished

associated with, and may conceivably be a precursor of, vitamin E (on an analogy with carotene and

vitamin A), it is improbable that it is itself the vitamin. Thus treatment with hydrochloric acid, and catalytic hydrogenation, both destroy the visible bands although not reputed to destroy biological activity, while acetic anhydride does not affect the visible absorption although supposed to inactivate the vitamin. The ultra-violet absorption at 2850 to 2400 Å. also frequently persists when the biological activity has presumably been destroyed, and so cannot always be correlated with activity. On the other hand, the ultra-violet absorption between 3200 and 2850 Å. closely follows the biological activity, since both are destroyed by acetic anhydride and irradiation, and both resist the action of hydrochloric acid, hydrogenation and oxidation. It is with this region of the absorption spectrum that the biological activity is most likely to be associated. At liquid air temperature the absorption band in this region shows a structure.

It has long been a puzzle why vitamin E concentrates should retain their activity after such drastic treatment as catalytic hydrogenation. In our experiments, hydrogenation was continued for several hours after the yellow colour of the concentrate had disappeared, but even under these conditions saturation was not complete (iodine value of original concentrate 210; of hydrogenated concentrate 70) while the ultra-violet absorption, although reduced to about half its original intensity, was little changed in appearance. It seems probable, therefore, that the answer may lie in a high resistance of the vitamin E molecule to hydrogenation, rather than to the persistence of activity in the completely hydrogenated molecule.

F. P. BOWDEN.

Laboratory of Physical Chemistry,
Cambridge.

T. MOORE.

Nutritional Laboratory,
Cambridge.
July 1.

- ¹ Bowden and Moore, *NATURE*, **131**, 512, April 8, 1933.
² Morton and Edisbury, *NATURE*, **131**, 618, April 29, 1933.
³ Euler, Hellström and Klusmann, *Seensk Kemisk Tidskrift*, **45**, 132; 1933.
⁴ Evans and Burr, *Memoirs of the University of California*, **8**; 1927.

Monetary Standards

JUDGING by his letter in *NATURE* of July 22, p. 133, Prof. H. E. Armstrong and I do not mean the same thing by the constancy of a monetary standard.

It is easy, and in many way advantageous, to take a fixed weight (or rather mass) of gold, and call it a pound sterling. If we do that, as Prof. Armstrong has discovered, the pound will always possess the same value *in gold*. But what about other things? As I take it, money should represent a fairly steady standard of purchasing power. A pound should enable us to buy roughly the same amount of wheat, and cloth, and omnibus rides, and theatre tickets. We do not want only gold; indeed, I am not sure that I want any gold at all.

Now in this criterion of constant purchasing power, gold has proved very untrustworthy. Even in the calm years of the nineteenth century, the purchasing power of gold over wholesale commodities rose between 1823 and 1848 by 25 per cent, fell from 1848 until 1873 by 20 per cent, rose by 40 per cent during the great agricultural depression from 1874 until 1896, and then began to sink again as South African gold

slowly made gold cheap—that is, put up prices ("Layton's History of Prices", 1922). A rise in prices impoverishes those with fixed incomes; a fall in prices destroys the profits of industry, creates unemployment, and, in the end, would bring the economic machine to a standstill.

During the present more hectic century, the vagaries of gold have been much greater. At the outbreak of War, the gold standard, so often proclaimed as a sure shield against disaster, was, as always in a crisis, suspended as too dangerous. We returned to gold in 1925, thereby lowering prices immediately by some 10 per cent and precipitating the coal strike. Moreover, we thus condemned prices to the downward drag, which, due chiefly to the maldistribution of gold, lasted until we were forced off gold in 1931 ("Statistical Year Book of the League of Nations"). Almost immediately, informally and indirectly, our currency was again linked to gold, and the fall in prices, with its accompanying depression and unemployment, re-established. Just lately, the trade cycle has turned, and it looks as though prices would rise for a time and trade improve.

Now whatever views Prof. Armstrong may hold, personally I do not think that a standard which, in its chief function of measurement, expands and contracts by 25, 20 and 40 per cent in the course of one century and undergoes even more violent changes in the next, is a scientific standard in any useful sense of those words.

Whether the gold standard can be made more constant and workable, or whether we shall have to look elsewhere when things settle down, is not relevant to this letter. Personally, I do not know, and can only wait and watch. Anyhow, I hope that no premature decision will be taken.

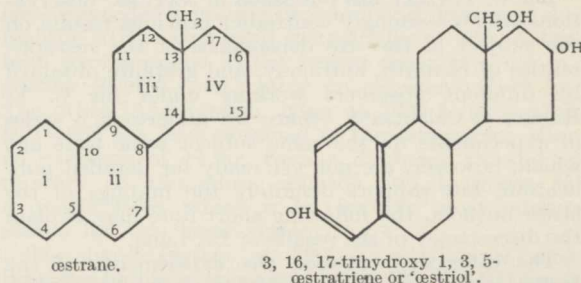
W. C. D. DAMPIER.

Upwater Lodge,
Cambridge.
July 24.

Nomenclature of the Oestrin Group

THE recent work of Butenandt, Marrian, and others on the oestrus-producing hormone, summarised in the Chemical Society's discussion on March 16th, has consolidated our knowledge of the chemistry of these substances and shown that they are probably closely related to the sterols. It appears opportune to adopt a uniform chemical nomenclature for the derivatives of oestrin, which harmonises with that used for the sterols, and we suggest the following.

The parent saturated hydrocarbon of the oestrin group, $C_{18}H_{30}$, containing the sterol skeleton with one methyl group but without the side chain, may be termed 'oestrane'. The numbering should be the same as in Rosenheim and King's formula for the sterols, that is:



On this scheme the full chemical names of two important derivatives, which Marrian and others have called 'trihydroxyœstrin', and 'keto-hydroxyœstrin', are 3, 16, 17-trihydroxy 1, 3, 5-œstratriene, and 3-hydroxy 17-keto 1, 3, 5-œstratriene. These names, though suitable for chemical literature, are cumbersome for general and biological use. We suggest as common names, for use where the chemical nature of the principle has been identified, 'œstriol' for the trihydroxy compound, and 'œstrone' for the keto-hydroxy compound. These short names will be found to recall the principal features of the constitution of the compounds, sufficiently for everyday use.

of the small-sized particles, which the former prepared by grinding fine powders, mechanically separating the different sizes by decanting after sedimentation of the large particles and collecting sufficiently large amounts of crystals of approximately equal size. The samples were put into the magnetic balance. It was found that below a certain 'critical' size the susceptibilities decreased very rapidly, the critical size being of the order of 10^{-4} cm. Lane, however, deposited bismuth on glass by evaporation and measured the susceptibilities of such deposits of different thicknesses, known by the time of exposure to the molecular beam. The result

Formula	Names previously used	Chemical name proposed	Common name proposed
$C_{17}H_{21}(OH)(CO)$	theelin (<i>D</i>) follicular hormone (<i>B</i>) keto-hydroxyœstrin (<i>M</i>)	3-hydroxy 17-keto 1, 3, 5-œstratriene	œstrone
$C_{18}H_{21}(OH)_2$	theelol (<i>D</i>) follicular hormone hydrate (<i>B</i>) trihydroxyœstrin (<i>M</i>) emmenin (<i>C</i>)	3, 16, 17-trihydroxy 1, 3, 5-œstratriene	œstriol
$C_{18}H_{22}(OH)$	desoxofollicular hormone (<i>B</i>) desoxotheelin (<i>D</i>)	3-hydroxy 1, 3, 5-œstratriene	
$C_{18}H_{22}(OH)_2$	dihydrofollicular hormone (<i>B</i>) dihydrofolliculin (<i>G</i>) dihydroxyœstrin (<i>M</i>)	3, 17-dihydroxy 1, 3, 5-œstratriene	
$C_{18}H_{23}(OH)$	hexahydrodesoxofollicular hormone (<i>B</i>)	3-hydroxy œstrane	
$C_{18}H_{27}(OH)_2$	hexahydrofollicular hormone hydrate (<i>B</i>)	3, 16, 17-trihydroxy œstrane	
$C_{18}H_{28}(OH)_2$	hexahydrodihydroxyœstrin (<i>M</i>)	3, 17-trihydroxy œstrane	
$C_{18}H_{18}O_2$	equilenin (<i>G</i>)	probably 3-hydroxy 17-keto 1, 3, 5, 6, 8-œstrapentaene	

B, Butenandt. C, Collip. D, Doisy. G, Girard. M, Marrian.

The accompanying table shows the nomenclature of some of the principal compounds of this group, with their formulæ and some of the names previously in use, together with the new chemical and abbreviated names which we now propose.

N. K. ADAM.	G. F. MARRIAN.
J. F. DANIELLI.	A. S. PARKES.
E. C. DODDS.	O. ROSENHEIM.
H. KING.	

The Sir William Ramsay Laboratories of Physical and Inorganic Chemistry and Department of Biochemistry, University College, London, W.C.1.

National Institute for Medical Research, Mount Vernon, Hampstead, London, N.W.3.

Courtauld Institute of Biochemistry, The Middlesex Hospital Medical School, London, W.1.

July 8.

¹ *Chem. Ind.*, 52, 268, 287; 1933.

Diamagnetism of Thin Films of Bismuth

DR. C. T. LANE has published in *NATURE*¹ observations which seemingly contradict previous results on the subject of the size dependence of the susceptibilities of bismuth, antimony, and graphite obtained by different observers working under Sir C. V. Raman at Calcutta^{2,3}. Since we undertook a series of experiments on the same subject some time ago which, however, are not yet ready for detailed publication, but support definitely the findings of the latter authors, the following short note may explain the discrepancy of the results of Dr. Lane.

The difference between the experiments of the Indian authors and C. T. Lane lies in the preparation

showed that the susceptibilities observed did not depend on the thickness of the layer, that is, on the number of atoms forming the specimen.

It seems that the discrepancy can be explained by a phenomenon which I have studied. If bismuth is deposited on a surface at a temperature below 100° C. by evaporation in a very good vacuum, the structure of the first few thousand layers is very different from the nature of the later deposits. If such deposits are produced at a low rate of evaporation and under carefully controlled cooling conditions of the background for a long time (10–20 hours) and the cross-section of the deposits is examined under a microscope in polarised reflected light, the difference between the first and the later deposits becomes very obvious. Whereas the later deposits show definite crystalline structure indicated by the parallel growth of small individual columns of triangular or rhombohedral cross-section, the base of these columns is not in the plane of the background but several μ above it, that is, the columns are rooted in an 'amorphous' layer of the condensate which is distinctly different from the crystals. From this, it follows that deposits of bismuth below a certain thickness are not of the crystalline nature common for bismuth in bulk.

In past years it has been proved by several authors that a true amorphous modification of bismuth does not exist; and especially Kirchner's results⁴ with electron spectroscopy show that even exceedingly thin layers deposited on an amorphous background show a microcrystalline structure. One has to assume therefore that there exists a fundamental difference between microcrystalline and macrocrystalline structure so far as the diamagnetic susceptibility is concerned. Since the method of

Lane would produce only layers of microcrystalline structure within the thicknesses used by him, the discrepancy would thus find an explanation due to the fact that Lane measured the susceptibilities of microcrystalline bismuth in gradually increasing volumes whereas the Indian authors used macrocrystalline substance. This difference could not come out in Lane's experiments since he has not measured the absolute values of the susceptibilities, which, if our argument be right, should coincide with the asymptotic susceptibilities for 'infinitely' small particles, that is, Lane's values should be below the lowest values of the Indian authors.

It should be mentioned finally that an observation first published by P. Kapitza⁵ supports this point of view perfectly. If one tries to 'inherit' a certain orientation on to the condensate of bismuth vapour by depositing it on, for example, a cleavage plane of an already existing bismuth crystal, one is not successful so long as one works at low temperature, and one obtains only 'amorphous' substance with no recognisable orientation. The 'inheritance', however, is at least partially successful so soon as one heats the background up to approximately 200° C., in which case the vapour atoms arrange themselves into a large number of small crystal columns. We would therefore suggest that the bismuth deposits of Lane be annealed for a considerable time at a temperature between 200° and 250° C. *in vacuo* or in a noble gas atmosphere before the susceptibility is measured. It is to be expected that during this treatment the microcrystalline structure of the deposit may transform into a structure commensurable with the bismuth particles used by the Indian physicists.

A. GOETZ.

California Institute of Technology,
Pasadena, California.

¹ C. T. Lane, *NATURE*, **130**, 999, Dec. 31, 1932.

² Vaidyanathan, *Ind. J. Phys.*, **5**, 559; 1930.

³ S. R. Rao, *ibid.*, **6**, 241; 1931.

⁴ F. Kirchner, *Z. Phys.*, **76**, 576; 1932.

⁵ P. Kapitza, *Proc. Roy. Soc., A*, **119**, 428; 1928.

INVESTIGATIONS by Vaidyanathan¹ and myself² in this laboratory have shown that the diamagnetism of bismuth is reduced by colloidalisation. On recrystallising a sample of pure bismuth powder it was found that its diamagnetic susceptibility rose to very near the mass value³. In a recent letter to *NATURE*, Lane⁴ reports that thin films of bismuth produced by evaporation and having a thickness of 0.2 μ –15 μ had the same susceptibility value as the metal in mass, allowing however for fluctuations of so much as 12 per cent.

No information is given about the temperature at which the films were deposited. If the films are deposited at low temperatures, there are uncertainties of a particular kind. Langmuir⁵ has shown that in such a case, the metal film is amorphous. Steinberg⁶ concluded from X-ray analysis that the amorphous films had the same crystal structure as the metal in bulk and that the crystal grains were too fine to distinguish with a microscope. He found also that in the case of films 20–200 $\mu\mu$ thick, the specific resistance was 15–57 times the value for the metal in bulk. This suggests that in this range of thickness, the films consist of discontinuous crystal grains each having the properties of the solid metal, conduction occurring only along strings of granules in contact with each other. Wart⁷ has independently verified the same conclusions. Hence the thickness of the

films determined by weighing would not give us the dimensions of the individual grains, which obviously should have much larger values.

I suggest therefore that, even in films 0.2 μ thick, the particles have a much larger diameter and hence would not show any large decrease in diamagnetic susceptibility. Ingersoll⁸ found that as the films obtained by cold deposition were heated, the finely divided particles coalesced after heat treatment, almost nonmagnetic films of nickel becoming strongly magnetic during this process. It seems to be clear that in the case of films about 1 μ thick, the magnetic properties are almost independent of the thickness but depend a great deal on the thermal treatment.

If, on the other hand, the deposit is made at high temperatures and then cooled down for magnetic measurements, there are the stress effects obtained by Howey⁹ in the case of nickel films. He obtained altogether different magnetisation curves using different backing materials, and showed that the differential thermal contraction imposed a strain along the thickness of the film. This strain is nearly independent of the thickness. A rough calculation for bismuth films deposited, say, at 500° on glass, shows the existence of a strain of 4×10^{-3} which, according to the results of Lowance and Constant¹⁰, would mean an increase of about 6 per cent in the susceptibility. Howey has also shown that any imperfect adhesion would give rise to a buckling of the film and hence to another kind of strain which increases as the film becomes thinner.

Hence in the determination of the magnetic properties of thin metal films we are dealing with a large number of unknown factors and it is not surprising that Lane gets large fluctuations in his results, so much as 12 per cent. The properties and the conditions of the films should be ascertained with accuracy before any conclusions are drawn from experiments on metal films. Colloidal methods of approach have distinctly the advantages of certainty, particularly the method of recrystallisation, which is found to give very consistent results.

S. RAMACHANDRA RAO.

Annamalai University,
Annamalainagar, South India.
June 13.

¹ *Ind. J. Phys.*, **5**, 559; 1930.

² *Ind. J. Phys.*, **6**, 241; 1931.

³ *Ind. J. Phys.*, **7**, 35; 1932.

⁴ *NATURE*, **130**, 999, Dec. 31, 1932.

⁵ *J. Amer. Chem. Soc.*, **38**, 2221; 1916.

⁶ *Phys. Rev.*, **21**, 22; 1923.

⁷ *Phys. Rev.*, **19**, 615; 1922.

⁸ *Phys. Rev.*, **25**, 114; 1929.

⁹ *Phys. Rev.*, **34**, 1440; 1929.

¹⁰ *Phys. Rev.*, **38**, 1547; 1931.

New Band Systems of Aluminium Hydride

IN an arc burning between two aluminium electrodes in a hydrogen atmosphere at reduced pressure, we have succeeded in getting two new band systems of the hydride AlH. One band system lying at 3800 Å. has been photographed in the second order of a 6.5 m. grating (0.96 Å./mm.) after an exposure of 12 hr. The other band system, lying at 3600 Å. (degraded to violet) has been obtained in the same order after an exposure of 1½ hr. from a discharge through a mixture of aluminium chloride and hydrogen in a quartz tube, which is by far the most intense source for this band system.

The band system at 3800 Å. consists of nine branches and is in appearance very like the NH band

system at 3360 Å., except that the triplet separation is smaller than for NH. It has been impossible to number the branches down to origin on account of the unresolved Q branches, but from the difference in the values of the constants (B , D) and the l -uncoupling in the first members, it has been evident that the band belongs to a ${}^3\Sigma \rightarrow {}^3\pi$ system, following case b .

A perturbation in the upper state ($P(20)$, $R(18)$) has been a valuable help for numbering the branches.

The following constants have been obtained.

${}^3\pi_0$	${}^3\pi_1$	${}^3\pi_2$	${}^3\Sigma$
$B = 6.721$	$B = 6.704$	$B = 6.703$	$B = 6.760$
$D = -0.000426$	$D = -0.0004$	$D = -0.0004$	$D = -0.000436$
$F = -2.12 \times 10^{-8}$	$F = -0.85 \times 10^{-8}$	$F = -0.35 \times 10^{-8}$	$F = -1.58 \times 10^{-8}$
$J = 4.12 \times 10^{-10}$			$J = 4.097 \times 10^{-10}$
$r = 1.61 \text{ Å.}$	$v_e m = 26221.81 \text{ cm.}^{-1}$		$r = 1.605 \text{ Å.}$
$\omega = 1688 \text{ cm.}^{-1}$			$\omega = 1683 \text{ cm.}^{-1}$

Besides the (0, 0) band, the Q branch of the (1, 1) band has been observed close to the origin of (0, 0). No other bands have been obtained.

The (0, 0) band shows predissociation in the upper state ($P(26)$, $R(24)$) analogous to the ${}^1\pi \rightarrow {}^1\Sigma$ system, and accordingly we calculate for the energy of dissociation $D = 0.519 \text{ v.} ({}^3\Sigma)$.

A full report will appear later in connexion with the analysis of the band system at 3600 Å.

W. HOLST.

Laboratory of Physics,
University of Stockholm.

Phosphorescence and Finger-Prints

SOME recent experiments carried out by us indicate that the use of phosphorescent powders for the photography of finger-prints ensures satisfactory results where the ordinary methods fail.

Finger-prints occurring on an article having a multi-coloured or highly patterned background cannot be satisfactorily photographed with the help of the grey or black powders commonly used, owing to the interference of the background with the pattern of the digital impression. It was thought that if a phosphorescent material were used as the dusting powder and the photograph taken by utilising only the phosphorescent light from the finger-print, a result free from the blurring effect of the background would be obtained. The feeble luminosity of the phosphorescent print necessitated fairly long exposures and frequent re-illumination of the phosphorescent powder. These were provided for as follows: the surface containing the powdered finger-print was placed horizontally in a light-tight box having two apertures in its upper face. Over one aperture was supported a vertical camera focused on the finger-print and over the other was fixed a tungsten or tungsten alloy arc. A slowly rotating sector served to ensure that only one of these apertures was open at any moment. Very fast Ilford hypersensitive panchromatic plates, when intermittently exposed in this way for twenty minutes, gave good results. A negative, which was found to be even better for purposes of detection, was obtained by using Ilford rapid process panchromatic plates. This gave greater contrast and was at the same time free from background fog. For these much slower plates, 'exposures' of forty minutes were required.

Photographs taken in this way of finger-prints on backgrounds showing strong reflection contrasts, for example, a tin box printed in black and white stripes, showed that the background had some slight effect,

for the parts of the negative corresponding to the white stripes were somewhat denser than the parts corresponding to the black stripes. This would appear to be due to the feeble illumination of the background in its immediate vicinity by the phosphorescent powder. Slight interference of this kind, however, is not serious, as the pattern of the finger-print stands out strongly in all parts of the negative. The powder actually used was phosphorescent zinc sulphide. Great care must be taken to remove excess powder from between the ridges of the finger-print either by means of a soft camel-hair brush or by gentle blowing.

The use of fluorescent powders was also investigated, but the difficulty encountered here was that of excluding visible radiation from the source of the ultra-violet light. Wood's glass and a Jena filter, U.G.2., either alone or in combination with a saturated solution of copper sulphate, proved inadequate for this purpose, and although photographs of fluorescent prints (through protex glass) were obtained after exposures of about ten minutes, the background appeared so dense in the negative as to mask seriously the lines of the finger-print. Rather better results were then obtained by using an ultra-violet filter of solutions of cobalt chloride and nitrosodimethylaniline and photographing the fluorescent light through protex glass. In this case a fast plate, insensitive to orange and red light, was used.

In the meantime Superintendent Else of Buxton and Inspector Evans of the Derby C.I.D. have succeeded in obtaining excellent photographs, free from background, by using very pure, finely powdered anthracene, which adheres particularly well to the ridges of the finger impressions. To eliminate the heat rays it is found advantageous to interpose a plate of Chance's calorex glass between the source of ultra-violet and the Wood's glass.

A detailed description of these experiments will appear elsewhere. The phosphorescent work was carried out in collaboration with Inspectors Pentland and Doubleday of the Nottingham C.I.D.

HENRY L. BROSE.
C. G. WINSON.

University College,
Nottingham.
July 10.

Centralisation of Anthropological Studies

THE centralisation of anthropological studies in Great Britain, to which attention is directed in NATURE, July 22, pp. 113-5, is no new problem. Beginning with the fusion in 1871 of the old Anthropological and Ethnological Societies to form what is now the Royal Anthropological Institute, there have been several attempts to co-ordinate and improve the provision, both for research and for teaching, in this wide and complicated group of studies. There is a summary of them in the Institute's *Journal*, vol. 59, 1929, under the title "The Science of Man in the Service of the State".

Hitherto all those projects have been hampered by public indifference and postponed for lack of funds; and since the failure of the project for an Imperial Bureau of Ethnology—promoted by the British Association for the Advancement of Science in 1896, and 1898, accepted in principle by the British Museum, and accidentally overlaid by its foster-mother—all that has seemed to be practicable has been to avoid overlap, and encourage co-operation, among the numerous bodies which have been

willing to do for these subjects as much as their separate resources allow.

It was with this object, after the War, that the British Association (which had been again pressing on the Government in 1914 the need for better training in ethnology for officials abroad) called a conference of representatives of institutions engaged in research and in teaching in these subjects. After a careful review of all existing facilities and current projects, this conference unanimously recommended that the proper body to act as clearing-house for matters of common concern in anthropological research and teaching was the Royal Anthropological Institute, with such assistance as each and all of the bodies represented at the conference might be able to supply. The Institute accordingly appointed the "Joint Committee for Anthropological Research and Teaching", on which every university, institution, and society in Great Britain engaged in this work, was entitled to be—and in fact normally is—represented.

This "Joint Committee" has continued to act as proposed until the present time. It meets as required; through its executive (the officers of the Institute for the time being) and with the voluntary help of its members, it is kept informed as to facilities offered and work undertaken or proposed, by each constituent body; and its first report, in 1923, was a complete survey of the teaching arrangements for anthropology and ethnology in Great Britain.

To the Royal Commission on the National Collections, the Institute was enabled by this means to give valuable evidence as to the requirements of teachers and research workers. It took a leading part in the movement for an Oriental Museum, as recommended by that Commission; and it has now in progress a similar inquiry about the position in ethnography. It has given careful attention to the anthropological training of officials destined for service among native peoples; and to the standardisation of anthropometric measurements in preparation for the international scheme inaugurated in 1932. It has supported the Royal Anthropological Institute in establishing the long-needed International Congresses for Prehistoric and Protohistoric Sciences (which met in London in 1932) and for Anthropological and Ethnological Sciences, invited to meet in London in 1934.

By this simple and effective procedure the Royal Anthropological Institute has been enabled during the last twelve years to express, as accredited mouth-piece of British institutions concerned with these subjects, a considered opinion on current anthropological questions; and its utility as a centre of study and research has been recognised by the liberal grants from the Rockefeller Trustees which have enabled it to maintain its valuable library and other collections, and to keep open house for colleagues far beyond the limits of its own fellowship.

The general appeal which was being organised in 1928–29 was postponed—I think wisely—in anticipation of economic difficulties which have been more than realised. But the constitution and past activities of the Institute and its Joint Committee qualify it to make immediate use of any favourable turn in the situation, with the good-will of all whom it is constituted to represent, and, we may hope, with their active support when that moment comes.

JOHN L. MYRES

(Ex-President, Roy. Anthropol. Institute).
New College, Oxford.

'Hard' Seeds in *Panicum coloratum*, Stapf

Panicum coloratum is a grass which occurs naturally in East Africa in areas of comparatively low rainfall. In the course of a preliminary study of the indigenous pasture plants of Kenya, this species has shown considerable promise. Efforts to establish it from seed have, however, been unsuccessful, although an abundant crop of apparently good seed is produced. In small field experiments kept under observation for periods of from three to six months after sowing, no germination was observed. The caryopsis is extremely hard and is closely invested by hard shining paleae.

As it appeared likely that failure to germinate was due to the impermeable nature of this covering, treatment designed to scratch the covering was attempted. Following a suggestion made by Williams for the treatment of 'hard' clover seeds and published in Bulletin Series H. No. 11 of the Welsh Plant Breeding Station, vigorous rubbing with coarse sand-paper was tried. The seeds were placed in a mortar and rubbed with a pestle covered with the sand-paper. This seed was then tested for germination against untreated seed and the results shown in the accompanying table were obtained:—

Number of days	Treated seed. Per cent germinated	Untreated seed. Per cent germinated
6	28	—
9	31	—
21	32	—
68	40	—

Afterwards a 1 per cent germination occurred in the untreated seed, 19 days later than the observations recorded above.

More thorough treatment may be expected to produce even better results as, from its appearance, it is believed that a very high proportion of *Panicum coloratum* seed is viable.

D. C. EDWARDS.

Scott Agricultural Laboratories,
Nairobi, Kenya.

Sponges Without Collared Cells

ALTHOUGH chambers formed of collared cells may be a characteristic feature of sponges as a whole, it is probable that during certain phases of the life-history of some species they are entirely absent; and, further, it is possible that in other species they are completely wanting, at least during the adult stage.

While identifying the sponges of the Swedish Antarctic Expedition, I had occasion to examine five specimens of a new species of *Tenacia*, each of which was filled with embryos; and having cut stained sections in order to study further the structure of the embryos, it became apparent that no flagellated chambers or collared cells were present in the tissues, nor could any trace of such structures be found. It had been previously noted that no oscules were present and a very exhaustive search was made for inhalant pores with the same result, although the surface of the entire animal was searched with hand-lens and binocular microscope, and numerous sections of various kinds examined. Contraction due to preservation may sometimes cause an apparent absence of pores and oscules, but when the examination is sufficiently exhaustive, one or more pores or oscules, only partially closed, may usually be found

and always indications may be seen, especially in stained sections, of their presence. In the case of this specimen of *Tenacia* sp., no such indication could be found and it may be safely assumed that pores and oscules, as well as flagellated chambers, were entirely absent.

The remaining specimens were then examined and in each case the result was the same. In one or two of the specimens there were groups of depressions at various points on the surface, resembling contracted oscules, but these proved on closer examination to be pits occupied, or formerly occupied, by commensals (or ectoparasites?). The internal tissues in each case were composed of an exceedingly loose network of stellate cells, with occasional rounded or amoeboid cells in their interstices, and nowhere could anything in the nature of an inhalant or exhalant canal be found.

Lipostomatous sponges are commonly found but no critical examination of them has so far been attempted. They are usually branched, with, as a rule, dense skeletons of siliceous spicules, making section-cutting extremely difficult. For all we know, therefore, lipostomy may be frequently correlated with the absence of pores and flagellated chambers, in which case the complete absence of flagellated chambers in the Tetraxonida will be found to be more common than is even now suspected. At all events, it is not unusual to find post-larval incrustations of moderately large size which are without pores, oscules or flagellated chambers, but in which a fair degree of growth must have taken place since the metamorphosis.

In this connexion, mention may be made of some sponges growing in the filter beds of the Aquarium in the Zoological Society's Gardens, London. Some of these were broken into pieces, each about 5 c.c. in volume, for experimental purposes. In a few days, the fragments had become rounded off, the injured surface having healed, and they remained in this condition for about a week without any sign of oscule or pore (no examination for flagellated chambers being made). During this period the fragments actually increased slightly in size. Other experiments were made which show fairly conclusively that in this species (of *Haliclona*), the sponge will not only survive without pores and oscules (and presumably therefore without flagellated chambers) but also will increase in size and show other signs of activity.

In the case of these sponges in the Aquarium, some observations were made on the exhalant currents which may be mentioned here. There were nearly a hundred specimens in various parts of the filter beds, each of which possessed from two to twenty oscules. The conditions for observing water currents were, in one part of the beds at least, practically ideal, owing to a suspension of fine sand which exposed immediately the slightest current in the water. Although watched again and again, only once were exhalant currents seen issuing from a sponge, and in this case feeble streams were being ejected from two oscules only, of the score or so present on the surface of the sponge, and these were on opposite sides. My repeated attempts at Plymouth to demonstrate exhalant and inhalant currents in siliceous sponges were in every case unsuccessful, and I understand that others have tried to demonstrate them with no more success. Most investigators tend to attribute their failure to faulty technique, but it appears probable that this is not the case, and that the flagellated chambers of siliceous sponges are frequently quiescent over long periods.

It seems therefore that the Tetraxonida are a group of turgid animals, often without any circulatory currents, and with a very low rate of metabolism. It must also be presumed that, in the case of the lipostomatous forms, nutrition, excretion and respiration take place through the general surface and that nutriment is derived from substances in solution.

MAURICE BURTON.

British Museum
(Natural History),
London, S.W.7.
July 3.

Strainless Monocyclic Rings

THE comparatively greater stability of cyclohexane over its immediately lower ring homologue with reference to strain has not been explained satisfactorily. Experiments now afford evidence in support of the multiplanar and consequently strain-free, stable character of the substituted cyclohexane ring¹. So far, only one form of 1:1-dimethylcyclohexanone-3, was known². Now it is found that by direct reduction of dimethyldihydroresorcinol by Clemmensen's method a ketone is obtained, which is different from the ketone described previously. 1:1-Dimethylcyclohexanone-3 obtained by Crossley and others gave a semicarbazone melting at 195°-203°, whereas the ketone now obtained gives a semicarbazone melting at 162° C. The existence of the ketone in two isomeric forms is in accordance with the expectation of a strain-free configuration of the substituted cyclohexane ring.

The details regarding this compound, as also some other observations in this connexion, are reserved for a future communication.

MUHAMMAD QUDRAT-I-KHUDA.

Presidency College,
Calcutta.
June 8.

¹ *J. Ind. Chem. Soc.*, **7**, 277; 1931.

² Léser, *Bull. Soc. Chim.*, (3), **21**, 547; 1899. Blanc, C. R., **144**, 143, 1357; 1907. Crossley and Renouf, *J. Chem. Soc.*, **91**, 81; 1907.

Stereochemistry of Platinum

By acting with *iso*-butylenediamine upon a new compound, namely, the mixed β -diammine Pt(NH₃)(NH₂Et)Cl₂, we have obtained a mixture of two isomeric β -plato-tetrammines of formula [Pt(NH₃)(NH₂Et)(NH₂.CH₂.CMe₂.NH₂)]Cl₂, which have been separated. These substances, which are necessarily both of β -structure owing to the presence of the chelate group, do not become interchanged, and they give rise to plato-salts which are unmistakably different. A similar pair of isomeric β -plato-tetrammines, [Pt(NH₂.CH₂.CMe₂.NH₂)]Cl₂, has also been obtained in admixture, giving rise to a mixture of two different plato-salts which have been separated. The pairs of isomerides almost certainly represent *cis*- and *trans*- forms in each case, and their existence seems to us to afford the first authentic chemical evidence of planar structure among the plato-tetrammines, in agreement with Cox's evidence based on the X-ray crystal diagram of [Pt(NH₃)₄]Cl₂.

H. D. K. DREW.
F. S. H. HEAD.

East London College, E.1.
July 12.

Research Items

Ritual Dances in Portugal. Miss Violet Alford contributes to *Folklore*, vol. 44, June, 1933, a note on the midsummer and Morris dances of Portugal, directing attention to features which appear to point to a survival of a pagan cult of the type reputedly celebrated by the witches' coven in the Sabbath. Two performances are recorded, one of a St. John's play at Braga on midsummer morning and a second on the same day at Sobrado, near Vallongo, in honour of St. Anthony. The interest of the former in this connexion lies not so much in the performance of the present day as in past practice. It is recorded that in the sixteenth century young girls danced in the procession with other girls dancing on their shoulders, while the dancers were surrounded by women who behaved with considerable freedom. At Sobrado the performance was of a lengthy and complicated character, and only certain features are mentioned here. The dancers were divided into two troupes of which one, the *mouriscos*, was opposed by another coming from the other side of the village. The latter consisted of about fifty persons with a king. They are called *Bugios*, which means 'imitators', but with a possible secondary meaning of sorcerers. Following them comes a man riding a donkey with his face to the tail. He sows flax seed, calling it maize. The donkey wears a collar under its chin and is followed by a plough which must be broken up after the performance. At a certain stage of the proceedings the *bugios* danced a remarkable dance in which each couple rushed toward the king in a crouching attitude, while he waved them off. They then danced around him. This in its context is curiously reminiscent of the ritual salute at the witches' Sabbath. A fight then takes place between the two parties, who use muzzle-loaders, firing from wooden 'castles'. The *bugio* king is captured, and it may be formerly suffered a ritual death, though now he escapes, when a dragon is introduced. It is suggested that both the saints are a traditional memory of a priapic cult associated with a fertility festival at the summer solstice.

Sociology in Changing Cultures. American anthropologists have not been slow to recognise the implications for students of social anthropology of the closer contacts between western civilisation and the backward peoples, which are becoming general throughout the world. Dr. Margaret Mead's studies of an Indian tribe living on a reservation, but in constant touch with a white community, and the studies of Mayan conditions in Yucatan by members of the expeditions of the Carnegie Institution of Washington, are now being followed by Dr. Robert Redfield of the University of Chicago, who is engaged in an elaborate investigation of the civilising process as it is to be observed by a comparison of Mayan life and progress as observed in city, town and village in Yucatan. The three types of community are taken as representing three stages of Indian life in transition. According to a report of a communication presented to the American Association for the Advancement of Science by Dr. Redfield, which is issued by Science Service (Washington), one of the most striking changes noted is the diminishing importance of religious belief and ritual. Among the farmers, religion—a blend of Catholic faith and old native beliefs—is still close to their lives, especially

in so far as it touches their anxiety about drought and harvest. To ensure a harvest they follow the instructions of the shaman-priest, while sickness is regarded as due to a lapse from piety. In towns the rites are less understood and are performed perfunctorily as a matter of prudence. On the other hand, sorcery is more prevalent in town and city than in the country, its frequency becoming greater the further the advance in the social grading. This, Dr. Redfield attributes to the loss of familiarity with other members of the community, and the greater insecurity of the conditions of life in a city as compared with the village, which leads to a greater reliance on magic as a protection.

'Red Disease' of the Eel in Danish Waters. In the summer of 1931 numerous cases of the 'red disease' of the common eel (*Anguilla vulgaris*, Turton) occurred in various parts of the Danish waters and these were specially investigated by Anton Fr. Bruun and Børge Heiberg (*Meddelelser fra Kommissionen for Danmarks Fiskeri- og Havundersøgelser*, Serie: Fiskeri. Bind 9, No. 6. 1932). Epidemics of disease in eels have been known for some time and according to available information these are probably due to one of four causes: (1) the influence of cold, the eels dying off in spring after a hard winter; (2) red cyst disease caused by the bacterium, *Vibrio anguillarum*; (3) red disease (mass mortality in summer) caused by the bacterium, *Vibrio anguillicida* n.sp. as described in the present report; (4) the fresh-water red disease caused by *Pseudomonas punctata* f. *sacowiensis*. The cause of the summer mortality seems to be almost entirely the epidemic red disease so far as Danish waters are concerned, and this applies to a considerable stretch of water including the Sound and the waters south of Zealand. There are great possibilities of the disease being carried far owing to the transport of eels. Red disease will be met with at all seasons of the year but reaches a maximum in the late summer, the yellow eels being attacked in very large numbers. It is usually fatal, infection probably taking place through the gills or digestive canal from the bacteria living in the water. In the storing of eels, where the disease is most prominent it would probably lessen its further spread if the boxes were sunk in deeper waters, away from the influence of the sun's rays, and, if possible, with cool, running, fresh water. Also separating the sound and infected eels and not placing the catches near those that are diseased is advised.

Fresh-water Sponges of the Genus *Tubella*. Mr. Gist Gee (*Peking Nat. Hist. Bull.*, vol. 7; 1932-1933) brings together valuable information relating to these interesting fresh-water sponges, having already dealt with the literature in comparing this genus with *Trochospongilla* in a previous paper in the same journal (vol. 6, part 2; 1931). He now figures the spicules of all the known forms (seven good species and one doubtful) and summarises the history, habitat, distribution and structure of each. Two of these, *Tubella recurvata* and *Tubella reticulata*, were collected by Bates on the Amazon and described by Bowerbank as *Spongilla*. These sponges are usually found encrusting wood, the stems of plants or leaves, and in one case, a mollusc, living on the swampy

banks of rivers where they are submerged for at least a part of the day. *Tubella vesparum* from North Borneo consists of masses of very hard, dark-coloured sponge, some as large as one's fist, which were at first thought to be wasps' nests, hence the name. *Tubella vesparioides* has a similar form but differs in its spicules and comes from Burma. Five of the sponges described here are South American, one coming from the Congo region of Africa; thus the genus is widely distributed and many more species should be forthcoming with careful collecting.

Marine Relicts in Japanese Lakes. Two species of mysid crustaceans, belonging to the genus *Neomysis*, have been found in fifteen fresh-water lakes in Japan (D. Miyadi, *Proc. Imp. Acad. Tokyo*, 9, 27; 1933). These lakes are drowned valleys cut off from the sea by sand dunes or alluvial barriers and are to be regarded as lake relicts of what were formerly arms of the sea. They possess physical characters comparable to those of the glacial and relict lakes of Europe and North America in which *Mysis relicta* has been found. The upper limit for this species is 14° C.; the Japanese lakes vary from level temperatures of less than 15° C. in July and August to above 20° even at the bottom, so that the Japanese relict mysids appear to have a wide temperature range. They avoid the deoxygenated bottom waters which occur in some lakes, but most lakes are sufficiently replenished through the stagnation period of summer to permit the existence of *Neomysis* at the greatest depths. Both Japanese species, like *M. relicta*, reproduce in the winter season, and females with young in the brood pouches appear in early spring. There is some difficulty about the synonymy of the Japanese species of relict mysids, but according to Tattersall's nomenclature they are *Neomysis intermedia*, Czerniavsky and *N. awatschensis*, Brandt.

Genetics of Tetraploid Tomatoes. It is well known that if a diploid tomato shoot is decapitated, about 7 per cent of the adventitious shoots arising from the cut surface will be tetraploid. Using this method, Dr. F. W. Sansome (*J. Genetics*, vol. 27, No. 1) has investigated the genetics of eight factors in tetraploids, the behaviour of which in diploids was already known. The method was to compare the offspring from diploid and tetraploid shoots arising on the same F_1 diploid plant. The tetraploid shoots are coarser, with broader, thicker and darker green leaves. They show a slower rate of growth acceleration but grow for a longer period, and exhibit much less fertility than the diploid. The dwarf factor, d , is completely recessive to D in the diploid, but tetraploid plants of constitution D_1d_3 are distinguishable from D_2d_2 and D_4 . The factors y for clear skin and R for red flesh give nine possible fruit colours in the tetraploid, as against four in the diploid. The tetraploid ratios obtained in F_2 make it possible to investigate the manner of pairing and segregation in meiosis. It is concluded that chromatid segregation is probably shown by some factors and whole chromosome segregation by others. The linkage in tetraploids between factors which show random chromatid segregation is also discussed. In an appendix, Mr. K. Mather furnishes further evidence regarding the exact method of doubling of the chromosomes in tetraploid shoots. Decapitation stimulates both large and small cells to divide; but in large, highly vacuolate cells, wall formation fails

following mitosis of the nucleus. This produces a binucleate cell in which fusion occurs later to form a tetraploid nucleus either in the resting stage or during the subsequent division.

Geology of Central Australia. Continuing his important work on the MacDonnell Ranges, C. T. Madigan has recently described the geology of the Eastern Ranges (*Trans. and Proc. Roy. Soc. S. Aust.*, pp. 71-116; 1932). The Ranges form the southern border of an easterly-projecting tongue of the great Archaean shield of western Australia. Against this tongue the younger marginal formations have been crushed and buckled by thrusts appearing to come from the basins of deposition. Overlying the oldest gneisses is the Pertaknurra Series, which has been invaded by granites and is auriferous. Following strong orogenesis and denudation came the sea invasions and the deposition of the Pertatataka (Nullagine) sediments. No evidence of a glaciation corresponding with the Sturtian tillites has been found. The formations pass up into thick limestones of Cambrian age and these in turn are succeeded by the Larapintine shallow water facies of the Ordovician. After the retreat of the Ordovician seas, a period of peneplanation set in which continued unbroken until the close of the Palaeozoic. It is probable that the MacDonnell were raised about this time as a great flysch-like conglomerate, 9,000 feet thick, and assigned to a Permo-Carboniferous age. During the Mesozoic the gradually eroded ranges supplied the sands of the artesian basin lying to the east and south-east. At the close of this era the MacDonnell received their final uplift, since when erosion has gone on continuously. Pleistocene rejuvenation of the streams was brought about by the sinking of the Lake Eyre basin.

Seismographic Methods for Determining Crustal Structure. During the summer of 1931, Messrs. B. Gutenberg, H. O. Wood and J. P. Buwalda carried out an important series of experiments to test the use of seismic methods in the exploration of the earth's crust (*Bull. Amer. Seis. Soc.*, 22, 185-246; 1932). The experiments were made at five different places in California, two of them in the Owen's Valley near the fault-scarps produced during the earthquake of 1872. Miniature earthquakes were generated by firing explosives either on the surface or in holes a few feet deep. The arrival times of the resulting waves were recorded by single-component seismographs erected at two to six stations, arranged along nearly straight lines from the shot-point, from which the farthest station was less than 1,000 ft. The instruments recorded the interval between the firing of the shot and the arrival of the waves with an accuracy of about one-thousandth of a second. The authors conclude from their experiments that the velocities of surface waves and compressional waves in the upper layers of the crust can be measured with a high degree of precision; that, by the reflection and refraction of the waves, the bounding surfaces between rock-masses possessing different physical properties can be measured to a depth of two miles and, under favourable conditions, of four miles; and that the existence of a fault, even if concealed, can be ascertained, its inclination to the horizon measured, and perhaps even the amount of the vertical displacement along it estimated. As the experiments at any place require only two or three days, the authors thus believe that seismic methods

form a new and powerful instrument for determining the shallower, as well as the deeper, structure of the earth's crust.

Pendulum Observations. The normal way of comparing gravity at a number of points is the timing of an 'invariable' pendulum. E. C. Bullard (*Proc. Roy. Soc., A.*, July) has devised a method of recording swings of the pendulum and wireless signals simultaneously on a drum covered with photographic paper. The wireless signals may be special time signals, but for the comparison of pendulums at two stations the author adopts the ingenious expedient of recording the swings at the two stations, together with a portion of an ordinary commercial message from a high power transmitter. The message serves to provide simultaneous marks at the two stations. Using a time of observation of one hour, the errors in timing are small compared with other uncertainties, the accuracy attained being of the order of one part in a million.

Detecting Cracks in Metal Surfaces by Magnetism. A description of apparatus for detecting cracks, otherwise invisible, in machined metal surfaces is given in the *Metropolitan-Vickers Gazette* for July. The method is first to magnetise the part inspected, then immerse

it in a fluid carrying finely divided iron particles in suspension. If there is a crack, the iron particles will line up along the crack or cracks owing to the disturbance of the magnetic field caused by them. When the cracks are located, the part is demagnetised. The apparatus provides for the magnetisation of the surface, for its immersion or the pouring of fluid over it, for inspection and finally for demagnetisation. When the objects to be inspected are small and conveniently shaped, a number of parts can be magnetised and inspected simultaneously, thus saving considerable time. A circulating device is used for agitating the fluid in the immersion tanks so as to keep the iron particles uniformly distributed. As it is undesirable to leave parts in a magnetised state, means are provided for demagnetising them before use. This is done by passing the parts slowly through an alternating current solenoid, either by means of a moving conveyor or trolley. In the Company's own factory, the method is extensively used for the inspection not only of large forgings such as turbo-alternator rotors, but also of smaller products such as gear pinions and milling cutters. The most suitable apparatus for routine inspection tests depends on the number of objects to be inspected and on their size, shape and material.

Astronomical Topics

The Planetary Nebulæ. Prof. H. N. Russell has published an article on these nebulæ in the *Scientific American* for July. He complains that the name planetary is unsuitable, but, it seems, without sufficient reason. The photograph of the Owl nebula that is reproduced bears a decided resemblance to Mars when slightly gibbous.

One of the first problems is to determine the distances and sizes of these nebulae. Dr. van Maanen tried several years ago to obtain direct measures of parallax at Mount Wilson; the objects measured gave a mean parallax of $0.012''$, but the fact that the mean proper motions were only twice the parallaxes, whereas the radial velocities indicated that they ought to be seven times as great, led to the conclusion that the parallaxes were too large. An explanation was found in the nebular light being bluer than that of the comparison stars, which caused unequal refraction. A new method of attack was to determine the proper motions by plates extending over an interval of 15 years. They were small; but just large enough to use for comparison with the radial velocities. The average distance of the nebulae observed came out as 4,500 light-years, and the diameter of the nebulae nearly a light-year. The photographic magnitude of the central star came out as fifteen times that of the sun, but the visual only ten times that of the sun; this difference arises from the blueness of the nebular light.

It appears that the central stars must be white dwarfs, with diameter one-fifth of the sun's, and density not less than a thousand times the sun's.

As to the chemical composition of the nebulae, our familiar atmospheric gases oxygen and nitrogen were identified several years ago, and Boyce, Menzel and Miss Payne have just identified the strongest two remaining lines as those of doubly ionised neon.

The distance of the Ring Nebula in Lyra is given as 1,500 light-years; its diameter two-thirds of a

light-year. Prof. Russell makes a slip in describing it as spherical, for its outline is an ellipse, with axes in the ratio seven to ten.

The "Nautical Almanac". The *Nautical Magazine* for July contains an article on the "Nautical Almanac" by its superintendent, Dr. L. J. Comrie. He gives a sketch of the state of navigation before the Almanac existed, and then briefly traces the various changes that have been introduced in it. The following quotation emphasises the startling nature of the changes that have been made in the last seven years: "Up till about 1926 the work of computing was done, with slight exceptions, by hand. Highly skilled computers, who lived on 7-figure logarithms, were the order of the day. In that year the work of mechanising the calculations was begun, and to-day no logarithms are used. . . . About one-third of the staff are astronomers, the rest are computers. This mechanisation has resulted in great economy, and has rendered the routine portions of the work much less fatiguing."

The article then describes in detail the methods of using the machines. Differencing has always been used for checking values that are calculated for uniform time-intervals; this differencing is now done mechanically by the National accounting machine, which prints both the function and its differences. Actually two copies of the function are printed, one being kept for reference, the other sent to the printers; the differencing secures that the copy for press is free from errors. Two other machines are described, one of which builds up a function from the calculated second differences, and the Hollerith machine, by which a large part of the calculation of the positions of the moon, as given by Brown's tables, has been carried out up to the year 2000; the cost was £1,500, as compared with £6,000 by the old methods. The workers have to depress keys, instead of writing down figures; this is both much quicker and freer from errors.

World Petroleum Congress

THE first World Petroleum Congress since the War was held in London on July 19-25 inclusive. Delegates from twenty-five countries attended and 1,200 members from all parts of the world took part in the proceedings. Members were welcomed by the president, Mr. T. Dewhurst, at the Science Museum, South Kensington, on the evening of July 19, and on the following day the work of the Congress began. Apart from the daily sessions, lectures were given at the Royal Institution by Mr. J. B. Aug. Kessler on "Rationalisation of the Oil Industry" on July 20, a résumé of which follows this article, and by Sir John Cadman on "Science in the Petroleum Industry", referred to in NATURE of July 29, p. 162.

H.M. Government held a reception at Lancaster House on July 20 after Mr. Kessler's lecture, delegates and members being received by the President of the Board of Trade. Other social functions, also visits to various relevant industrial works, were arranged during the Congress period.

The Congress was divided into three main sections: geological; production; and refining, chemical and testing. The Geological Section was concerned at first with the significance and the fundamental principles governing regional distribution of oilfields. Later, problems of actual oilfield developments were discussed. In this connexion consideration was given to unit development, well spacing, electric logging, methods of increasing oil recovery, evidence provided by coring, flush sampling, etc., and to general development schemes involving gas conservation, edge water control, group production, etc. Finally, recent developments in geological exploration were considered and the value of geophysical surveying, aerial photography and current field methods assessed.

The Production Section began its sessions with a survey of modern methods of drilling under various conditions. Later, transport and storage of oil were debated and theories advanced for protection and construction of pipe-lines. Further sessions were devoted to actual production methods as now practised in various parts of the world, and their relationship to reservoir conditions. The most effective rate of production and methods of control of flowing wells were discussed. Finally, a joint session was held with the Refining, Chemical and Testing Section, to consider measurement of oil in bulk.

Hydrogenation, which was brought before members of the Refining, Chemical and Testing Section,

naturally attracted much attention in view of the recent declaration of policy in this matter by H.M. Government. Dr. Bergius opened the meetings with a historical account of hydrogenation and described some of the experiments he carried out some twenty years ago, when the subject was first mooted. Mr. Gordon, of Imperial Chemical Industries, Ltd., explained briefly the plant to be erected at Billingham-on-Tees for experimental production of liquid fuel from coal; reference has already been made to this subject in NATURE of July 29, p. 160. The scope of this section was extremely wide and included discussions on bituminous emulsions, the determination of gum in gasoline, viscosity and its expression, the desirable characteristics of fuels for high-speed compression engines, also problems connected with kerosene, lubricating oil, refining of cracked gasolines, oil-coal fuels, knock-rating, alternative fuels and, finally, a session was allotted to the study of petroleum as a chemical raw material, an extremely vital aspect of the modern technology.

The business of the Congress was concluded by a joint meeting of all sections, the main issue being international co-operation and standardisation. Emphasis was laid on the lack of accepted international nomenclature for petroleum and petroleum products and the need for co-operation between all existing national and international standardisation bodies. It was urged that the first step towards achievement of international terminology and complete standardisation of methods of test was to secure co-ordination of opinions among the various individual bodies in the countries concerned. The next stage was to appoint regular channels through which information could be readily disseminated and interchanged by the different countries. It was proposed and carried at the meeting that, in order to avoid overlapping and duplication of work, national petroleum nomenclature and methods of test should be arranged through the medium of an international body, namely, through Committee 28 of the International Standards Association.

It was generally felt that the Congress had fulfilled its purpose by bringing together specialists in all branches of the industry and by affording opportunity for open discussion of the many salient problems arising from the rapid technical, scientific and commercial development of the industry during recent years. It was therefore proposed and unanimously carried that a World Petroleum Congress should be held triennially in order to further the constructive work of this 1933 Congress.

Rationalisation of the Oil Industry

IN his lecture on "Rationalisation of the Oil Industry" delivered to members of the World Petroleum Congress on July 21, Mr. J. B. Aug. Kessler contended that the lack of balance between production and consumption of each individual main product in the petroleum range is largely responsible for the present depressed state of the industry. Hitherto, the abnormally low prices prevailing for gasoline and fuel oil have been attributed generally to over-production of crude oil and to a systematic decrease in the consumption of its products. During

the past few years, conservation of crude oil has been rigorously adopted as a corrective measure against these two major evils, but the fact remains that, although the consumption of petroleum products as a whole has exceeded the production, prices have fallen rapidly.

Primarily, crude oil is produced to meet the world's demand for gasoline. All other derivatives, therefore, must necessarily be regarded as by-products, and of these fuel oil is by far the most important.

Gasoline, being a fuel endowed with special properties, rarely acts as a substitute for other fuels and for this reason supplies only 'legitimate' markets. Fuel oil, however, is at the present time supplying 'illegitimate' markets, that is, markets where its peculiar properties as a liquid fuel are not a real asset and where the solid fuel, coal, is in every way satisfactory; the irrational treatment of coal is probably the most potent single factor in the disorganisation of the petroleum industry as a whole.

With the advent of the cracking process, liquid fuel became a raw material for the production of gasoline. Cracking plants were installed which enabled gasoline to be produced at a cost price of not more than 3 cents above the price of the raw material used. Similarly, the price of fuel oil automatically dropped owing to excessive production and the consequent necessity for securing markets irrespective of their financial value and suitability. Long-term contracts were negotiated at low prices and the industry is thus still compelled to produce more crude oil than is economically desirable in order to meet such 'illegitimate' demands.

The coal industry, which is the other main source of the world's fuel supply, has been materially affected not only by this unjustifiable competition of liquid fuel, but also by the fact that authorities in coal-producing countries have deemed it necessary to tax gasoline. Thus it is that the beneficial effects of years of continued research into the economic production of gasoline have been practically annihilated and attention has perforce been focused on the expensive process of hydrogenation of coal and lignite, and on cheaper alternative fuels. In the latter connexion, authorities anticipating a reduction in revenue from gasoline have imposed taxes on Diesel oils and other fuels which, if their development were unhampered, would automatically raise the general standards of living. It is therefore apparent that the great excess of fuel oil has, by facilitating the production of cheap gasoline, helped to build up a system of taxation which is restricting the marvellous economic developments of the age.

From a detailed study of modern methods of refining crude oil, it is apparent that there are several methods by which the present excessive production of fuel oil may be curtailed. Theoretically, the maximum reduction of 86 per cent is obtainable by cracking all straight-run fuel oil to coke; by a combination of hydrogenation and cracking, a reduction of 70.5 per cent can be secured; by cracking all straight-run fuel by composite residue and non-

residue processes, a reduction of 47 per cent is possible and, finally, by cracking all straight-run fuel by the low level (liquid residue) system, a reduction of 30 per cent is obtainable. Not only are there these savings of fuel oil production, but also in each case a conservation of the world's crude oil supply would automatically accrue. Each of these four systems has its specific advantages and disadvantages, but it is suggested that by cracking all straight-run fuel by current methods, that is, residue and non-residue processes, much would be achieved towards the ultimate balance of production with legitimate demand in so far as fuel oil is concerned. This system would doubtless have to be modified to meet the demand for gas oil, Diesel oil, etc., and partial change towards the other possible processes might prove essential. Fundamentally, however, it is free from appreciable defects and its advantages are considerable.

Omission to provide part of the liquid fuel at present marketed would immediately raise fuel oil prices to a reasonably remunerative level. Much illegitimate fuel oil business would return to coal. There would be a cessation of any real or apparent justification for the restrictive measures enforced by coal-producing countries and less inducement for producers to seek such abnormal outlets as coal hydrogenation for their products.

Supplies of fuel being limited, its use would be restricted to those applications where its special properties are of real value. By permitting the oil industry a reasonable return for its produce and labour, the consumer would be guaranteed a supply of petroleum products of the constantly improving quality rendered necessary by modern progress in engine design. Moreover, the life of crude oil resources would definitely be prolonged. It is true that such a reorganisation would involve a moderate capital expenditure on additional cracking equipment, but this would be offset by direct savings in production and drilling costs. The difficulties involved in the successful application of this scheme are primarily operative, and not due to the fundamental composition of cracked fuel; their solution, therefore, must be entrusted to the technologists of the industry.

Summarily, conservation of crude oil has already paved the way towards the balance between production and consumption of petroleum but, unaided by rationalisation on the lines indicated above, it cannot restore the industry to prosperity, and just so soon as this balance is achieved in respect of fuel oil, so soon will the industry emerge from the present chaos.

Annual Conference of the Museums Association

THE forty-fourth annual conference of the Museums Association was held at Norwich on July 3-7, when one hundred and eighty members of the Association met under the presidency of Sir Henry Miers.

The prevailing financial conditions, which prevented some municipalities from sending delegates, were responsible for a somewhat smaller attendance than usual, but the Conference atoned for this by the unusual diversity of subjects on the programme and the vigour of the subsequent discussions, while the social side was reduced to a minimum and each of the receptions afforded an opportunity of seeing one of Norwich's museums or some feature of scientific or artistic importance.

In his fifth presidential address, Sir Henry Miers gave an encouraging account of the Association's work in many fields, at home and abroad, during the past year. Despite the difficulty of the times, the Association is holding its own with regard to membership, while its importance and usefulness are increasing markedly throughout the museum world. The Empire survey has been completed by Mr. Markham's tour of Australasian museums and Dr. Bather's and Mr. Sheppard's visit to the West Indies. At home the most important advance has been the strengthening of the Association at its new headquarters, Chaucer House.

Reviewing the events of the last five years in his capacity as president, Sir Henry referred to the great

debt the Association owes to the Carnegie Corporation of New York which has made the Empire surveys possible, and the Carnegie United Kingdom Trustees, who have co-operated with the Association in trying to improve local museums in Great Britain. He referred to the usefulness of the Regional Federations which now number six, and he believes they are powerful factors in the effective development of the new museum service.

Museums continue to increase in number and in size, and Sir Henry reported that since 1928 the total number of museums in Great Britain has increased from 530 to 578. Unfortunately, in the problem of the curator little change has taken place. A very useful survey might be made of the immediate effect produced by the appointment of a qualified curator. Sir Henry regrets that very little has been accomplished with regard to the extension of the influence of museums into rural districts or with the much-discussed establishment of so-called folk museums. Although there still exist defects in museum service, he feels there has also been a great advance.

Other matters of importance with which Sir Henry dealt were co-operation with the British Broadcasting Corporation; and the usefulness of temporary art exhibitions in small museums. In commenting upon the continued value of the *Museums Journal*, Sir Henry referred to the great services rendered by its retiring editor, Dr. F. A. Bather.

Following the presidential address, Mr. F. Leney, curator of the Norwich museums, gave a talk, illustrated by lantern slides, on the main features of the collections in his care and their arrangement. He directed particular attention to the avoidance of reflections in plate glass.

For the remainder of the morning the delegates heard the reflections of the Empire survey secretary, Mr. S. F. Markham, on the conclusion of his seven years' experience in visiting museums in Great Britain and other countries. He is particularly concerned with the financial grants made by councils or other bodies to their museums and gave an analytical list of the most generous and the poorest areas; with methods of exhibition of art and antiquities; and with publications for the visitor. As Mr. Markham has probably seen more museums than any other one man, his remarks were most valuable, although often very unflattering, to the home curator and museum.

Wednesday was devoted to the discussion of art problems. Mr. Eric Brown of the National Gallery of Canada, Ottawa, spoke on Canadian art and pointed out that Canada's first art school predated any of England's by a generation, and Mr. H. M. Hake described recent extensions at the National Portrait Gallery. The remainder of the morning was occupied by an animated discussion on provincial art galleries, opened by Major A. A. Longden. A great variety of suggestions was made for brightening these, including local exhibits; freedom of action for the director; brighter interiors with music, flowers and first class refreshment facilities.

In the afternoon, Prof. W. G. Constable gave his views on training for museum work based on his year's experience as director of the Courtauld Institute, and pointed out how far the Institute could assist museum curators. He was followed by Dr. H. J. Plenderleith who discussed some problems respecting water-colours and inks, and gave an account as satisfactorily practical as Prof. Constable's was theoretical.

Most of Thursday morning was devoted to the annual business meeting, but the delegates welcomed Dr. Robert Gurney who opened a discussion on the illustration of natural science. He pleaded for more exhibits illustrating life-histories and evolution, and thinks that the great importance of insects should be much more strongly stressed. The subsequent discussion showed that whatever may be wrong with museums it is not for lack of ideas in curators. In the next paper Miss Delia Griffin, of the Children's Museum, Hartford, United States, gave a talk on children's museums, in which she said the idea was to make the museum a sort of club which the children felt belonged to them. She has found that, at first, natural history specimens prove more attractive than artistic objects.

Further contributions to the natural history side were made in the afternoon by Mr. H. J. Howard of Norwich, who spoke on "Nature Study and the Child", and by Mr. Colin Matheson of the National Museum of Wales, who gave many good hints on exhibits of invertebrate animals. Afterwards, Dr. R. T. Gunther made many practical suggestions for emphasising the human side of collections and it was encouraging to learn how far curators are endeavouring to tell the public something of the lives of the men associated with the objects they show.

Practically the whole of Friday was taken up by excursions. On Friday evening, however, the Conference closed with a most interesting lecture, illustrated by cinematograph films, by Lord William Percy on the Bittern in Norfolk.

University and Educational Intelligence

CAMBRIDGE.—An important change in the regulations for Part II of the Natural Sciences Tripos (physics and chemistry) has been announced, to take effect in 1934. Under the new regulations, there will be four papers in chemistry; two of a general nature and two more specialised, including questions in inorganic, organic, theoretical and physical chemistry, colloid science, metallurgy, and crystal chemistry. A sufficient number of questions will be set for a candidate to attain a first class in one or more of the sub-divisions. Four papers will also be set in physics, three being of a general nature. The fourth paper will contain specialised questions on some branches of physics, but a sufficient number of questions on crystallography and crystal physics will be set in this paper to allow a candidate to gain full marks by answering questions on these branches only.

Mr. Leslie Howarth, of Gonville and Caius College, Cambridge, has been awarded the Busk studentship in aeronautics for 1933-34. The studentship was founded in memory of Edward T. Busk who lost his life in 1914 while flying an experimental aeroplane.

LONDON.—Prof. H. W. Florey, since 1931 Joseph Hunter professor of pathology in the University of Sheffield, has been appointed to the Sir William Dunn chair of pathology tenable at Guy's Hospital Medical School.

The following degrees have recently been awarded: D.Sc. in zoology to Mr. K. G. Blair (Birkbeck College) for published papers on the "Taxonomy of various Families of Coleoptera, more especially of the Series Heteromera"; D.Sc.

(Engineering) to Mr. P. Dunsheath (private study) for nine independent publications on the "Dielectric and other Properties of Electric Cables", together with one conjoint subsidiary contribution.

THE following Beit fellowships for scientific research at the Imperial College of Science and Technology, during the academic year 1933-34, have been awarded: extensions for a second year of fellowships already held for one year: Dr. R. M. Shackleton, for research in geology dealing with the Moel Hebog (Snowdon) district, and an area of metamorphic rocks in Argyllshire (under Prof. P. G. H. Boswell); Mr. E. G. Jones, for spectroscopic research, specially the hyperfine structure of spectrum lines (under Prof. A. Fowler); and Dr. R. L. Rosenberg, for theoretical investigations in topics connected with quantum mechanics (under Prof. S. Chapman); new fellowships for one year, renewable for a second year: Mr. S. F. Boys, of the Pudsey Grammar School and the Imperial College, for experimental research connected with the structure of molecules and some problems linked with these in the light of modern chemistry and physics (under Prof. J. C. Philip); Mr. M. Blackman, of Rhodes University College, Grahamstown, South Africa and the University of Göttingen, for research on the theory of crystal structure, and molecular vibration in crystals (under Prof. S. Chapman); Mr. H. B. Squire, of Bedford School and Balliol College, Oxford, for research into the stability of certain viscous fluid motions (under Prof. L. Bairstow); fellowship limited to one year: Dr. K. Bailey, of Orme Boys' School, Newcastle-under-Lyme and the University of Birmingham, for botanical research (under Prof. V. H. Blackman).

THE "Crisis in Education" forms the principal topic of discussion in the February issue of *School Life*, the organ of the United States Office of Education. It reproduces the forty recommendations formulated at a conference convened by Mr. Hoover in January at the American Academy of Arts and Sciences for the purpose of considering the school and tax system from the point of view of maintaining the welfare of children in the face of decreasing school revenues. Prominent among the recommendations is one relating to the "critical condition of certain underprivileged groups, particularly the negroes, and the necessity for special solicitude with regard to them", lest the inequality of educational opportunity which already divides them from the rest of the community should be accentuated with disastrous results. Instances of this inequality are: the percentage of illiteracy, white 1.5 and coloured 16.3; percentage of children living three miles or more from the nearest school, white 4 and coloured 15; percentage of children transported at public expense, 19 and 1; salaries of rural teachers, 945 dollars and 388 dollars. Classes have grown to monstrous sizes owing to reductions of negro teaching staff accompanied by reductions of salary amounting in some cases to forty per cent. The most serious of the problems confronting the negro colleges is that of helping to find ways and means for students to maintain themselves. It was found in 1930 that 30 per cent of the freshmen entering these colleges expected to earn all, and 27 per cent to earn at least half of the cost of their maintenance. These percentages have since become higher, while many of the jobs formerly available for them have been taken by white students.

Calendar of Nature Topics

Fifth 'Buchan Cold Spell'

August 6-11: After rising to a peak in the middle of July, the average temperature in London decreases slightly until early in August, after which it rises again to a second maximum in mid-August. Dr. A. Buchan placed this secondary minimum in the period August 6-11, but the 90-year averages at Greenwich are lowest on August 3 and 4. In individual years, the heat of mid-July is frequently followed by a period of unsettled weather with fluctuating temperatures, sometimes associated with thunderstorms. A possible explanation of this cool, damp weather is the incursion of cool winds from the ocean over the heated land surface of Europe, which would tend to occur at a fairly constant interval after the summer solstice, but it is not possible to pick on any definite period of days as marking a regularly recurring cold spell.

Red Deer shed the Velvet

In the first week of August the oldest stags generally shed the 'velvet' or hairy vascular coat which has contributed to the growth of the antlers. The process is deliberate, the stag rubbing its antlers, on which the 'velvet' now hangs dried, upon a hard surface, such as the trunk of a tree. But preferences are shown, for rubbing-trees seen a week or so ago by the writer, in the high deer-forest of Deeside, were all young trees and were all larch, although other kinds of trees were more abundant. Richard Jeffries used to say that the red deer's antlers grew with the brake fern, the annual regrowth beginning when the fern showed above ground and overtopping the stag's ears as the fern began to conceal his reclining body. With the growth of the antler the velvet is intimately associated, for although the vascular supply connected with the actual laying down of the bony tissue is confined for the most part to the centre of the antler, the cuticular covering (or velvet) with its abundant supply of blood-vessels and its characteristic dense coat of short hairs, maintains the high temperature necessary for the rapid growth of the bone. To the touch a growing antler feels extraordinarily warm.

Mechanism of Velvet Shedding

The shedding of the velvet cannot take place until the blood supply has been cut off, else undue bleeding would occur, and the arrest of the blood flow is brought about in a curious fashion. At the base of each regrowing antler, where it joins the permanent projection of the frontal bone, an enlarged disc of rugged bone, the burr or corona, develops. During the growing period, the vessels carrying supplies to the velvet pass over the ridge of the burr by way of surface channels lying between the rugosities of the burr. In these channels they are at first protected by the bony projections; but as the antler grows and the burr increases in size, the walls of the channels gradually close in upon the blood-vessels, so that ultimately the superficial blood supply is checked, and the velvet dries up and shrivels. At this stage the stag hastens the shedding of the velvet by rubbing, and antlers are adorned with ribbon-like streamers. Although the outer blood supply ceases, the antler does not become a dead structure, for the interior still retains its vascularity and there bone is still

being deposited, and will continue to be until these vessels also become constricted and preparations begin for the shedding of the antlers themselves in April or May (see NATURE Calendar, April 29, p. 629).

Recent Appearances of the False Killer Whale

On August 3, 1929, a school of false killer whales (*Pseudorca crassidens*) numbering 167 individuals, was stranded upon the Island of Velanai in northern Ceylon. This was the last of three remarkable occurrences, all happening in the latter part of the year, which directed fresh attention to the movements of a species about which science had much to learn. In mid October, 1927, more than a hundred individuals were stranded in the Dornoch Firth in northern Scotland; in December, 1928, a school of similar dimensions was stranded near Cape Town; and finally, almost a year later, came the Ceylon record. In November, many years before (1861), about a hundred appeared in the Bay of Kiel. Otherwise records from northern seas are scanty. An odd individual has appeared in the Baltic and Mediterranean Seas, there are three records from North America; but, according to Dr. Joseph Pearson, it is apparently abundant in the South Pacific, where there are records from Tasmania, New Zealand and the Chatham Islands (*Spolia Zeylanica*, 16, 199; 1931).

Dr. Pearson suggests that the false killer is a subantarctic oceanic form which occasionally wanders northward in large schools. If this view be correct, perhaps the consistent autumnal appearance of the large schools in the northern hemisphere suggests a regular northward migration which sometimes overshoots its normal limit. But the false killer was originally described from a skull, discovered as a fossil, in the fens of Lincolnshire, so that the appearance of the species in British seas is no new event.

Potato Blight

The labours of crop production are practically over. Little can now be done to increase the harvest. The season is too far advanced for crops to profit from further supplies of plant food while cultivation among dense vegetation probably does more harm than good. Potato growers, however, still have one operation to perform. At the first onset of warm damp conditions, the risk of damage by the common blight (*Phytophthora infestans*) is very real, and when once started, the disease may completely ruin the foliage in a surprisingly short time. Repeated sprayings with suspensions of copper salts serve to keep the disease within bounds, and this is the standard practice. In an attempt to dispense with the large quantity of water demanded by wet spraying, many growers operating on a large scale apply their copper compounds in the form of a dust cloud. The work is best done at night when the foliage is damp with dew.

Success largely depends on weather conditions and machines of large capacity enable the best use to be made of favourable periods. Night dusting, like the use of headlights on the tractor, is yet another case of the intensification of agriculture—conditions being more akin to the methods of the factory than the dawn-to-dusk routine of husbandry. A few hours' effort at the right time may be more effective than days of labour under adverse conditions.

Societies and Academies

DUBLIN

Royal Irish Academy, May 8. L. B. SMYTH: Certain Carboniferous corals with epithecal scales. Two new species of coral were described from the Carboniferous of Tournai, Belgium, under the names *Squameophyllum spumans* and *Stratophyllum tenue*. Both are small, massive, 'porous' forms. A remarkable feature is the presence of scale-like structures, 1 mm. or less in diameter, on the epitheca of most specimens of the first-named species, and of occasional specimens of the second. '*Michelinia*' *antiqua*, McCoy is transferred to the new genus *Stratophyllum*, which thus contains two species.

EDINBURGH

Royal Society of Edinburgh, July 3. T. TAIT and W. W. SMITH: The abnormal atomic weight of calcium contained in two very old potassium-rich deposits at Rhiconich, Sutherlandshire and Portsoy, Banffshire. Investigations on the abnormal atomic weight of calcium contained in two very old potassium-rich rocks have confirmed the tentative value of 1×10^{12} years for the half-period of the radioactive potassium isotope of mass 41 derived by physical methods. T. J. JEHU and R. M. CRAIG: Geology of the Outer Hebrides. (5) North Harris and Lewis. The prevalent gneisses of the Archaean complex are acid biotite-gneisses and hornblende-biotite-gneisses with which are associated some earlier basic types and other basic and ultra-basic types intrusive into the prevalent rocks. All these come under the designation of orthogneisses, but at two or three localities paragneisses have been noted. A massive granite-gneiss with associated pegmatites forms the latest member of the complex. The most striking feature in the geology is the belt of crushed and sheared rocks which can be traced along the eastern side of Lewis—a continuation of the belt observed along the eastern side of the islands farther south, which is characterised by the development of mylonites, and flinty crush phenomena. The red sandstones and conglomerate in the neighbourhood of Stornoway are probably of Torridonian age. Tertiary dykes, chiefly dolerites of Crinan type, occur. During the maximum glaciation the whole region was buried under ice to a height of 1,800 ft. thick and later there is striking evidence of local glaciers. LANCELOT HOGGEN: The effect of consanguineous parentage upon metrical characters of offspring. First-cousin parentage does not raise the fraternal correlation when transmission is autosomal to an extent which would be recognisable, unless a very large sample of sibs whose parents are first cousins is available to compare with a control group of sibs with unrelated parents taken from the same population. On the other hand, the correlation for mixed sibs whose mothers are sisters is appreciably higher than that for sibs of unrelated parents when transmission is sex-linked. The variance of offspring of first cousin unions is very large compared with that of offspring of unrelated parents, when the frequency of the contributory recessive genes is low and the degree of dominance is very nearly complete. HILARY B. MOORE: The faecal pellets of *Hippa asiatica*: The structure of the faecal pellets of the anomuran, *Hippa asiatica*, is described and figured. They have separate tracts of coarse and fine grade material, and are drained by longitudinal canals.

Their structure is compared with that of other Anomura which have similar canals, but a smaller proportion of fine grade material, and it is suggested that the complex structure is related to the processes of digestion. NELLIE M. BLAILEY: Structure of the foot in certain mosses and in *Anthoceros lewis*. An anatomical examination of the foot as the absorbing organ of the sporophyte in mosses reveals certain structural features which appear to be distinctive for the several classes into which this group of plants is divided. Deviations from typical structure occur, however, in the Eu-Bryales. The resemblance of the foot in *Anthoceros* to that of *Tmesipteris* is commented upon. S. WILLIAMS: A contribution to the experimental morphology of *Lycopodium selago*, with special reference to the development of adventitious shoots. Decapitation of the shoots of young plants derived from bulbils leads to the production of various types of regenerative growths. Adventitious buds have also been obtained on partially isolated leaves and on detached bulbil leaves. The bearing of the facts on the morphology of the normal bulbils is discussed. A comparison is made between the regenerative developments of *L. selago* and those of other species of *Lycopodium*, of *Phylloglossum* and of *Rhynia Gwynne-Vaughani*. R. A. R. GRESSON: Studies on the gametogenesis of *Stenophylax stellatus*, Curt. (Trichoptera). The growth of the oocytes and associated cells, during the larval and pupal stages of the caddis-fly, *Stenophylax stellatus*, is described in detail. The chromosome number, as determined by counts in oocytes and spermatocytes, is sixty. The fatty yolk-globules, present in the older oocytes, are formed from the Golgi elements; it is suggested that the protein yolk is formed from nucleolar extrusions, and that the mitochondria and substances derived from the ooplasm may also take part in this process. Vacuoles which are stained by neutral red are present in oocytes, nurse-cells and follicle-cells. J. E. MACKENZIE and H. W. MELVILLE: The diffusion coefficients of bromine-argon, bromine-methane, bromine-hydrogen chloride, bromine-nitrous oxide. The diffusion coefficients of these mixtures have been determined by a visual method, described in a previous paper. The results have been confirmed by a photoelectric method of measuring the concentration of bromine vapour. This method has the advantage that the variation of diffusion coefficient with composition and pressure of the gas mixture may be measured.

PARIS

Academy of Sciences, June 19 (C.R., 196, 1841-1932). MARCEL BRILLOUIN: Spherical functions. General formulæ of recurrence. The development of non-antipodal functions in series of Legendre and Laplace polynomials. L. CAYEUX: The differential diagnosis of the sedimentary breccias and the tectonic breccias. The distinction between these two classes of breccias on stratigraphical data alone has occasionally proved impossible, the controversies concerning the Pyrenees breccias being a case in point. The author shows that microscopical analysis, if done on a sufficient number of specimens, can solve the problem. J. COSTANTIN: The influence of high altitudes on the cultivation of wheat. A discussion of the work of Schübeler on the changes in wheat produced by cultivation in northern Scandinavia, bearing on the question of the heredity of acquired characters. L. BLARINGHEM. The *habitus*, or biological individuality, of the hybrids of the Cruciferæ (*Cheiranthus*,

Erysimum, *Mathiola*, *Lunaria*). A. RECOURA: The triaquo-chromic and biaoquo-chromic chlorides. Study of the brown chloride, $\text{Cr}(\text{H}_2\text{O})_3\text{Cl}_3$, including a proof that in aqueous solution at a low temperature (-15°C .) no silver chloride is produced on adding silver nitrate. A fifth chromium chloride, $\text{CrCl}_3 \cdot 2\text{H}_2\text{O}$ has also been isolated and this is not in accordance with Werner's theory. PROF. PIETER ZEEMAN was elected a foreign associate in succession to the late Sir Ray Lankester. E. J. GUMBEL: The smallest value among the greatest. G. VRANCEANU: The number of differentials of a Pfaff system. MIRON NICOLESCO: Some points of direct finite geometry. H. AUERBACH: The analytical representation of closed linear groups. PAUL BOISSEAU: New apparatus for mechanical integration. F. E. MYARD: An apparatus allowing the tracing of the mean derivative of a function represented by its curve in Cartesian co-ordinates. G. D. MATTIOLI: The conditions at the wall for the equation of turbulence in conduits. D. BARBIER: A selective absorption of light in the Pleiades. The fact that the Pleiades are distinctly more yellow than their types of spectrum would suggest, led P. ten Bruggenate to explain this fact by a selective absorption in the interior of the group itself. An analysis by the author based on the data recently published by Miss C. H. Payne lends support to this hypothesis. ALEXIS GUERBILSKY: A piezo-electric resonator with a uniform response for a given range of frequencies. T. V. IONESCU and MME. IRÈNE MIHUL: The ionisation of air and of hydrogen in the high-frequency discharge. R. LEGENDRE: A new colorimeter. L. HERMAN: The absorption of oxygen in the ultra-violet. A detailed study under high dispersion of the absorption in the region 2750-2400 Å. ANDRÉ CHARRIQUO: The increase of sensibility of photographic emulsions by electrophoresis. It is shown that the action of electrophoresis in presence of water increases the sensibility of the silver bromide in a greater proportion than the action of water alone. KANTZER: The photochemical properties of chromyl chloride. Under the action of radiations longer than 3500 Å. the vapour of chromyl chloride is decomposed: evidence is given that the reaction taking place is probably $\text{CrO}_2\text{Cl}_2 = \text{CrO}_2 + \text{Cl}_2$. RENÉ AUDUBERT and VAN DOORMAAL: The emission of radiation by chemical reactions. Using a modified photoelectric cell of great sensitivity, it has been proved that a large number of chemical reactions emit photons in quantities not capable of detection by ordinary means. MME. IRÈNE CURIE and F. JOLIOT: Positive electrons of transmutation. R. ETIENNE: The displacement of equilibrium by variation of mass. DECARRIÈRE and J. ANTHEAUME: Contribution to the study of the iron catalyst utilised for the hydrogenation of carbon monoxide at the ordinary pressure. Starting with a catalyst of the Fischer type, iron oxide-copper-potassium carbonate, and varying its composition, it was found that the potassium carbonate was unnecessary, that reducing the proportion of copper gave a more active catalyst, but without copper the catalyst became inactive. MARCEL PRETTRE: The variations of the spontaneous inflammation temperatures of mixtures of hydrogen and air as a function of the velocity of heating. T. KARANTASSIS: Double decompositions between the germanium halides and the halides of trivalent, tetravalent and bivalent elements. JEAN AMIEL: Some products of the slow combustion of benzene. A mixture of benzene and oxygen in the proportion

$C_6H_6 + 15O$ was heated to 460° – 490° C.: phenol and benzoquinone were definitely proved to be present; aldehydes and peroxides were absent. PIERRE BOUDNIKOFF: The reaction of sulphur with terpenes and the utilisation of this reaction for the preparation of a solution of liquid gold. Details of a method of preparing a solution of gold containing 12–16 per cent of gold for use in ceramics. HENRI WAHL: The chlorine derivatives of *p*-xylene. C. ARAMBOURG and R. JEANNEL: The scientific expedition to Omo. RAYMOND FURON: Observations on the stratigraphy of western Africa (Mauritania and Sudan). G. DENIZOT: The age of the old conglomerates of Durance and Crau. MAURICE PARAT and PIERRE DRACH: The Portlandian of Cape Leslie in Scoresby Sound (Greenland). L. CLARIOND and H. TERMIER: The Djebel Gagho (Saharan Morocco). V. FROLOW: The heights of the rise of the Seine at the Austerlitz bridge. ETIENNE PATTE: The origin of the oyster heaps of Chauds à Saint-Michel-en-l'Herm (Vendée). Arguments for and against the human origin of these heaps. P. BUGNON: The origin of monocotyledonous plants. AUG. CHEVALIER: Michel Adanson, precursor of Lamarck. Adanson in 1763 had a clear conception of the possibility of the transmission of acquired characters. AD. DAVY DE VIRVILLE: Contribution to the study of the lichen zones on the coast of Portugal. JEAN TIMON DAVID: Contribution to the study of the evolutive cycle of the Zoogonides (Trematodes). CHARLES FRAIPONT: The differential microscopic characters of bone in the primates. A. BLANCHETIÈRE: A product resulting from the action of pepsin on glycine. GILBERT RANSON: Algæ excrete into the sea soluble pigmented organic material. PH. LASSEUR, Mlle. A. DUPAIX and J. G. MARCHAL: Observations on the phenomenon of Charrin and Roger (seric agglutination of bacteria).

CRACOW

Polish Academy of Science and Letters, April 3. W. SIERPIŃSKI: A characteristic property of non-enumerable measurable *B* ensembles. F. LEJA: Certain limits relative to Lagrange polynomials and closed ensembles. M. CENTNERSZWER and W. PIEKIELNY: The thermal dissociation of the nitrites of the alkaline earths. The authors have determined the dissociation isochores of the nitrites of calcium, strontium and barium, and by applying Nernst's formula have deduced the heats of dissociation. L. MARCHLEWSKI and WL. GABRYELSKI: The absorption of the ultra-violet rays by certain organic substances (29). Studies on the changes produced in the ultra-violet absorption spectrum of glucose by a gradual increase in the alkalinity. GATY-KOSTYAL and J. TESARZ. Nucleic acid from ergot of rye (1). K. KANIEWSKI: The influence of the type of spikelet on the density of an ear in the tetraploid species of wheat. Z. RYZIEWICZ: *Ovibos recticornis*. Contribution to the study of the sub-genus of the Oribovidae. J. MARCHLEWSKI: The development of the blood-vessels in the organ of smell of the domestic pig. K. WODZICKI: Contributions to the study of the goats living in Poland during the neolithic period and the Middle Ages. J. ZACWILICHOWSKI: Researches on the innervation and sensorial organs of the wings of *Panorpa*. M. KONOPACKI. The histo-physiology of the development of *Loligo vulgaris*. Mlle. H. GAJEWSKA: The structure of the skin of *Axolotl*.

Official Publications Received

GREAT BRITAIN AND IRELAND

- Education (Scotland). Report for the Year 1932 by the Director on the Royal Scottish Museum, Edinburgh. Pp. 14. (Edinburgh.)
 The National Central Library. Seventeenth Annual Report of the Executive Committee, 1932–33. Pp. 51. (London.)
 Cambridge Observatory. Annual Report of the Observatory Syndicate, 1932 May 19–1933 May 18. Pp. 3. (Cambridge.)
 Proceedings of the Royal Society. Series A, Vol. 141, No. A843, July 3. Pp. 281. (London: Harrison and Sons, Ltd.) 13s. 6d.
 Falmouth Observatory. Meteorological Notes and Tables for the Year 1932, also additional Meteorological Tables of Temperature, Rainfall and of Sunshine, 1880–1932, and Miscellaneous Phenomena during 1932. Pp. 10. (Falmouth.)
 The Journal of the Institution of Electrical Engineers. Edited by P. F. Rowell. Vol. 73, No. 439, July. Pp. 96+xxvi. (London: E. and F. N. Spon, Ltd.) 10s. 6d.
 Navy—Hydrographer's Report. Report on Admiralty Surveys for the Year 1932 by the Hydrographer of the Navy. Pp. v–x. (London: The Admiralty.)
 Proceedings of the Royal Physical Society, Session 1932–33. Vol. 22, Part 3. Pp. 107–158. (Edinburgh: Oliver and Boyd.) 6s.; to Fellows, 5s.
 Proceedings of the Royal Society of Edinburgh, Session 1932–1933. Vol. 53, Part 3, No. 15: Matrices and Continued Fractions, II. By Prof. H. W. Turnbull. Pp. 208–219. (Edinburgh: Robert Grant and Son; London: Williams and Norgate, Ltd.) 1s.
 Forestry Commission. Thirteenth Annual Report of the Forestry Commissioners for the Year ending September 30th, 1932. Pp. 43. (London: H.M. Stationery Office.) 9d. net.
 (University of London): County Councils of Kent and Surrey. The Journal of the South-Eastern Agricultural College, Wye, Kent. No. 32, July. Edited for the College by Dr. S. Graham Brade-Birks. Pp. 236. (Wye.) 7s.; to Residents in Kent and Surrey, 4s.
 Medical Research Council. Thirteenth Annual Report of the Industrial Health Research Board to 30th June, 1933. Pp. ii+28. (London: H.M. Stationery Office.) 9d. net.

OTHER COUNTRIES

- Report of His Majesty's Astronomer at the Cape of Good Hope to the Secretary of the Admiralty for the Year 1932. Pp. 10. (Cape of Good Hope.)
 U.S. Department of Agriculture. Circular No. 269: A Pest of Cured Tobacco, *Ephesia elutella* Hübner. By W. D. Reed, Erskine Livingstone and A. W. Morrill, Jr. Pp. 16. (Washington, D.C.: Government Printing Office.) 5 cents.
 U.S. Treasury Department: Coast Guard. Bulletin No. 22: International Ice Observation and Ice Patrol Service in the North Atlantic Ocean, Season of 1932. Pp. iii+64+27 plates. (Washington, D.C.: Government Printing Office.)
 Japanese Journal of Mathematics. Transactions and Abstracts, Vol. 9, No. 4, June. Pp. 231–284+24. (Tokyo: National Research Council of Japan.)
 Koninklijk Nederlandsch Meteorologisch Instituut. No. 102, Mededeelingen en Verhandelingen, 34a: Het Klimaat van Nederland. By Dr. C. Braak. A (vervolg): Neerslag. Eerste gedeelte. Pp. 101+5 plates. ('s Gravenhage: Rijksuitgeverij.) 1.40 f.
 Publications of the Dominion Observatory, Ottawa. Vol. 10: Bibliography of Seismology. No. 17: January, February, March, 1933. By Ernest A. Hodgson. Pp. 289–302. (Ottawa: Acting King's Printer.) 25 cents.
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 Bulletin of the Vanderbilt Marine Museum, Vol. 4: Scientific Results of Cruises of the Yachts *Eagle* and *Ara*, 1921–1928, William K. Vanderbilt Commanding. Coelenterata, Echinodermata and Mollusca. By Lee Boone. Pp. 217+133 plates. (Huntington, L.I.: Vanderbilt Marine Museum.)
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