



SATURDAY, AUGUST 12, 1933

No. 3328

Vol. 132

CONTENTS

	PAGE
State Policies of Eugenic Sterilisation	221
'External' Degrees in Engineering	222
Gas Calorimetry. By Dr. J. S. G. Thomas	223
Quantitative Study of Animal 'Drives'. By Prof. James Drever	224
Pigmies of the Congo	225
Inorganic Chemistry	226
Short Reviews	227
Problems of Mining at Great Depths. By Prof. S. J. Truscott	229
Meteorology in India. By G. T. W.	232
News and Views	233
Letters to the Editor :	
Physico-Chemical Experiments on the Amphibian Organiser.—C. H. Waddington, Dr. Joseph Needham and Dorothy M. Needham	239
Behaviour of Electrons and 'Holes' in Cuprous Oxide.—Prof. A. Joffé, D. Nasledov and L. Nemenov	239
Impulse Corona in Water.—Prof. Y. Toriyama and U. Shinohara	240
Predissociation in Fluorescence Emission Spectra: Fluorescence of Acetone Vapour.—H. G. Crone and Dr. R. G. W. Norrish	241
Fine Structure and Predissociation in the Spectrum of Calcium Hydride.—B. Grundström and Prof. E. Hulthén	241
The Stopping Layer of Rectifiers.—W. Jusé	242
Position of the Bands in the Spectrum of Oxyhemoglobin.—Prof. A. Krupski and F. Almasy	242
Existence of a Neutron of Mass 2.—Harold Walke	242
Sakai Marksmanship with a Blowpipe.—J. B. Scrivenor	243
Hysteria in Dogs.—H. D. Walston	243
Pelvic Filaments of Lepidosiren.—L. C. Beadle; J. T. Cunningham; G. E. H. Foxon	243
Scale Structure of the Hair of the Bat.—J. Manby	244
Occurrence of <i>Protopistoma</i> in Ceylon.—G. M. Henry	245
Low Auroras and Terrestrial Discharges.—Dr. C. S. Beals	245
Research Items	246
Astronomical Topics	248
Jubilee of Prof. A. d'Arsonval	249
Blowflies. By W. M. D.	249
Natural Woodlands of Great Britain and Ireland	250
Sex-Distribution in <i>Thalictrum</i>	251
Disintegration of Atoms by Protons	251
University and Educational Intelligence	252
Calendar of Nature Topics	252
Societies and Academies	254
Official Publications Received	256

State Policies of Eugenic Sterilisation

RECENT reports from the United States show that twenty-seven States in the Union have eugenic sterilisation laws on their statute books, and that up to January 1, 1933, not less than 16,066 operations have been performed in State institutions under State laws. During recent years, as the public have become educated to the need for such a measure, and as the laws have been improved in the light of experience, sterilisation has proceeded at an ever-increasing rate, and, in general, it may be accepted that the results have been satisfactory.

On January 1, 1934, a Bill for "the avoidance of inherited disease in posterity" will come into force in Germany. It was to be expected that the present rulers of Germany, to whom the notion of racial purity means so much, would be guided by the teachings of eugenics in their aim to abolish from the population those who are considered to be suffering from illnesses which, in the experience of medical science, are regarded as being hereditary, at present incurable and racially undesirable. As reported in the *Times* of July 27, hereditary illness in the meaning of this Bill is defined as congenital feeble-mindedness, manic depressive insanity, schizophrenia, hereditary epilepsy, hereditary St. Vitus's dance, hereditary blindness and deafness, hereditary bodily malformation and habitual alcoholism.

The subject for sterilisation may propose himself, or be proposed by his legal representative, by medical officers of health in the case of inmates of hospitals, or by the governors of penal establishments in the case of prisoners. The proposal comes before a Court of Eugenics, consisting of a magistrate, a medical officer of health and a geneticist with medical qualifications. Above and beyond this Court is a High Court of Appeal. The operation, if the decision is confirmed, is to be carried out either with the patient's consent, or against his will. The use of direct force is permissible if other measures do not suffice.

Two points seem worthy of comment. One is that, according to the Bill, it is competent for a governor of a penal establishment to recommend that a prisoner shall be sterilised. Since there is reason to think that, at the present time, there are large numbers of persons now suffering imprisonment without trial in Germany, and for purely political reasons, it would seem that the power thus given to the governor might perhaps be abused.

Editorial and Publishing Offices :

MACMILLAN & CO., LTD.

ST. MARTIN'S STREET, LONDON, W.C.2

Telephone Number : WHITEHALL 8831

Telegraphic Address : PHUSIS, LESQUARE, LONDON

Further, the Bill is regarded as a good beginning on the path of provision for coming generations, and, as medical science progresses, it states, the list of inherited diseases may be supplemented. It is forgotten, apparently, that only so long as an inherited disease remains incurable does it constitute a social and racial problem. Surely the aim should be to find a cure and not to enlarge the list. The German Government, it is reported, not only approved of this Bill, but specifically decided that a special Bill, which shall come into force simultaneously with it, shall authorise the compulsory emasculation of dangerous criminals.

The value of eugenic sterilisation could be tested much more thoroughly and completely in Germany than in the United States, and certainly it is most desirable that its worth should be assessed; but, for the present, it is impossible to avoid the thought that here is provided a most frightful opportunity for those politically strong at present to outrage the politically oppressed. 'Fit' and 'unfit' are defined differently at different times and in different places. The Bill, as it reads, will command the appreciative attention of all who are interested in the controlled and deliberate improvement of human stock, but the power that it gives is such as should be possessed only by the almost omniscient and by the most moral. The problem is to find them.

'External' Degrees in Engineering

SINCE 1902, the University of London has conferred the degree of B.Sc.(Eng.) on 1,890 external students who have gained this degree by examination only. Many of these students passed the necessary examinations without having received any instruction in the laboratory, drawing office, or field, although such teaching is generally recognised as essential if the student is to understand the scientific principles underlying the subjects studied and is not being merely crammed to pass an examination. The external examiners for the degree were well aware of the common deficiency in this instruction as shown continually in the answers of the students, and the usual examination methods, special papers and 'orals', were practised to try, if possible, to ensure that the candidates' knowledge was not derived merely from textbooks.

The necessity of real evidence that the student had followed properly organised courses of instruction was apparent and it was felt that the granting

of the external degree in engineering on the results of an examination alone could only be a temporary expedient. The continual improvement in the standard of teaching and equipment of the technical colleges and institutions throughout Great Britain had made them generally available for the necessary laboratory training of those seeking London degrees and so, in 1931, after serious consideration of the whole subject, the Senate agreed that the time had come when the University could, without undue hardship, insist that candidates for a degree in engineering should be trained by the best methods and so should follow courses of study at approved institutions and present records of their course-work when taking their examinations. This decision has recently been the cause of considerable discussion and comment in the columns of the *Engineer*.

Teachers in engineering colleges and others interested in the preliminary training of young engineers have looked forward to this change, which really was a little overdue. It is quite true that many excellent candidates have taken the external degree by private study without any of the advantages which are now so easily obtained at the numerous colleges and technical schools. This external degree examination has produced special teachers, special textbooks and special students. Engineering employers generally have welcomed the college-trained student, and a degree in engineering is no longer the handicap which we are told it was in the old days. It is necessary therefore that the degree should mean that the holder has been trained by the most up-to-date methods, and not that he has merely passed an examination. In defence of the continuation of the former method of granting an external degree in engineering, it has been said that the examiners could devise tests to ensure that those receiving degrees are worthy engineers. Devising suitable examinations leads unfortunately to devising, teaching and learning suitable answers.

The degree should not be the prize for a competition between the examiner and the student and, in any event, the university degree does not say that the recipient is a worthy engineer, though it should indicate that he has had a sufficient training in the sciences underlying the practice of engineering. The object, therefore, is to see that this training is as effective as possible. No one would dispute that laboratory training is necessary for the student studying chemistry or physics, and the teaching of mathematics has been completely

revolutionised by adopting laboratory methods. In fact, at the present time, we find it difficult to understand how it was ever possible to think that the engineering subjects now taught in schools and colleges could be learned by reading textbooks only and that an examination could find out if a candidate had gained a certain knowledge in engineering science. Doubtless the difficulty in designing suitable apparatus and the cost of the necessary plant delayed for a time the equipment of many college laboratories, but few would care to assert that such subjects as strength of materials, theory of structures, hydraulics, electrical engineering, heat engines and surveying can be studied properly without exercises in the laboratory, field and drawing office.

There is sometimes a confusion of ideas introduced by calling such exercises practical work. These exercises are part and parcel of the instruction in the science which the engineer must have before he can practise his profession successfully. It has been suggested that machine work in an engineering shop, testing in an electrical works, or field and routine work in a surveyor's office, may be the equivalent to the laboratory work in a college. In fact, some may claim that it is more useful because it is 'more practical'. However useful such work may be, it can never take the place of the laboratory instruction and graduated course-work of the engineering school, where the training is not in the practice of engineering, but in the principles on which engineering science rests.

Moreover, by the change now brought about in engineering education, the external student will benefit not only in his technical studies, but also by obtaining a broader education. He will necessarily attend a school or college during his course of study and must derive much benefit from associating with the other students. In every branch of the profession, the leading engineer is the one who can deal most successfully with men, and the hard-working student loses much when his private study deprives him of the companionship of his fellows. Knowledge of human nature and tact, as well as engineering science, will be learned in the college.

The University's offer to inspect any college with the view of granting recognition in a subject in which teaching and equipment is found adequate, should obviate hardship. Moreover, while no doubt the result of such inspection will be gradually to raise the standard of teaching in some cases,

there is no reason why it should influence unduly the work of the college or its relations with the neighbouring universities. The sole object of the change is the laudable one of insisting that external candidates shall obtain the teaching which is now regarded as requisite for the B.Sc.(Eng.) degree.

The action which the University of London has taken will ensure that the best possible means available will be at the service of those who wish to take an external degree, and possession of the engineering degree will indicate then not only that the candidate has passed certain examinations, but also that he has followed courses of study and worked in laboratories properly equipped for the work in hand, and that this work has been carried out with the assistance of qualified teachers. As a result of this change, those who possess the London degree of B.Sc.(Eng.), 'external', will have received that thorough theoretical training necessary for the practice of engineering as much as the 'internal' students have.

Gas Calorimetry

Gas Calorimetry. By Major C. G. Hyde and F. E. Mills. Pp. xvi+376. (London: Ernest Benn, Ltd., 1932.) 42s. net.

THE supply of towns gas in Great Britain is nowadays controlled in conformity with the Gas Regulation Act, 1920, supplemented, where necessary, by the Gas Undertakings Act of 1929. Practically the whole of the gas supplied by statutory undertakings in Great Britain is now sold on a thermal basis, and charges to individual consumers are based upon the value of the total thermal energy supplied to each. It is open to individual undertakings to declare the calorific value of the gas they desire to supply; thereafter such calorific value must be maintained, subject to specified notice being given of any intention to alter it. Under the Acts, penalties are inflicted upon the gas undertaking, if on any day for a period of two hours or more the calorific value of the gas actually supplied is more than six per cent below the declared calorific value, or if in any quarter the average calorific value is less than the declared calorific value. Such, in brief, are the main thermal clauses of the Gas Regulation Act, 1920, the Act, which, as Prof. Boys says in his introduction to this volume, "gives importance to the subject of gas calorimetry as an everyday or an all-day and all-night operation".

The Act has effected revolutionary changes not only in matters concerned with the supply of gas but also in matters concerned with the manufacture of gas. Gas retorts have now to be operated in such manner of sequence that the calorific value of the mixed gases evolved approaches as near as may be to the declared calorific value without falling below that figure. A departure of 1 per cent from that figure in respect of the annual gas supply of England, Scotland and Wales represents about £500,000. Exact scientific control over gas-making operations is essential nowadays; coal carbonisation is both an art and a moderately exact science.

In the matter of the supply of gas, the Act has necessitated the institution of numerous testing stations within the area of supply of each gas undertaking and the calorific value of the gas is there either recorded continuously or determined at intervals. It was inevitable therefore that considerable advances in gas calorimetry should have occurred since 1920. More especially was the need felt for a continuous recording calorimeter. Extraordinary ingenuity has been shown in the development of such recorders. Prof. Boys, prince of experimenters that he still is, several years ago considered the design and construction of such a recorder not unworthy of his attention (see *NATURE*, 110, 251, Aug. 19, 1922). Other recorders have been designed by Messrs. Scientific and Projections, Ltd., and the Cambridge Instrument Co., Ltd., and along with the Boys instrument are in constant use recording the calorific value of gas supplied to the Metropolis.

It is clear that there should be considerable demand for a book dealing with gas calorimetry; here is the very book the gas industry needs. It can be recommended whole-heartedly to the industry and not to the industry alone; all interested in practical physics will find in it something to interest them and make them better practical physicists. One of the authors is chief technical assistant to the Gas Referees, those three gentlemen who, doing "their work quietly and unobtrusively are quite unknown as a body to the public at large"; the other is a gas chemist.

The subjects discussed include the accommodation and equipment of testing stations, waterflow calorimetry and calorimeters, gas, water and thermometer measurements, effect of possible errors, recording, still-water, explosion, indicating and flame calorimeters, effect of partial drying on calorific value and the control of calorific value. All are very well treated. The section on recording

calorimeters merits special mention. Numerous ingenious devices, which can find additional application in branches of physics other than gas calorimetry, are described. One cannot but be struck by the fact that practically all these developments have come from within the gas industry; it has ever been the Cinderella of the arts. I would like here to refer to one of the few errors I have found in the volume. On p. 2 the authors, referring to the operation of the Gas Regulation Act, 1920, state "the freedom thus extended in regard to the supply of gas, *coupled with the absence of normal competition*. . . ." Absence of normal competition, forsooth! Gas companies are nowadays suppliers of energy and as such have to meet the normal competition of coal and oil companies, and the *abnormal* competition of State-aided electricity schemes. Here surely is competition enough.

Let me conclude with a quotation from Prof. Boys's characteristic introduction to this volume:

"The public do not understand gas, they do not understand the meter and they cannot even read its dials. It is this ignorance which breeds suspicion. It is curious how suspicious the general and uninstructed public have always been about their gas accounts—long before Mark Twain put the matter tersely when he wrote about the man who came to speculate the meter. The fact is that no single commodity generally purchased by the public is so carefully watched and maintained of its guaranteed quality as gas, and it is a fairly safe thing to say that gas and water, about the cost of which complaints are so often made, are the two things ordinarily bought which are best worth while."

J. S. G. THOMAS.

Quantitative Study of Animal 'Drives'

Maternal Behaviour in the Rat. By Bertold P. Wiesner and Norah M. Sheard. (Biological Monographs and Manuals.) Pp. xi + 245 + 53 plates. (Edinburgh and London: Oliver and Boyd, 1933.) 12s. 6d. net.

CRUDE and unconvincing to the psychologist as the arguments of extreme behaviourists are, there can be no question but that they have rendered a great service to psycho-biology and to psychology by the stimulus they have given to the application of experimental and objective methods of investigation in fields that have long been given over to somewhat futile theorising, speculation, and disputation. An admirable illustration of the kind of work that is now being

done as a result of this stimulus is afforded by the book before us. The authors have studied, more exhaustively than has ever been done previously, one phase of the maternal behaviour of white rats—the phase designated by them ‘retrieving’. They have also succeeded in devising a method by which a quantitative estimate may be obtained of what we may call the ‘retrieving’ phase of the maternal ‘instinct’ of rats. The word ‘instinct’ is used advisedly. The authors, following an example which has lately been set by American biologists and psychologists, use the word ‘drive’. There does not seem, however, any real grounds for discarding the old word ‘instinct’ in its original meaning as a translation of the Greek word *όρμη*.

The measurement of the intensity of animal ‘drives’ has been attempted previously by various investigators—Szymanski, Moss, Nissen—and by different methods. Wiesner and Sheard base their measurement on the age of the young ‘retrieved’ by the maternal rat; that is, of the young which the rat will carry or attempt to carry to the nest. This method appears to have none of the defects of the methods hitherto used. The rat is not placed under highly artificial conditions, or subjected to unusual stimuli, the precise effects of which are difficult to forecast. The measurement itself is a simple matter of recording the age (or weight) of the young ‘retrieved’, in what is to the rat a more or less normal situation to which it gives a more or less normal response, determined by the ‘drive’, the intensity of which we desire to measure.

The authors are undoubtedly to be congratulated on the use they make of this method of study. Not only does it give them a basis of measurement for an important ‘drive’ underlying and characteristic of maternal behaviour, but ‘retrieving’ is also a simple and reliable test of the presence or absence of the ‘drive’. As such, Wiesner and Sheard have utilised it to study the period during which the ‘drive’ is normally present, and to explore the possibilities of prolonging the operation of the ‘drive’ indefinitely, or of producing it in virgin rats by injection of the appropriate hormones. Success under certain conditions in inducing ‘retrieving’, and failure under other conditions, are equally illuminating, and, to a psychologist, of scarcely less interest is the evidence obtained of what he would call ‘temperamental differences’ among rats. Altogether the book describes a very notable piece of work.

JAMES DREVER.

Pigmies of the Congo

Among Congo Pigmies. By Paul Schebesta. Translated from the German by Gerald Griffin. Pp. 287+47 plates. (London: Hutchinson and Co. (Publishers) Ltd., 1933.) 18s. net.

DR. PAUL SCHEBESTA, already well known for his studies of the Semang—the negrito jungle people of the Malay Peninsula, who form a link in the chain of low-statured peoples of primitive culture stretching at intervals from West Africa to New Guinea—has been fortunate in having an opportunity to extend his investigation of pigmy peoples to the Congo area. From January, 1929 until September, 1930, he travelled among the pigmies of the Ituri forest, and luckier than most travellers, who have obtained little more than a glimpse of this elusive little people, he lived among them, at times for months on end.

The Congo pigmies are among the most primitive of the backward races of to-day. The tribes visited by Schebesta are still nomad hunters. They do not cultivate, and their women-folk are food-gatherers, in so far as their subsistence depends upon vegetable products of the forest. Owing to the scarcity of such food stuff, they have come to rely on the banana as a staple food. As this, together with the sugar-cane and other food and the iron for spear- and arrow-heads, can be obtained only from the full-statured peoples around them, a system of overlordship or patronage has been established, in which a pigmy group is attached to a land-owner, supplying him with game and forest produce, in return for their own requirements. They also act as elephant hunters, their overlords taking the ivory.

Although the pigmies use fire, and are familiar with the use of the fire-drill among the surrounding peoples, they do not make fire themselves. When they move from place to place, they carry with them a burning brand or log. An amusing folk-tale tells how they first obtained fire by stealing it from the chimpanzees, from which also they first learnt to eat the banana.

It is evident from the data recorded by the author that the culture of the pigmies has been much affected by that of the tribes with whom they consort. Thus they have adopted a clan system, and their languages, of which they speak a variety, are those of their overlords, though not necessarily those with whom they are now associated. Indeed the author suggests a profitable line of research in the matter of the languages

they speak as a possible source of information relating to the migrations of surrounding peoples.

Dr. Schebesta refutes the popular conception that the pigmies have no religion; but the only truly pigmy belief he records is a form of crude animism. The belief in a supreme being and creator appears to be entirely Bantu.

The author promises further studies of the peoples visited on this expedition. These will be awaited with interest. His present work is a valuable record of a phase of culture which must, inevitably, pass away at no distant date. It foreshadows the disappearance of the nomad hunter from among backward peoples.

The translation is well done; but there are misprints which should not have been allowed to pass, such as "Hainy" for Hamy, "Aruwini" for Aruwimi. The term "negro" is loosely applied to the Bantu peoples throughout. Wherever the word "Indian" appears the author intended a reference to the Malay Peninsula; and the change should have been made in accordance with English usage to avoid confusion.

Inorganic Chemistry

Gmelins Handbuch der anorganischen Chemie. Achte völlig neu bearbeitete Auflage. Herausgegeben von der Deutschen Chemischen Gesellschaft. Bearbeitet von R. J. Meyer. System-Nummer 7: *Brom.* Pp. xviii+viii+342. 56 gold marks. System-Nummer 29: *Strontium.* Pp. xviii+xii+239. 41 gold marks. System-Nummer 58: *Kobalt.* Teil A, Lief. 1. Pp. 220. 34 gold marks. System-Nummer 58: *Kobalt.* Teil A, Lief. 2: *Das Element und seine Verbindungen, ausschliesslich der Ammine.* Pp. 221-502. 48 gold marks. System-Nummer 59: *Eisen.* Teil B: *Die Verbindungen des Eisens.* Lief. 5. Pp. 873-1166. 53.50 gold marks. (Berlin: Verlag Chemie G.m.b.H., 1932.)

IN these volumes the high standard set up in previous issues of this comprehensive work appears to be well maintained. The general plan of the work has been followed and the literature carefully reviewed up to within a few months of publication. In fact one of the most valuable features of the whole work is the very full list of references to original sources of information.

In the volume on bromine a historical account of Balard's discovery of the element is given and

reference is made to the curious error made and admitted by Liebig. Other early references to the journals are numerous. Considerable prominence is given to methods adopted for the technical production of bromine and methods of purifying it are described in some detail. Much space is devoted to the physical properties of the element, and the compounds which it forms with hydrogen, oxygen, nitrogen and other halogens are recorded.

The volume on strontium opens with an account of the discovery of the metal and of the difficulties encountered by Sir Humphry Davy in liberating it from its compounds. The geographical distribution and the preparation of strontium are dealt with very fully. In this section will be found, tabulated in chronological order, a useful list of references to the numerous patent specifications of processes used in the reduction and subsequent decomposition of minerals not only of strontium but also of alkaline earths generally, with a brief indication in each case of the procedure. The volume contains a number of phase-rule diagrams, including one used in the sugar industry showing the system, strontia-cane-sugar-water.

The two parts of Section A of the volume on cobalt are devoted to a review of the properties of the metal and of its compounds other than the complex amines, which form the subject-matter of Section B. There is a historical account of the application to industrial uses of cobalt-bearing minerals, which have been used from very early times, since cobalt has been found as a component of some of the ancient Egyptian, Babylonian and Assyrian glasses. In the Middle Ages, great pains were taken to keep secret the processes used in the manufacture of coloured glass, so that the numerous references to the subject are often either difficult to interpret or are definitely misleading. Comparatively little seems to have been known about the nature of the minerals and compounds of cobalt until the nineteenth century. Part 1 deals with the geographical distribution of the metal, its production and the physical and chemical properties of the element and of its principal alloys, whilst Part 2 deals with compounds of cobalt with non-metallic elements and complex salts other than amines. Compounds with carbon include carbides and carbonyls as well as salts of organic acids. Owing to the unstable nature of the quadri-valent cobaltocyanide group, less attention appears to have been given to it by investigators than to the very stable trivalent cobaltocyanide group.

There are several diagrams, including one showing the arrangement of the crystal-lattice of cobaltous hydroxide.

The concluding part of the volume on iron deals with compounds of the metal with other elements from lithium to cobalt (according to the numerical

system indicated at the beginning of each published part), together with the various complex salts which are formed. There is a triangular diagram of the complex system $\text{Na}_2\text{O} - \text{Fe}_2\text{O}_3 - \text{SiO}_2$ and a comprehensive index for the five parts of Section B on iron.

Short Reviews

Lehrbuch der ökologischen Pflanzengeographie. Von Prof. Dr. Eug. Warming und Prof. Dr. P. Graebner. Vierte Auflage, nach Warmings Tode bearbeitet von P. Graebner. Lieferung en 1-4. Pp. 1-960. (Berlin: Gebrüder Borntraeger, 1930-32.)

WARMING'S well-known "Ecology of Plants" (English edition, Oxford, 1909) is a book of reference which still has much value apart from its historical importance. The fourth (German) edition, edited, since Warming's death in 1924, by Prof. P. Graebner, is not only considerably enlarged, but also improved and somewhat modified in scope. The habitat factors (light, water and soil), the life-forms, and symbiotic and other relationships are dealt with in turn. There follows a short account of general vegetational physiognomy and then the communities of vegetation are dealt with under a classification based primarily on habitat characters. In the four parts so far published, the halophytic and fresh-water communities, the series of mesophilous and hygrophilous formations, the formations on acid soils, the series of the cold deserts, and the series of rocky and sandy soils (incomplete) are considered.

A feature of the work is the large number of figures, many of them excellently reproduced photographs. In spite of a large number of references to a bibliography, presumably to be published in a later part, it would appear that much important recent literature, especially English and American, has been overlooked. A minimal value is allowed to succession, only one and a half pages being devoted to a general consideration of this important subject. A full evaluation of the new edition must, however, await its completion. W. B. T.

Early Steps in Human Progress. By Harold Peake. Pp. xii + 256 + 74 plates. (London: Sampson Low, Marston and Co., Ltd., n.d.) 12s. 6d. net.

MR. PEAKE has written a popular account of the beginnings and early stages of development of material culture, which ranges from the earliest use of stone as an implement to the working of iron, and incorporates the most recent results of archaeological investigation, especially in Egypt and Mesopotamia, bearing upon his problems. His method of arrangement is both chronological and logical; for his chapters, in following the order of development of the means devised by man to satisfy his needs, first as a food gatherer, then as hunter, pastoral nomad and agriculturist, give a

generalised picture in the order of succession of the ages of stone, copper, bronze and iron. As might be anticipated from Mr. Peake's preoccupations elsewhere, and on other occasions, full weight is given to the development of agriculture in relation to its effect on progress in the other arts of life.

It must not be concluded too hastily that because Mr. Peake's book has primarily a popular appeal, it has no interest for his archaeological colleagues. This is far from being the case. His book is no mere compilation. It is a synthetic study, and much of its value lies in the bringing together and interpretation of data from many diverse sources. Further, writing in popular form, Mr. Peake has felt at liberty to indulge in elaboration of theory; and here, if there is much to dispute, there is also much to ponder, as, for example, in the ingenious explanation offered for the occurrence of pottery in the pre-agricultural stone age of Kenya.

Caravan Cities. By M. Rostovtzeff. Translated by D. and T. Talbot Rice. Pp. xiv + 232 + 35 plates. (Oxford: Clarendon Press; London: Oxford University Press, 1932.) 15s. net.

AFTER an introductory chapter in which the author surveys the geographical and cultural conditions governing the development of desert trade routes in the Middle East from prehistoric times onward, he describes the results of archaeological investigation in four of the desert cities which grew up as caravan halts—two, Petra and Gerasa (Jerash), on the southern route between Mesopotamia and Egypt and two, Dura and Palmyra, on the road from the Euphrates to the Mediterranean littoral. In the excavation of three of these four cities Prof. Rostovtzeff has himself taken part, with expeditions from the United States; but as the official reports are not yet completely published, he has felt himself under obligation to deal with the results bearing on one period only, the Hellenistic and Roman, of the early centuries of our era. Although evidence is accumulating of the wealth of these cities, the mixed character of their population and the various cults which they embraced, evidence of their origin—except in the case of Dura which was a Macedonian military post—and early history is still missing. Dura, though unimportant compared to the other cities, has yielded much new information especially in connexion with Parthian culture and with the art of the early centuries of the Christian era.

The Statesman's Year-Book: Statistical and Historical Annual of the States of the World for the Year 1933. Edited by Dr. M. Epstein. Seventieth Annual Publication: Revised after Official Returns. Pp. xxv + 1,471. (London: Macmillan and Co., Ltd., 1933.) 20s. net.

ONCE more this carefully edited volume presents a summary of the statistics of every aspect of activity in all the States of the world. Beyond the revision of the figures and other information, there appear to have been no material changes in the book and its size remains unaltered.

To many students and men of affairs the volume is an indispensable companion: to others it can be recommended for the wealth of information it contains and for the ease with which any fact can be found. One turns to this book not merely for figures of population, production, finance and trade, but also for the form and methods of government, state of education, distribution of occupations, conditions of transport and even the weights and measures used by every country.

This year the two maps show respectively international radio telephone communications and the routes of air mail services. There are the usual introductory tables dealing with the world's shipping, petroleum, iron and steel production, and motor output. The editor notes in his preface that in the seventy years of publication of this book, the monarchies in Europe have been reduced from eighteen to eight and the republics increased from one to eleven; the population of England and Wales has almost doubled and the trade of Great Britain almost trebled.

Thomas Johnson: Botanist and Royalist. By H. Wallis Kew and H. E. Powell. Pp. xi + 151 + 13 plates. (London, New York and Toronto: Longmans, Green and Co., Ltd., 1932.) 8s. 6d. net.

IN this attractive little volume the authors have gathered together all that is known of Thomas Johnson, the seventeenth-century apothecary, who edited Gerard's "Herbal" in 1633. Those interested in the history of British botany will be grateful to the authors, not only for providing the first biography of Gerard's admirable editor, but also for the light they throw on Johnson's little-known and extremely rare "*Mercurius Botanicus*, . . ." (1634-41). It is conclusively shown that this work, and not How's "*Phytologia Britannica*" (1650), should be considered the first Flora of Britain. Its neglect hitherto is largely due to the fact that Pulteney, when he described the "*Phytologia*" as the "first English Flora" in 1790, possessed only the first part of the "*Mercurius*". Subsequent authors have copied Pulteney's statement.

The book is illustrated with portraits and figures from Johnson's works, and contains an absorbing account of the operations at the siege of Basing House, in which Johnson lost his life in 1644.

Die Buchenwälder Europas. Redigiert von E. Rübel. (Veröffentlichungen des Geobotanischen Institutes Rübel in Zürich, Heft 8.) Pp. 502. (Bern und Berlin: Hans Huber, 1932.) 25 francs; 20.80 gold marks.

THIS symposium on European beech forests is the outcome of a proposal, made at a meeting during the International Phytogeographical Excursion in 1923, to carry out phytosociological research on beech forests in different countries on a uniform scheme of work.

The results of these researches were discussed at the International Botanical Congress at Cambridge in 1930, and are now brought together under the editorship of Dr. E. Rübel. There are fourteen chapters (eight of them in English), on the ecology of the beech in different countries, including a full account of British beech woods by Dr. A. S. Watt and Prof. A. G. Tansley. There is a concluding summary by Dr. Rübel, who divides the *Fagion silvaticæ* "*Assoziationsverband*" (of Braun-Blanquet) or "*Föderation*" (of Du Rietz) into ten *Assoziationen*, with such designations as *Fagetum asperulosum*, *F. melicosum*, *F. mercurialesum*, *Südalpinen Fagetum*, etc., according to the nature of the undergrowth and other ecological characters. The whole volume represents a most interesting and successful attempt at co-ordinated synecological investigation.

The Blue Book, 1933: the Directory and Handbook of the Electrical Engineering and Allied Trades. 51st edition. Pp. 1,442. (London: Ernest Benn, Ltd., 1932.) 25s. net.

THE "Blue Book" is well known to the electrical engineering and allied trades as an excellent directory and handbook. It has now reached its fifty-first edition, so it started practically at the same time as the electrical industry. The matter is excellently arranged. All electricians and manufacturers are given individually. The latter are also arranged under the headings of meters, lamps, switches, etc., so one sees at a glance all the manufacturers of these accessories under one heading. Colonial and Continental alphabetical sections are also given. We have found the book very useful.

Quantity Surveying for Builders. By Wilfred L. Evershed. (The Directly-Useful Technical Series.) Third edition, revised. Pp. xix + 278 + 10 plates. (London: Chapman and Hall, Ltd., 1932.) 10s. 6d. net.

IN this book Mr. Evershed has justified his claim, that he has combined the consideration of theory and practice. Issue may, it is true, be joined here and there, but the one supreme objection to the preparation of bills of quantities by *ad hoc* surveyors, is their excessive indulgence in itemising the 'labours', whereby the employer is subjected to heavier expense than is really warranted. An architect's bills are more likely to prove just to both parties.

P. L. M.

Problems of Mining at Great Depths*

By PROF. S. J. TRUSCOTT

THE heights of mountains and the depths of oceans are measured from sea-level; depths in mining are measured from the surface at the particular spot. The mineral won has to be raised to that surface; there is the cost of raising. The water met has generally a vertical distribution bearing some relation to that surface; there is the cost of pumping. The rock temperature increases with depth from the surface; there is the consequent cost of ventilation. Finally, the rock pressure increases with depth from the surface; there is the consequent cost of support.

Great depth in mining may nowadays be taken to be 6,000–8,000 ft. below the surface, depths which, being out of reach of a winding engine situated at the surface, require other winding engines underground. Outstanding cases of mining at great depths, and at the same time the deepest mines in the world to-day, are: the Morro Velho mine in Brazil, the lowest level of which is 8,040 ft. below the surface; the Robinson Deep mine in the Transvaal, the lowest level of which approaches 8,000 ft., while the lowest point reached is deeper; and the Champion Reef mine on the Kolar goldfield, Mysore, the lowest level of which, where development is proceeding, is 7,580 ft. All of these mines, which started thousands of feet above sea-level, are now working below sea-level.

It is of interest that all these mines are gold mines and all are situated in Archæan or pre-Cambrian country, that is, in rocks of very great age. Though they have that much in common, they work entirely different types of deposit. The Robinson Deep is one among many mines working a very extensive conglomerate bed moderately inclined. The Champion Reef is one of a small number of mines along a steeply-inclined quartz reef; while the Morro Velho is a lonely mine working a relatively short, heavily mineralised ore-shoot pitching at an angle of about 45° upon a plane roughly vertical. Of additional interest is the fact that, situated in such widely separated regions as they are, these mines are all British enterprises; this being also true of most other mines approaching their depth.

The problems to be reviewed are those arising in the technical operations of primarily the four which have been mentioned. Raising or winding is only possible by means of wire rope. The best wire ropes will, however, not serve with safety and economy for a greater depth than about 4,500 ft., the rope then becoming too heavy and the winding engine excessively large. Below that depth or even before it is reached, a second winding stage will be necessary or will have been judged desirable, this second stage, not generally so deep as the first, being equipped with shafts

and electric winders of its own. Again there may be a third stage. The Morro Velho has seven stages, each short, though greatly daring in view of the relatively small horizontal extent of the deposit. The Robinson Deep has a first vertical stage, a second main-incline stage, and a third sub-incline stage. The Champion Reef has a primary vertical, a secondary vertical, and then bottom inclines. Though such stage-winding with the unavoidable transfers from one shaft to the next is more expensive than winding at such depths as permit a single stage, it may be said that the problem of raising the mineral causes no more than ordinary concern. Greater mechanical efficiency has largely offset the greater number of units of work to be done.

Pumping is normally no problem at great depth. The water-table or ground-water level marks the upper limit of a zone saturated with water, but this saturation becomes less with increasing compactness of the rock beneath, and normally at no great depth a dry zone is entered. At Morro Velho there is little water below 2,500 ft. and none below 3,500 ft.; deeper than that, such water as is required for men and machines must be sent down. On the Witwatersrand, fissures reaching up to saturated ground above occasionally cause a troublesome amount of water to be met in depth, but speaking generally, the amount of water to be raised is relatively small. Pumping is done by electrically driven centrifugal pumps in stages each of about 2,500 ft. The Champion Reef and neighbouring mines are dry below about 1,000 ft. so that service water must be sent down. It is interesting here to recall that steam engines came into being to enable mining to be carried on below adit or drainage level; in those early days mine drainage was the major problem.

Ventilation, that is the coursing of air through the workings in manner suitable and in quantity sufficient to maintain it in good physiological condition, is one of the two main problems in mining at great depth, largely because of the increase of rock temperature with depth. The rate of this increase of temperature, known as the geothermal gradient, varies from region to region on the crustal sphere: it is lowest where the country has long been a land surface and long free from igneous intrusion. Of the three districts mentioned the Witwatersrand has the lowest gradient; namely, a rise of 1° F. for every 212 ft. or of 4.7° for every 1,000 ft.; starting from an average surface temperature of 60°, the rock temperature at the present lowest level of the Robinson Deep will be about 97°. The gradients in the other two districts are about 1° for every 150 ft. of depth or 6.6° per 1,000 ft. The recorded rock temperature at the 7,380 ft. level of the Champion Reef is 129°, the average surface temperature being about 75°. Starting from a somewhat lower surface

* From a lecture delivered before the Royal Cornwall Polytechnic Society at its centenary celebrations on July 21.

temperature, the rock temperature at the present bottom of the Morro Velho is about 125° .

Differing as they do in respect to temperature gradient and to surface air temperature, there is one essential factor practically constant for all regions: namely, the rise in temperature of the air due to the heat expressed from it by the compression it experiences as it passes from surface into depth, this rise being about 5.5° F. per 1,000 ft. On the Witwatersrand the resultant air temperature at the present lowest level of the Robinson Deep would be 104° , that is, 7° higher than rock temperature. At the 7,380 ft. level of the Champion Reef it would be about 115° , and at the bottom of the Morro Velho about 110° , these two being lower than the respective rock temperatures.

Fortunately, air temperature is not the index to the physiological condition of the air. The position with respect to temperature underground is not dissimilar to that at surface in some tropical regions; indeed in going underground we pass from a relatively cool climate to a hot one. Take for illustration the air condition at the military station of Quetta, the Aldershot of India; in the dry summer season the temperature in the sun is well above 150° and for periods shade temperatures of 100° and more are registered, yet military exercises are carried out without interruption in the open. This activity is possible because the air is dry, the relative humidity being 10–20 per cent, equivalent to a wet-bulb temperature of, say, 70° . Wet-bulb temperature is the most ready index to the condition of the air. The body is in effect much like a wet-bulb thermometer in that at high air temperatures it is cooled by evaporation, and evaporation is always possible so long as the air is not saturated with moisture. There is this difference, however, that the body generates heat which the wet-bulb thermometer does not. To keep the body temperature from rising above normal, that is, 98.4° , the wet-bulb temperature must be below body temperature, and all the more so when the wet-bulb approaches the air temperature.

The measures taken for mine ventilation start by conducting the surface air as directly as possible to distributing stations at depth by downcast shafts kept so free as possible from water or moist surface. By so doing, the air arrives at a temperature determined by auto-compression and little affected by that of the rock. It also arrives drier than at the surface, since though the wet-bulb temperature rises, it does so at a substantially lower rate than the air temperature. Indeed even at such depths as 8,000 ft. the air can arrive in good condition. From the distributing stations the air passes along horizontal roads where, though there will no longer be any heating by auto-compression, there will be heating from the rock if the temperature of the rock be higher than that of the air, or if there be water present; in the first case both air and wet-bulb temperature rise; in the second the wet-bulb temperature will

rise while the air temperature may or may not.

At normal air velocities, the condition in respect to cooling can still be fair even at considerable distances from the downcast. Then the air begins its upward movement through the working places where the air velocity is lower, the contact with freshly exposed rock is greater, oxidation in one form or another generates heat, air pressure drops, humidity rises. Here are the severest conditions; it is here that the ventilating system is tested. Critical working conditions are reached in dry mines such as Morro Velho and Champion Reef when the wet-bulb temperature approaches 95° , and in saturated air as at the Robinson Deep when that temperature is above 90° ; before then, working efficiency will have fallen off. Fatal heat stroke has occurred and does occasionally occur on all these mines. Finally, the air moves upward out of the working places into definite and well-maintained upcast shafts or airways and eventually passes out of the mine saturated at a temperature well above that at which it entered.

Taking average temperatures, the greater weight of the downcast air column over that of the upcast column would maintain natural ventilation, particularly when after the lapse of time the downcast had cooled off and the upcast had warmed up; but such a ventilation would be too precarious, and in summer might even stop. It is obvious that where normal working conditions may quickly change for the worse, the ventilation must be under such mechanical control as fan ventilation only can give. Technical control likewise must be in the hands of a responsible official, who, on the Witwatersrand, is actually designated the 'ventilation officer'. In this control, temperature readings, humidity calculations, velocity and volume measurements, pressure surveys, and dust counts where necessary, become routine work.

The management of the Robinson Deep considers that the present ventilating procedure on the Witwatersrand, which takes winter and summer air as it comes and accepts the poorer ventilation which summer brings, will suffice not only for sinking but also for mining down to a depth of 8,500 ft., and on that field that mine will be the first to put the matter to the test. Other engineers there consider that mining at such a depth will not be possible unless the air be re-conditioned by artificial cooling, at least during the summer months.

Some artificial cooling is achieved in ordinary working by the exhaust from rock drills or auxiliary hoists using compressed air, and this is particularly useful in cooling development ends. Sometimes underground pumps have been worked by compressed air with the same intention, and even main underground hoists. But if cooling of the main stream is to be an essential part of the ventilating scheme, it must be by means of special cooling plants.

Some special cooling of the air along a main level by a cold water circuit has been attempted

at a German colliery, but the Morro Velho is the only mine which has fully adopted cooling of the main stream. There an ammonia refrigerating plant on the surface, commissioned in 1920, reduces the average air temperature entering the mine from 73° and 65 per cent humidity to 42° and saturation, the air being de-humidified in the process. With continued advance into depth, and because of the indirect course of the downcast through the several winding stages, an underground cooling plant became necessary and was put into commission in 1930. This plant, situated about three parts of the way down, uses ethyl dichloride as refrigerant since this liquid, while non-poisonous and non-inflammable, requires low and even negative pressures in the operation. By it the air temperature at that depth is reduced from 100° to 75° and the wet-bulb temperature from 75° to 64°, the heat being abstracted by water which is pumped to the upcast to be cooled by evaporation for re-use.

Reviewing the three ventilating procedures, the Robinson Deep, in common with all mines on the Witwatersrand, uses water to lay the dust and a moist atmosphere to keep it laid; in consequence, cooling in the working places must depend mostly upon air movement, large volumes roughly equivalent to five tons of air per ton of ore being required. The Morro Velho relies upon cooling the air to de-humidify it to such an extent that it remains sufficiently dry right through the working places, the volume of air being relatively small. The Champion Reef relies upon a direct downcast kept dry, so that the air remains dry throughout the workings; ventilation in depth is also promoted by shutting off the bottom part of the mine from the upper part, except for the air ways.

The second main problem in depth is that of support. In the undisturbed crust there is equilibrium; the weight of the superincumbent ground is borne by reaction from the rock beneath, that rock resisting further compression. If an excavation be made, that is, if a portion of the rock be removed, then the load which it originally supported is diverted to the sides, to become an additional load upon them. Moreover, free faces having been made, there is a tendency for the rock, since it is elastic, to close in upon the excavation; a pressure arch is formed in the rock above, a pressure invert in that beneath, and lateral arches at the side. At shallow depth the tendency of the back of the excavation to scale or flake and to assume an arched shape is common to see; the pressure invert underfoot, however, is obscured, and the lateral arches remain undeveloped. But in mining at great depth, which it may be said is only possible in hard, strong rock, the tremendous pressure of the superincumbent ground reveals much in the nature of fluid pressure; the tendency for the rock at the sides to close in upon the excavation becomes noticeable, as also does that of the floor to lift. The rock which thus moves into the excavation

is that which, being released from compression, shears itself from the solid.

A road left untimbered at such depths, unless it collapses entirely, will gradually assume a round or oval shape as equilibrium by arching becomes established. What takes place in respect to a road develops to a larger extent around the working places; the arching noticed in roads becomes doming in respect to working places. Doming follows the settlement or collapse of the roof and the upward shearing of the floor, or, as the case may be, the sag or collapse of the hanging wall and the inward shear of the footwall. At great depths the necessity of controlling these inward movements is as great with steep deposits as with flat deposits. No large span can be left open or there will be abrupt failure such as will close the working place. Routine support must see to that, and this support must be sufficiently yielding that it be not destroyed by the pressures which it cannot wholly resist but can at best only control. On the moderately inclined Witwatersrand, this support is by waste broken with the ore; on the steep Champion Reef it is by dry walls of granite bricks; at Morro Velho it is by waste filling.

As the excavation gets larger, doming will reach farther from the excavation, in roof, in floor, or in wall, by gradual settlement mostly, but sometimes by sudden failure of particular thicknesses. These sudden failures, though the actual movement be small, send a concussion wave through the country; this occurrence, when noticeable and causing falls of ground and damage, being termed a 'rock burst'.

Equally and almost as unavoidably, when one excavation approaches another and the mineral pillar between them becomes smaller, this remnant pillar will eventually yield under the pressure accumulating upon it, and a 'rock' burst will occur again, though careful and cautious work may minimise its effects. Domes which had their abutment upon this pillar will then become merged in a wider doming extending farther from the excavation, further tremors continuing until doming is complete.

As already explained, doming involves both hanging wall and footwall, or roof and floor, as the case may be; consequently it involves any roads existing within the distance to which it extends. Thus shafts and roads put in the footwall or floor for safety's sake, but not far enough away, will suffer.

Accidents set down to falls of ground are much more frequent than those ascribed to any other single cause. It is, however, an interesting fact that, on the Witwatersrand, sudden uplift of the footwall is considered to be the cause of the majority of fatal spinal injuries that occur in the working places. Support also costs more than ventilation. Greater accident rate and greater cost may be reasons for considering that mining in still greater depth will be limited by the problem of support rather than by that of ventilation.

Meteorology in India*

TWO reports which have recently arrived enable us to form an idea of the change in the Meteorological Department of India brought about by retrenchment: they are the Administration Report of the Department for 1931-32 and an account of its "Functions and Organisation" in 1933. Beyond the provision of daily weather reports and forecasts, and the issue of special information to aircraft which are common to most services, the Department has the important duties of warning shipping of cyclones in the Indian seas, and engineers of heavy rain that would affect railways and canals.

Two years ago the chief centres were at Poona, Calcutta, Bombay, Agra, Kodaikanal and Madras, at all of which were first-class observatories. Poona was the headquarters for administration, daily weather work, and warning for storms in the Arabian Sea; Calcutta produced the daily weather report of north-east India and warned for storms in the Bay; Bombay (Colaba and Alibag) maintained observations in terrestrial magnetism, seismology and atmospheric electricity; Agra was the headquarters of all the pilot balloon work necessary for determining the upper winds for the information of aviators; Kodaikanal, in the Palni hills, was an observatory for the study of the physical conditions of the sun, any variation in the radiation from which would presumably have important effects upon rainfall; and Madras, which produced a daily weather report for southern India, was the chief station for the issue of time-signals over India as well as for local shipping.

We learn from the administrative report for 1931-32 that early in the year the need of retrenchment prevailed over every other consideration and orders were received to cut down current expenditure by ten per cent; but later the Department had the sad task of estimating the relative effects of permanent cuts of 10, 25 and 50 per cent. A permanent reduction of more than 25 per cent was ordered, and it cannot have been easy to effect this without great loss of efficiency and great hardship to the staff. Government ultimately decided on:

- (a) the reduction of the 140-year old observatory at Madras to the status of a pilot balloon station,
- (b) the abolition of the Delhi meteorological office, including the pilot balloon station,
- (c) the reduction of the Rangoon meteorological office to the status of a pilot balloon station, and
- (d) various lesser items of retrenchment, including the abolition of four pilot balloon stations, and reductions in contingent expenditure, foreign stores and weather telegrams.

It must have been a serious financial situation

that justified a 25 per cent cut in a Department the main object of which is to save life and money; but, granted the situation, it was a far wiser step to reduce Madras rather than any of the other chief observatories. For the history of Madras is that of its astronomical contributions, and these came to an end in 1899 when Michie Smith was transferred to the new observatory at Kodaikanal. The daily weather work could be terminated without affecting the central office at Poona; and if its abolition caused some inconvenience in commercial circles, such a result was necessarily associated with retrenchment. But at Bombay and Kodaikanal the work, though less directly meteorological, is really more vital. For, as experience shows, efficiency demands the solution of a never-ending series of problems, and these can only be tackled by alert specialists who are in touch with developments in Europe and America. On one hand, it is only by study of the physical conditions that useful advances are made, as two years ago when Bombay showed that the advance of the monsoon and the formation of tropical cyclones were reliably indicated by a seismograph; and on the other hand, the observations made that are not of immediate value to India can be regarded as a small return to international science for the great benefits received.

The importance of the Delhi and Rangoon offices lay in their position on the air route from Karachi through Calcutta and onwards to the south: their abolition means that the 4,000 miles of the international air route between the Persian Gulf and south Burma—a distance greater than that between London and Bushire—are now served by two forecasting stations only, at Karachi and Calcutta, both of which are limited in staff and in the number of weather reports received daily. The service is thus definitely unable to attain the standard recommended by the International Air Convention. The route in question is used by the State Air Mail Service from Karachi to Delhi, the French and Dutch Air Mail Services, the Royal Air Force, members of India aero clubs and trans-continental fliers; and it is hoped that the skeleton weather service now being maintained will receive favourable consideration so soon as possible.

The reading of this administrative report produces a feeling of respect as well as of sympathy for Dr. C. W. B. Normand, Director General of Observatories. For it must have been no light task to make the redistribution of work involved in the retrenchment; and in addition he had to discuss other big projects, such as the arrangements for the possible separation of Burma. Yet the efficiency of the work was commendably upheld; about 160 sounding balloon ascents were made; and his staff of 29 Indian meteorologists and assistant meteorologists produced about twenty scientific notes or memoirs. G. T. W.

* Report on the Administration of the Meteorological Department of the Government of India in 1931-32. Pp. 34. (Calcutta: Government of India Central Publication Branch, 1932.) Price As. 8 or 10d. Functions and Organisation of the India Meteorological Department, 1933. Pp. 19. (Simla: Government of India Press, 1933.)

News and Views

Central Asiatic Research

WE have received a communication from Mr. T. K. Koo of Peiping, China, in reference to the article "Research in Central Asia" which appeared in *NATURE* of May 20, p. 705. Not only does Mr. Koo regard our statement of the problem as fair, but he admits that exploration has been made difficult by the Chinese, in a reaction against the too great freedom previously granted to foreigners. He goes on to comment on the two most conspicuous instances to which reference was made in *NATURE*, namely those of Sir Aurel Stein and Dr. Roy Chapman Andrews. Their difficulties, writing from his own knowledge in both cases, he attributes entirely to personal reasons. Both explorers would appear to have offended the susceptibilities of the Chinese. It is beyond question that the Chinese deeply resent Dr. Andrews's general attitude towards them and, more particularly, the tone of his references to the National Commission for the Preservation of Antiquities. Mr. Koo concludes his letter with an expression of opinion that if an international body for scientific investigation, as suggested, should some day become a reality, the difficulties of the present situation would vanish. While *NATURE* does not feel called upon to comment further on the merits of the contentions put forward by either side, beyond once more deploring the fact that personal matters should have blocked research in an extremely important field, it may, perhaps, be suggested that members of scientific expeditions should take a leaf from the books of their anthropological colleagues, and grasp the outlook of the peoples among whom they have to work. These are, after all, the heirs of the ages which the geologist, the palaeontologist and the archaeologist desire to investigate.

AN apposite reminder that co-operation between Europeans and Chinese in research expeditions has not proved impossible in all cases is afforded by the communication from the Peking correspondent of the *Times* in the issue of August 5 on the completion of the six years' work of the joint Swedish and Chinese expedition to the Gobi Desert under the leadership of Dr. Sven Hedin. This expedition had already been launched when, in 1927, Chinese policy in the matter of European exploration was changed; and in the following year it became definitely a joint Swedish and Chinese undertaking. There were then twenty-eight members on the scientific staff, between whom, Dr. Hedin has stated, no discrimination was made either in work or in camp life. All were treated alike. In the allocation of the work in the various branches of research, geology, palaeontology, topography, archaeology, meteorology, astronomy and so forth, one, two, or three Chinese men of science worked side by side with the Europeans engaged in each special investigation. Of the remarkable results achieved in the earlier years of the expedition, Dr. Hedin has already given some preliminary account; and further reports on the latest results will be awaited impatiently by the scientific

world. It is significant, however, that writing in 1931, at the time when additional subsidies from Sweden had ensured the work of the expedition for a further period of two years, he was able to record the successful achievement of the Chinese workers, such as, to mention two examples only, Prof. P. L. Yuan, the chief Chinese geologist, and Mr. Hwang Wen-pi, the archaeologist, while praising the account of the expedition published in 1930 by Prof. Hsü Ping-Chang, the Chinese leader (see also *NATURE*, 130, 151, July 30, 1932). In any estimate of the present situation, a record such as that of the Sino-Swedish expedition, covering a period of six years, must carry weight.

Institute of Industrial Administration

THE Institute of Industrial Administration, 47 King William Street, London, E.C.4, has as its objects the raising of management to the status of an organised profession; the encouragement of the maintenance of appropriate professional standards; and the development of the science and technique of Industrial Administration by papers, conferences and research. Although not a teaching body it holds examinations and grants certificates and diplomas, and in other ways promotes the education of students in the principles and practice of industrial administration. The new syllabus of Stage I under the title of "Fundamentals of Industrial Administration" is identical in content with syllabuses recently adopted by the Institution of Mechanical Engineers and the Institution of Electrical Engineers. The stage is designed to introduce the candidate to a general understanding of the place of industry in the world of affairs, the controlling influences under which it operates and the functions involved in its management, and the syllabus well illustrates the valuable work which the Institute is doing towards placing industrial administration on a scientific and professional basis.

THE first part of the syllabus deals broadly with the background and external factors of industrial administration; the second with the internal administration of the average industrial unit. The syllabus as a whole calls for a preliminary insight into many branches of knowledge which the student will find it necessary to explore at much greater length as, and when, he acquires industrial experience and seeks executive responsibility. In addition, a Students' Union has been formed which gives students the opportunity to hear authoritative papers on every function of business management and to discuss their problems with experienced business men and fellow students. The programme arranged by the London Group of the Union for 1933-4 includes papers by Mr. J. G. Rose on "General Management", Major L. J. Barley on "Product Development", Mr. A. G. Hill on "Market Research", Commander H. S. M. Ellis on "Advertising in Relation to Management" and Mr. R. R. Hyde on "The Human Problems of Management".

International Management Institute

THE annual report of the International Management Institute, Geneva, for 1932 indicates that the work of the Institute has been well maintained in spite of some reduction in financial resources. Membership showed a decline of 5-6 per cent but relations with the national management associations have been maintained, the need for co-operation and centralisation being increasingly felt. Management research groups have continued to be active—both the international groups, such as those for textiles, office management and paper manufacture, and also the national groups in Great Britain and other countries. Various services have been rendered to the League of Nations and to the International Labour Office, including a study of certain sections of the Secretariat and the study of the human factor in rationalisation. International co-operation on distribution problems has been fostered, as well as the application of scientific principles to public administration. If progress has been slower than had been hoped, the Institute has already done notable work and is steadily promoting the application of scientific principles not only to individual business enterprises but also to the whole economic structure, industrial and international. It steadfastly seeks to bring to the vast problem of distribution to public administration, as well as into the sphere of politics the same methods of thought and work—scientific analysis of the facts, co-operative working out of the best methods of performing the task in hand, the adoption of these methods according to a well-conceived and flexible plan, and co-operation both on a national and an international scale.

Eugenic Sterilisation in the United States

As referred to in the leading article on p. 221 of this issue, twenty-seven states in the United States now have eugenic sterilisation laws, and the Human Betterment Foundation, Pasadena, California, has completed a tabulation of all official sterilisations in the United States. These numbered 10,877 up to the end of 1929, and 16,066 in the following three years to the end of 1932, an increase of nearly 50 per cent. It should be understood that sterilisation, as now performed, does not in any way unsex the individual except in making parenthood impossible, is rarely performed without the consent of the next of kin, and is chiefly applied to mental defectives, whose taint is so frequently transmitted to their children. A critical survey of 6,000 cases during the last twenty years shows that the families of the sterilised patients generally approve of the operation, and of the patients themselves 6 cases out of every 7 appear to be satisfied with the results. Many feeble-minded girls have married after sterilisation, and the majority of these marriages have been reasonably successful. Whereas three-fourths of these feeble-minded girls were sex delinquents before sterilisation, only one in every 12 has been a sex offender after sterilisation. Sterilisation permits many patients to return to their homes who otherwise would be

confined in institutions, and thus eases the burden of the taxpayer, and is one practical step in the prevention of racial deterioration.

Politics and Religion in India

NATURE has hitherto refrained from further comment on the progress of discussion in relation to the political future of India, as for the moment it had passed from the field in which the results of scientific investigation of Indian peoples and institutions might usefully be applied. Attention has now, however, once more been directed to the larger issue of the applicability of western democratic institutions to an eastern community of heterogeneous composition in the evidence before the Joint Select Committee of Mr. M. K. Acharya, a representative of the All-India Varnashram Swarajya Sangha, which was reported in the *Times* of August 5. In the course of evidence it was claimed that this organisation represents 170,000,000 Hindus "who are not heterodox and are not denationalized". It is of little moment whether this claim can be fully substantiated, or whether any attempt should be made hereafter to discredit Mr. Acharya. He admits that he has broken his caste and on his return to India will have to undergo penance in accordance with the well-known rule affecting high-class Hindus who cross the seas. It is important to recognise that he represents an important body of Hindu opinion, whatever its exact dimensions may be, which is largely inarticulate; but for which religious observances are of more importance than political advancement. This feeling is not blindly conservative and obstructive; it is cultural. Mr. Acharya's replies, when questioned on such subjects as the relation of social reform to the fundamentals of religion, child marriage and suttee, deserve careful consideration, not as pointing to the necessity for any reversal of policy in these matters, but as indicative of the principles which should be observed in reform. The suggested utilisation of the village councils, for example, in preference to a lowering of the franchise, is more fully in accord with Indian institutions than any system which exalts the individual but ignores the social group of which he is an integral part.

The Dungeness Sanctuary

DUNGENESS Promontory, famous amongst bird-lovers as the last refuge of the Kentish plover and the home of the stone-curlew and many other interesting shore-birds, is the only remaining natural and undisturbed area of any size on the south-east coast of Great Britain. A year or two ago, the key position of the area was threatened by the building contractor, and it was saved by the sacrifice of Mr. R. B. Burrowes, a retired teacher, formerly in the Electrical Department of Liverpool Technical College. Mr. Burrowes obtained an option upon the site at a cost of £5,585, which meant the selling or mortgaging of the whole of his possessions. The Committee of the Dungeness Preservation Fund is anxious to refund at least £1,740 of this amount, so that the donor may regain possession of certain bonds and securities

lodged by him at his bank as security for a loan, without which he could not have made the original advance. He will still be out of pocket to the extent of £3,845, but he lives on a slender pension of £138 a year, gratified that his sacrifice has saved a valuable corner of England for the future. Any contribution towards the special sum now being raised will be gratefully received by the Manager, Lloyds Bank, Canterbury.

Coming of the 'Railbus'

SIR W. G. ARMSTRONG, WHITWORTH AND CO. has built a Diesel-electric 'railbus' which has been on exhibition at King's Cross Station, London, since its successful trial run from Newcastle-on-Tyne on July 30. The engine is the Armstrong commercial road vehicle engine and the vehicle has comfortable seats for 57 passengers. According to the *Times* of August 4, the fuel consumption was thirty-five gallons, the cost of which was 13s. 2d. for the journey of 268 miles from Newcastle to London. The running time was 5 hours 48 minutes and the railbus was stopped eight times at signal checks. This compares with 4 hours 55 minutes the time taken by the *Flying Scotsman* in its non-stop run from Newcastle to King's Cross. The same firm has previously built a heavier type of vehicle called a 'railcoach' which is now in regular operation on the north-east coast. The new railbus is the lightest type of self-propelled railway coach of its capacity ever built in Great Britain. It can provide frequent high-speed local services, frequent fast services on branch lines to market towns, and feeder services for main line connexions. The railways can buy these vehicles at about the same price as an ordinary railway coach and can run them frequently and quickly on lines where they are suffering from parallel competition on the roads. The first costs and running costs are said to compare favourably with those of the ordinary Diesel-engined road motor-coach. They have the advantage of superior speed, reaching 50-60 miles an hour, with a 100 horse-power engine, and 70-75 with a 150 horse-power engine.

Electric Power from the Rhine

At Kembs in Alsace about seven miles below the Franco-Swiss frontier there has recently been completed a hydro-electric station which utilises water-power from the River Rhine. According to the *Electrical Review* of July 28 the plant forms part of an extensive development programme which is being carried out in connexion with the Grand Canal of Alsace on the French bank of the Rhine. The present station is the first of eight hydro-electric stations which will be constructed between Strasbourg and the Swiss frontier. The canal, when completed, will have a length of about 70 miles and will be divided into eight sections having differences of level of between 33 and 54 ft. There will be a generating station at each lock and the total capacity will be 700,000 kilowatts. The construction of a dam on the Rhine at the Kembs station has raised its level by 23 ft. The power house has at present five turbo-generator sets each of 31,000 kilowatts. The power

generated is stepped up at a transformer station in the open air to 150 kilovolts for transmission to eastern France and to 220 kv. for the lines running to Troyes and the Paris area. In order to maintain an even load at the power station, a pumping station is being constructed so that when the electric load is light the excess power can be used for pumping water into Lac Noire about forty miles away. A generating plant at the lake returns the power to the Kembs station when the load on the latter is heavy. The central control room has been equipped with elaborate illuminated diagrammatic connexions. The devices used enable all the requisite connexion movements to be prepared and verified before they are actually made by direct control or by signals to substations.

Science and the Motor-Lorry

ACCORDING to the *Times* of August 2, the technical engineers attached to the Paris police force have put before M. Chiappe, the prefect of police, an ingenious system of signalling to be used on motor lorries in order that the drivers may be warned when motorists desire to pass them. A selenium cell is placed in a conspicuous position on the back of the lorry and connected through an amplifier to a bell or some other sound-signalling device placed close to the driver. When a motorist desires to pass, he turns on his headlights so that the beam of light strikes the cell and the warning signal is at once put into action. At night the signal can be switched off as the projection of headlights from behind gives sufficient warning. It is suggested that all French lorries will have to carry this device on and after January 1, 1934. In Great Britain nearly all lorry-drivers obey the rules of the road and let the faster car pass at once by moving to the side of the road. In some countries one sometimes meets a driver on a country road who deliberately drives in the middle of the road so as to hold up a faster vehicle for miles no matter how often it hoots. We think that the ringing of a bell on his own vehicle would be much more effective.

Street Traffic Devices

DURING the last few years there has been a rapidly increasing demand for electric traffic signalling apparatus. With 'fixed time' signalling, unnecessary delays are often caused, and this often leads to a disregard of the signals. For this reason the tendency is now to use purely automatic apparatus, operated by the traffic itself. In South Africa a recent enactment withdrew the nationalist police from traffic duties. This has led to a traffic-operated scheme being put on trial at a street crossing in Johannesburg for several months. This has proved such a success that it has been decided to place an order for twenty-six more of the same type. There is now a large world market for street traffic devices, but Britain is experiencing considerable competition from Central Europe and Japan. The low cost of labour in the latter country has considerably reduced the price of electric lamps. It is difficult to compare the relative values of electric lamps, as a life test is a difficult and expensive operation.

Activities of the Carnegie United Kingdom Trust

THE report of this body for 1932 tells how some £200,000 was spent during the year in furtherance of the multifarious enterprises which the Trustees elected to help. Some idea of the variety of the Trust's operations is conveyed by the following partial summary of grants paid or partly paid during the year in fulfilment of its promises: libraries, £85,000 (161 items including central libraries and regional library bureaux, county libraries, municipal book grants, boys and girls clubs, etc.); rural development and social service, £36,000 (112 items including village halls, rural community councils, new estates community associations and many national associations); music, drama, and related activities, £10,500; playing fields and play centres, £30,000 (123 items); adult education, £7,000; museums, £1,500; physical training college for men teachers, £14,500. Substantial as are these amounts, they are far from commensurate with the value of the services rendered by the Trust to the community, for a cardinal point of its policy is to stimulate enterprises which are likely to become independent and have permanent national value.

THE cumulative result of such a policy directed by a group of individuals with the wide and varied interests and mature experience of the Trustees untrammelled by regulations or suffrages obviously cannot be measured in terms of money. At many points, the operations of the Trust were related to problems arising from unemployment. The great gathering at the Albert Hall on January 27, to the cost of which the Trust made a large contribution, inaugurated a voluntary service movement, led by H.R.H. the Prince of Wales, in which the Trust played an important part and which culminated in the Government's decision to promote, through the agency of the National Council of Social Service, a systematic national scheme for organising voluntary occupations for the unemployed. Another movement fostered by the Trust was that associated with the Commission on Educational and Cultural Films, which promises to eventuate in the setting up of a National Film Institute, with functions more or less analogous to those of the British Broadcasting Corporation.

Scientific and Industrial Research in Australia

THE sixth annual report of the Commonwealth of Australia Council for Scientific and Industrial Research gives a brief review of the main activities of the Council in the year ended June 30, 1932. As might be expected, the major part of the work is concerned with plant and entomological diseases, animal, soil, forest products or storage problems, and the report reveals the admirable extent to which the Council is fostering important investigations in these fields. Due provision is made for co-operation with State organisations within the Commonwealth and also for Imperial co-operation, and the report includes full particulars of the staff of the Council, the official correspondents, as well as of the publications issued during the year and of expenditure. According to

the report, Australia suffers an annual loss of no less than £12,000,000 from animal diseases, and the investigations of the Plant Division have already materially assisted in the control of bitter pit of apples, blue mould in tobacco, water-blister on pineapples as well as in breeding strains of wheat more resistant to fly smut.

MUCH valuable information has been acquired regarding the losses suffered by exporters of Australian apples, particularly in the prevention of bruising, while the Entomological Division records important progress in the control of blowfly attack of sheep, as well as in the eradication of weed pests. Control of the apple thrips is being attacked mainly by the investigation of repellents. The Division of Animal Health is able to report an outstanding achievement in the discovery and practical application of an effective vaccine against black disease of sheep, which occasions an estimated annual loss in Australia of £1,000,000. In this field as in its investigations on cold storage, the utilisation of waste kari and mari barks for tannin extracts, the prevention of wood taint in butter, the establishment of the paper-making industry in Tasmania from local hardwoods, or on timber mechanics, the Council has already been responsible for large national savings or for constructive enterprises representing sums greatly exceeding its annual expenditure.

National Research Council of Japan

THE report of the National Research Council of Japan for the year April, 1930-March, 1931, has recently been issued (Report: National Research Council of Japan, Imperial Academy House, Ueno Park, Tokyo. March, 1933). It contains a complete list of papers published during that year in the various journals under the control of the National Research Council. These journals cover astronomy and geophysics, physics, geology and geography, botany, zoology, medical sciences, mathematics and oceanography. The divisional and committee meetings of the Council are also recorded. There are also reports of the delegates to the fourth general assembly of the International Union of Geodesy and Geophysics held at Stockholm in August 1930, and the tenth conference of the International Chemical Union, held at Liège in September 1930. A list of the members of the National Research Council is appended.

Fuels and Fuel Testing in Canada

THE Mines Branch of the Canada Department of Mines report on fuels and fuel testing for the year 1930-31 records considerable analytical and other work on the solid, liquid and gaseous fuels, and reflects on the special problems of the Dominion. Interesting large-scale tests on the storage of coal are recorded, notably one at Montreal, where 35,000 tons of Nova Scotia coal stored in a pile 40 ft. high attained a maximum recorded temperature of 88° F. The geographical distribution of fuel supplies in Canada is unfortunate and the storage problem is important. Efforts are being made to increase the

supply of Canadian motor spirit by the pyrolysis of natural gas in Alberta and by treatment of the bitumen. By hydrogenation of Alberta bitumen, yields of gasoline reaching 75 per cent could be obtained.

Severe Tornado at Nashville, Tennessee

IN the *Monthly Weather Review* for March 1933 there is an account dated April 5, 1933, by R. M. Williamson, of the Weather Bureau Office at Nashville, Tennessee, of a severe tornado that visited that city, on March 14, 1933. Although the storm has in Mr. Williamson's opinion been exceeded in violence by others, even within the state of Tennessee, the account is of more than usual interest in that it has been written by a meteorologist, who was extremely near to the centre of the storm's path. He was so near in fact that common prudence prevented him from making what would probably have proved fatal to him—direct observation of the storm's near approach. One of his assistants, F. V. Jones, gives a graphic account of the phenomenon as it appeared from a point about three-quarters of a mile north of the track of the funnel cloud, describing the latter as "moving rapidly across a light-coloured background of rain, looking very much like a shadow moving across a motion-picture screen". The right hand side of the path of destruction passed within about 400 ft. (to the north-north-west) of the Weather Bureau Station, where the wind after veering suddenly from south-east to south-west rose to a maximum of 65 miles an hour for about a minute, a speed which must not of course be confused for a moment with that probably reached in the vortex itself. A thunderstorm, with unusually large hailstones, preceded the tornado by several minutes, and the more permanent veer of the wind to north-west, the direction of the main wind-current of the rear of the V-shaped trough with which the storm was associated, did not take place until about an hour later. Material damage amounted to nearly half a million pounds, but the loss of life in Nashville, in spite of the eight-mile track through a densely populated city, was eleven only. The writer described a number of cases that seem to be a common feature in tornadoes, where comparatively fragile objects have penetrated or severed much more solid wooden objects, making clean holes or cuts without any splintering.

Meteorology in Cornwall

REFERENCE was made in *NATURE* of July 29, p. 163, to a lecture by Sir Napier Shaw, delivered to the Royal Cornwall Polytechnic Society at its centenary celebrations on the opportunities for useful meteorological research that are open to amateurs notwithstanding the growth of professional meteorological study in recent years. One of that Society's activities consists in the maintenance of the climatological observatory at Falmouth—an observatory which was at one time under official control—the work being carried out by Mr. W. Tregoning Hooper, the present superintendent. The small annual

publication of the Observatory entitled "Meteorological Notes and Tables for the Year 1932" has recently been received. As is pointed out in the introductory notes, the influence of the sea that almost surrounds the Cornish peninsula has a moderating effect upon the temperature. In 1932, the range for the whole year was only just over 50 deg. from 28.4° on February 11 to 80° on August 19 (the hottest day over England, generally, for twenty-one years). Such a variation can be approached, if not equalled, during calm clear weather in spring in eight hours or less in the interior regions of England far from the influence of the sea. Cornwall is, of course, a recognised place to which invalids can go so as to escape severe frost, but its immunity from excessive heat is probably not so well known. This immunity is well illustrated by a fact to which attention is directed in these notes, namely that temperatures above 80 deg. had from 1880 until the end of 1932 been recorded only six times at Falmouth. At Kew, it may be noted this figure had in this year alone been exceeded eight times up to July 24.

Ringling of British Birds in 1932

THE *British Birds* marking scheme has, for the fifth year in succession, established a record of number of birds ringed, 29,554 for 1932 as against 28,610 in the previous year. The grand total of British birds marked under this scheme has now reached the enormous figure of 347,548. It is a gratifying feature of the past year's work that one-fourth of the total for the year is made up of birds ringed and released from traps. Trapping ought to give a larger proportion of recoveries than examination of birds casually found, and this is most desirable if general deductions are to be made from the recovered birds. It is surprising how small a proportion of accessible bird life comes under close scrutiny. From the inception of the scheme until the end of 1932, no less than 25,171 swallows have been ringed, and of these only 189 (0.8 per cent) have been recovered. The warblers also are an elusive race; of 8,054 willow warblers only 34 have been seen again, of 892 and 824 sedge- and garden-warblers respectively only one each; and of 567 blackcaps none at all have been reported again. On the other hand, the birds of prey and the ducks generally yield high recoveries, suggestive perhaps of intensity of slaughter; and of common resident birds the red-breast has the relatively high (but actually surprisingly low) return of 761 out of 12,696 ringed, 6.5 per cent. The low returns throughout point in part to the high death-rate amongst young birds.

Taxonomy and Cytology

THE Hooker lecture of the Linnean Society delivered on February 16 last, by Sir William Wright Smith (*Proc. Linn. Soc.*, Part II, 1932-33), dealt with this subject, with specific reference to the genus *Primula*. Sir William examined the taxonomic value of the criteria submitted by the cytologist. This genus is particularly suitable for such a comparison

as morphologically it is divisible into some thirty reasonably definite sections. Cytologically the same is true and, on the whole, the analysis from this point of view agrees with the morphology very well. Sir William's general conclusion appears to be that chromosomic divergence would certainly indicate usually that a line can be drawn between two groups, but it would not follow that even a marked difference would justify generic separation. Such separation would require to be based on the morphological evidence at the final arbitrament.

Homes of the Linnean Society of London

THE *Proceedings of the Linnean Society of London*, Part 2 for the session 1932-33 contains an interesting plate of photographs of the various homes of the Linnean Society during the 145 years of its existence. As Mr. S. Savage, the librarian, points out, it is a remarkable fact that all these homes are within half a mile of the spot where the Society was founded and are to be found in an area bounded on the north by Oxford Street, on the south by Piccadilly and the north side of Leicester Square, on the west by Old and New Bond Streets, and on the east by Charing Cross Road.

The Hong-Kong Naturalist

SINCE its foundation in 1930, the *Hong-Kong Naturalist* has done much to encourage observation of Nature in the Colony. At first the magazine contained both technical articles for scientific workers, and more popular articles dealing with local fauna and flora. By aid of a grant from a scientific institution outside the Colony, Dr. Herklots, the editor, has been able to separate these two objects, so that the *Naturalist* now appears as a guide mainly designed for the amateur field naturalist, while the "Supplement" contains the specialist papers. We must congratulate the *Hong-Kong Naturalist* on the excellence of its natural history articles for the purposes they are intended to serve; the coloured plates and the line drawings which have been a feature of the magazine display art as well as scientific accuracy.

Use of Radium in Ireland

THE Irish Radium Committee reports that during the year 1932, 342 batches of radon tubes were issued, a slight increase over 1931. Attention is directed to the fact that the present general depression has adversely affected the regular hospital attendance of patients, and in consequence the results of treatment during the year are disappointing. Skin cancers react well to radium treatment, but the results of treatment of rectal cancer have been so unfavourable that it has been abandoned. For cancer of the breast, radium is now rarely used, a combination of deep X-ray therapy and surgery proving satisfactory (*Sci. Proc. Roy. Dublin Soc.*, 20, N.S., No. 38, Separate Issue, July, 1933).

New Gliding Record

WHAT is claimed to be easily a world record in gliding was achieved by Kurt Schmidt, a young

German student, on August 3-4. A correspondent, writing to the *Times* of August 5, states that Schmidt landed at Korschenruh, near Königsberg, on August 4, after having been in the air for more than thirty-six hours. The glider was of the Grunauer 'Baby' type.

Announcements

WE regret to announce the death of Prof. H. G. Greenish, formerly professor of pharmacutics to the Pharmaceutical Society of Great Britain and in the University of London, joint editor of the 1914 issue of "British Pharmacopoeia" and Hanbury gold medallist in 1917, on August 2, aged seventy-eight years; also of Dr. Otto Stapf, formerly keeper of the herbarium and library at the Royal Botanic Gardens, Kew, editor of Pritzel's "Iconum Botanicarum Index Londinensis" and the *Botanical Magazine*, on August 3, aged seventy-six years.

THE twenty-fifth autumn meeting of the Institute of Metals will be held at Birmingham on September 18-21. On September 18, Mr. W. R. Barclay (vice-president) will deliver the twelfth autumn lecture entitled "Twenty-five Years' Progress in Metallurgical Plant".

WE have received from Messrs. W. and G. Foyle Ltd., Booksellers, of 119-25, Charing Cross Road, London, W.C.2, a catalogue of books on technical and applied science subjects. They are conveniently classified under 450 headings. In some cases second-hand prices are quoted.

AN important "Bibliography of Prehistoric Indian Antiquities" has been contributed by H. C. Das-Gupta to the *Journal and Proceedings of the Asiatic Society of Bengal* (vol. 27, 1931, issued Feb. 1933, pp. 1-96). The bibliography, which has been collected over a period of fifteen years, contains 553 items, ranging from the early years of the nineteenth century to the present day, and its value is increased by an index to subjects and localities.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—An assistant master in chemistry and physics at the Bargoed Mining and Technical Institute—The Director of Education, County Hall, Cardiff (Aug. 14). A teacher of engineering subjects at the Northampton College of Technology—The Secretary for Education, Education Office, "Springfield", Cliftonville, Northampton (Aug. 21). A lecturer in mathematics at the Chelsea Polytechnic, London, S.W.3—The Principal (Aug. 23). A mechanical engineer to the Safety in Mines Research Board—The Under-Secretary for Mines, Establishment Branch, Mines Department, Cromwell House, Dean Stanley Street, Millbank, London, S.W.1 (Aug. 31). An assistant lecturer in physics at the University College of North Wales, Bangor—The Registrar (Sept. 7). A lecturer in fuel technology in the Department of Metallurgy at University College, Cardiff—The Registrar (Sept. 9).

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.]

Physico-Chemical Experiments on the Amphibian Organiser

THE process of induction by organisers, discovered during the last twelve years by Spemann and his collaborators, is now recognised to be among the most important morphogenetic factors in early embryonic development. The exact nature, therefore, of the organising influence exerted by the dorsal lip of the blastopore on surrounding regions, is a subject of peculiar interest. Recent experiments^{1,2,3,4} have given strong support to the view that induction is due to a definite chemical substance, since the organiser tissue can be narcotised, crushed, dried, frozen, or boiled, without loss of its inductive power. Holtfreter⁵, indeed, has shown that regions of the newt embryo, such as the ventral ectoderm, which do not normally possess inductive power, acquire it after being boiled.

We have now succeeded in obtaining inductions in *Triton* gastrulae from extracts of whole neurulae. The cell structure was completely destroyed by crushing, and the lipid-protein granules of the yolk, together with other debris, removed by centrifuging. Since the neurulae are crushed in as small a volume of water as possible, the cell-free extract is concentrated, and can, owing to its contained protein, be coagulated by pouring on to a warm glass plate. This solid material, when implanted into the blastocoele cavity of a gastrula (*Einsteckung*), will induce the formation of neural tube, and, more commonly, of unorganised but histologically recognisable neural cells.

Although the fatty material in the cell-free extract collected at the surface on centrifuging, a complete separation of the fatty and aqueous phases was not possible. But by grinding neurulae with anhydrous sodium sulphate, and extracting the mass with ether or with petrol-ether in a micro-Soxhlet apparatus, we succeeded in obtaining active material which induced the formation of neural tubes or, more commonly, solid rods, and other masses of tissue which were probably neural in character. As there is reason to believe, partly from older work^{6,7}, that the inductive power is also contained in the organs of larval or adult Amphibia, we prepared petrol-ether extracts of the viscera of the adult newts, and although, owing to the ending of the season, our experiments had to be left off, we have obtained strong positive indications that the active substance is present there also. Experiments in which the unsaponifiable portion only of the ether extract was employed, have not yet given clear results, and must be continued at the earliest opportunity.

The number of perfect inductions so far obtained with all these extracts is small in relation to the number of embryos which survived the operation, but it must be remembered that the surface relationships of the active substance are destroyed by the chemical processes of isolation, and that the implantation takes place into a living system, in which, owing to its lack of circulation, rather long-range diffusion processes are probably the limiting factors. A large

number of control experiments, in which other substances were implanted, for example, agar, celloidin, egg albumen, pure triglycerides, and mixtures of triglycerides with sterols, gave no induction effects. The positive results with embryo extracts cannot, therefore, be attributed to mechanical stimulation.

It is probable that the action of the primary organiser has two aspects, first, the induction of an embryonic axis in competent ectoderm, and secondly, the determination of the regional character of the axis^{8,9}. On the evidence at present available, only the first of these two aspects is exhibited by dead organisers or organiser extracts. This first aspect, the 'induction-as-such' of an embryonic axis, is brought about in different cases by rather widely distributed agents, as is shown by heteroplastic transplantations between urodeles and anurans¹⁰, and between birds and mammals¹¹.

In our opinion, the evidence now brought forward indicates very strongly that in the Amphibia this agent is a definite chemical substance, certainly soluble in ether, and probably of a lipoidal nature.

C. H. WADDINGTON.
JOSEPH NEEDHAM.
DOROTHY M. NEEDHAM.

Abteilung für Entwicklungsmechanik
(Prof. Otto Mangold),
Kaiser-Wilhelm Institut für Biologie,
Berlin-Dahlem.
July 2.

¹ Spemann, H., *Ver. deutsch. zool. Gesell.*; 1931.

² Bautzmann, H., Holtfreter, J., Spemann, H. and Mangold, O., *Naturwiss.*, 20, 971; 1932.

³ Marx, A., *Archiv. Entwicklungsmech.*, 123, 333; 1931.

⁴ Waddington, C. H., *NATURE*, 131, 275, Feb. 25, 1933.

⁵ Holtfreter, J., *Archiv. Entwicklungsmech.*, 123, 584; 1933.

⁶ Mangold, O., *Archiv. Entwicklungsmech.*, 117, 586; 1929.

⁷ Holtfreter, J., *Archiv. Entwicklungsmech.*, 117, 421; 1929.

⁸ Spemann, H., *Archiv. Entwicklungsmech.*, 123, 389; 1931.

⁹ Waddington, C. H. and Schmidt, G. A., *Archiv. Entwicklungsmech.*, 128, 522; 1933.

¹⁰ Geinitz, B., *Archiv. Entwicklungsmech.*, 106, 357; 1925.

¹¹ Waddington, C. H., unpublished work.

Behaviour of Electrons and 'Holes' in Cuprous Oxide

It is a remarkable feature of electron conductivity that an insulating crystal becomes conducting so soon as one section of it is illuminated by active light. The same phenomenon was found both in the experiments of Kikoin and in our own investigation on multicrystalline cuprous oxide plates. At liquid air temperature the current between *E* and *F* (Fig. 1) increases a hundredfold if a small section, *S*₁ *S*₂, be illuminated. Thus not only have we a stream of electrons from the illuminated section to the anode,

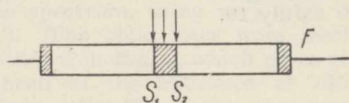


FIG. 1.

but necessarily a supplementary stream between the cathode and *S*₁ *S*₂ also; the latter must be ascribed to the movement of free 'holes' in a fully occupied band of electron levels, which is equivalent to a stream of 'positive electrons'.

Since the mechanism of the current is different on the two sides of the section *S*₁ *S*₂, we expected a distinction in specific conductivities. To test this, we illuminated a section adjacent to the electrode *E*.

However, we did not find any difference between the two opposite directions of the current. The current followed the illumination without measurable time lag and was equal in both directions. Up to 2,000 volts, it was proportional to the potential applied. At 5,000 volts, saturation was nearly reached. We therefore conclude that: (1) The mean time lag τ between the appearance of a photoelectron and its transition into a bound state is of the order 10^{-6} sec., assuming a normal mobility of electrons of 300 cm./sec. in a field of 1 volt/cm. at -180°C . (2) The equality of saturation currents in both directions shows that the number of free electrons and of free holes ('positive electrons') produced by light are also equal. (3) The equality of the currents in the region where Ohm's law holds is a proof of the equality of the mobilities of electrons and holes.

Without any external electric field, the movement of electrons and holes leads to a diffusion of photoconductivity from the illuminated spot in all directions. In fact, illuminating a section at one end of a cuprous oxide plate, we found at the other end that the conductivity rose gradually during one hour from the initial small value of about 10^{-12} ohm $^{-1}$

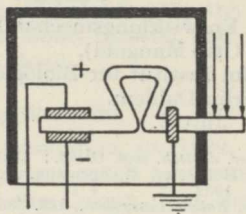


FIG. 2.

at -180°C . to a value about hundred times as large. Cutting off the light, we gradually reduced the conductivity to its initial value.

In order to be sure that the measured conductivity was not due to diffusion of light inside the plate or to the spreading out of the field, we gave to the cuprous oxide plate the form shown in Fig. 2 and illuminated one end through a yellow-green filter by light which was strongly absorbed. The remaining part of the plate was put in a closed black box. The opposite end of the plate was provided with two electrodes. Just as in the case of a plane plate, we observed an increasing current, 'transmitted' from the illuminated section.

A. JOFFÉ.
D. NASLEDV.
L. NEMENOV.

Physical-Technical Institute,
Leningrad.
July 10.

Impulse Corona in Water

IN order to obtain accurate data concerning the mechanism of breakdown phenomena in liquid dielectrics, we have investigated the impulse corona in liquids by means of the spectrograph. The liquid dielectric used in this case was distilled water. The impulse corona was produced by applying an impulse voltage between the aluminium needle *N* and the plate electrode *P* (Fig. 1); *M*, *C*, *C*, and *W* denote the impulse generator, which produces impulse voltage of $10^{-4} \sim 10^{-5}$ sec. in duration.

When the gap-length of *F*, in Fig. 1, is sufficiently large, the full impulse voltage is applied between electrodes *N* and *P*. If, in this case, an impulse voltage of adequate intensity is applied, a pink-coloured corona is produced on the end of the needle

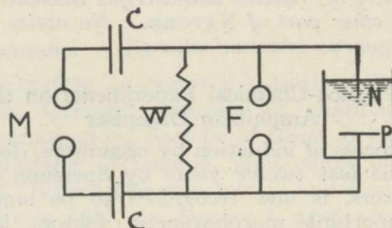


FIG. 1.

electrode *N*, and, at the same time, many very small bubbles of water vapour. The spectrum of this corona is very similar to that of a water vapour electric discharge tube as shown in Fig. 2.

When the impulse voltage is reduced by shortening the gap-length of *F*, the corona disappears. If the crest value, however, of the impulse voltage is increased by widening the gap at *M*, a white corona is produced. The spectrum of the corona, also shown in Fig. 2, is quite different from the pink one mentioned above. The duration of the impulse voltage was less than 10^{-7} sec.

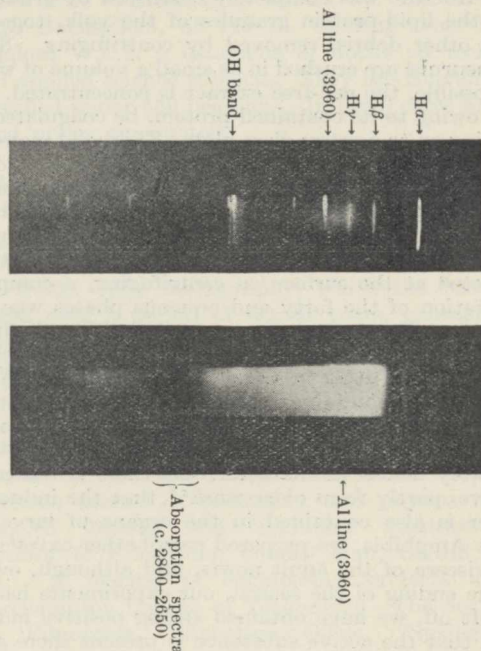


Fig. 2. Above, spectrum of corona of water vapour electric discharge tube; below, spectrum of white corona produced by increasing the crest value of the impulse voltage.

In short, there are two types of impulse corona in water; one pink in colour, obtained in the case of a rather longer impulse voltage, and the other white, in the case of a shorter impulse.

Y. TORIYAMA.
U. SHINOHARA.

Hokkaido Imperial University,
Sapporo, Japan.

Predissociation in Fluorescence Emission Spectra: Fluorescence of Acetone Vapour

THE fluorescence of acetone was first observed by Gelbke¹. It was also observed independently in the vapour by Mr. C. W. Woolgar of King's College, London, who kindly directed our attention to its existence. Recently, Damon and Daniels², in a paper on the photochemical decomposition of acetone, have described the visible fluorescence of acetone vapour as a greenish emission consisting of two diffuse bands, one extending from $\lambda\lambda$ 4100 to 4820 Å., the other from 4990 Å. to the limit of the sensitivity of the plate (5210 Å.). They record that the intensity is reduced and the colour of the fluorescence changed to blue by the addition of oxygen or air, but that the bright green fluorescence is restored after a period of illumination. These changes are readily explained by the specific quenching action of oxygen due to photochemical oxidation, which is known to occur. The excited molecules of acetone upon reaction lose their power to fluoresce, while the blue fluorescence is the product of a transient intermediate compound present during the process of oxidation.

We have ourselves been engaged in the study of this fluorescence during the past six months, and in view of the publication of the work of Damon and Daniels, feel we may be permitted to give this preliminary account of a result which we believe to be of fundamental importance to photochemical theory.

Using as exciting radiation the mercury line at λ 3340 Å., we have obtained a series of photographs of the fluorescence spectrum of acetone, of particular interest. From these it is apparent that the visible fluorescence is accompanied by a very considerable emission in the ultra-violet, the wave-lengths extending down to that of the exciting line. There is this striking difference between the visible and ultra-violet fluorescence, however; whereas the former consists of diffuse bands, the latter consists of a series of fine and sharp lines. The phenomenon of pre-dissociation (of which diffuse bands associated with photochemical decomposition are a manifestation) has previously been mainly associated with absorption spectra. We have here the first recorded example of its existence in the reverse process of fluorescence. Whereas in the case of absorption, the condition of predissociation represents a transition from a stable lower to an unstable upper level, predissociation in fluorescence represents the reverse, a transition from an upper excited level to a lower unstable level. These facts can be readily interpreted in terms of a Franck-Condon potential energy diagram.

The analysis of this fluorescence led us to infer, first the existence of a hitherto unsuspected region of absorption by acetone in the near infra-red, and secondly a region of discrete structure in the ultra-violet absorption band of acetone, which has previously been supposed to be continuous. Both these predictions have been verified: using specially purified liquid acetone, we have obtained photographs of a series of diffuse infra-red bands extending from $\lambda\lambda$ 7205 Å. to the limit of sensitivity of our plates (about 11000 Å.), while with a column of acetone vapour at low pressure we have obtained photographs of the expected discrete structure of the ultra-violet band.

The unstable infra-red level may well be the initial stage reached in the homogeneous thermal decomposition of acetone described by Hinshelwood and

Hutchinson³. Molecular activation (68.5 kcal. in this case) then represents the total energy which must, on the average, be introduced into the various degrees of freedom of the molecule to ensure the reaching of our unstable level; decomposition then follows. A full account of this work will be published when collateral experiments on the photochemical decomposition now in progress have been completed.

H. G. CRONE.

R. G. W. NORRISH.

Department of Physical Chemistry,
University of Cambridge.
July 19.

¹ Gelbke, *Jahrbuch der Radioaktivität*, **10**, 1: 1913.

² Damon and Daniels, *J. Amer. Chem. Soc.*, **55**, 2363: 1933.

³ Hinshelwood and Hutchinson, *Proc. Roy. Soc., A*, **113**, 221: 1926.

Fine Structure and Predissociation in the Spectrum of Calcium Hydride

IN 1925 Mulliken¹ reported a band system, emitted by the CaH molecule, and having a very unusual structure. It is composed of singlet *P* and *R* branches, which are abruptly cut off at *P* ($11\frac{1}{2}$) and *R* ($9\frac{1}{2}$). It was generally assumed that this band, shortly named the *C*-band, corresponds to a $^2\Sigma^* \rightarrow ^2\Sigma$ transition, and that the non-appearance of doublet components in the series was caused by some peculiar unstable conditions in the activated $^2\Sigma^*$ state. Later on², we were able to show that $^2\Sigma^*$ suffers from predissociation into the continuous region of an activated $^2\Sigma$ level, causing the remarkable cut-off in the series at low pressure in the source of light.

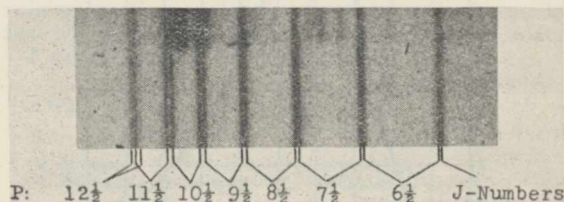


FIG. 1.

However, the singlet structure of the *C*-band is incompatible with the general theory on band structure as well as with Kronig's rules of predissociation. According to these rules, either both or none of the doublet components (F_1 , F_2) in $^2\Sigma^*$ should be missing, having identical symmetry properties in ψ . We considered these arguments of such weight that we undertook a new investigation of the spectrum, using very high dispersion (0.58 Å./mm.). The band lines were resolved into doublets, as shown in Fig. 1, which gives the region around the head of the *P*-branch at λ 3534. Our analysis indicates that $^2\Sigma^*$ forms very narrow rotational doublets [$F_1 - F_2 = 0.011(K + \frac{1}{2})$], with their centres represented by the formula:

$$T(K) = 28353.04 + 4.792 K(K+1) - 8.9 \times 10^{-4} [K(K+1)]^2 - 2.22K.$$

This expression contains a large term, linear in *K* and previously attributed to the interaction between the electronic spin and the rotation of the molecule. According to our new results, this term must now be identified with an *l*-uncoupling effect, $^2\Sigma^*$ forming a typical case *d*.

The splittings and the intensity relations in the doublets exhibit interesting irregularities, some of which are visible in Fig. 1. As these relations depend intimately on the development of the band system at increasing pressure in the source of light, details of observations will be given later in connexion with the performance of these investigations.

B. GRUNDSTRÖM.
E. HULTHÉN.

Laboratory of Physics,
University of Stockholm.
June 22.

¹ R. S. Mulliken, *Phys. Rev.*, **25**, 509; 1925.

² B. Grundström and E. Hulthén, *NATURE*, **125**, 634, April 26, 1930.

The Stopping Layer of Rectifiers

By gradually dissolving the surface layer of a cuprous oxide rectifier, W. Schottky and Waibel proved that both rectification and photoeffect were due to a layer of the order of 10^{-6} – 10^{-5} cm., the conductivity of which was reduced. So long as we could not produce such intermediate layers artificially, however, it was quite hopeless to try to test any of the numerous theories of rectification.

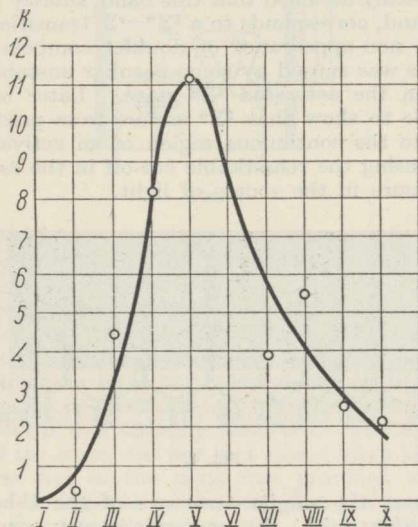


FIG. 1.

A sufficiently uniform non-conducting layer was obtained on the surface of a cuprous oxide plate by the sublimation of quartz in a high vacuum. The thickness of the quartz sheet increased gradually from one end of the plate to the other from zero to about 10^{-5} cm., and the resistance was about five times the resistance of the plate. Covering the quartz sheet by a metallic plate provided with a series of holes and subliming in the same way a layer of gold, I provided the quartz sheet with a series of gold electrodes.

The current passing through the quartz layer to the cuprous oxide plate showed a marked rectification: at 1 volt the ratio of currents in opposite directions reached 13. This ratio showed small fluctuations not exceeding ten per cent for electrodes in the same row, corresponding to equal thicknesses. Proceeding from one row to another, I found a systematic change in the coefficient of rectification, as shown in Fig. 1.

We thus see that rectification is dependent on the thickness of the contact layer between a semiconductor and a metal within quite narrow limits. These limits are 10^{-5} – 10^{-6} cm.

The problem was suggested by Prof. A. Joffé.

W. JUSÉ.

Physical-Technical Institute,
Leningrad.
July 10.

Position of the Bands in the Spectrum of Oxyhæmoglobin

WE have investigated the position of the absorption maxima of the spectrum of oxyhæmoglobin by a new photomicrometric method. The solutions were obtained by careful dilution of washed horse blood with 0.58 per cent ammonia solution.

We have found a very considerable shift of the band maxima towards the ultra-violet region with decreasing concentration of oxyhæmoglobin. The product, concentration \times thickness of the absorbing layer, was kept constant.

The maxima shifts according to the present measurements range from 5765 Å. to 5755 Å. for the α band, from 5424 Å. to 5367 Å. for the β band, and from 4188 Å. to 4094 Å. for the γ band.

These results seem to be important considering the work of Anson, Barcroft, Mirski and Oinuma, who have found a relation between the position of the α band and the distribution of hæmoglobin between oxygen and carbon monoxide.

A detailed account of the position of the band maxima of oxyhæmoglobin and carbon monoxide hæmoglobin will be published elsewhere.

A. KRUPSKI.
F. ALMÄSY.

Institute of Veterinary Medicine,
Institute of Physical Chemistry,
University of Zurich.
July 7.

Existence of a Neutron of Mass 2

THE existence of a neutron of mass 2 has been considered as a theoretical possibility by several physicists. The observations of Beck, that in the building up of heavier elements from the lighter, electrons are added in pairs, is of much interest and has caused Lord Rutherford to state in his address to the Royal Society on the "Structure of Atomic Nuclei"¹ that uncharged units of mass 2 as well as the neutron of mass 1 may be secondary units in the structure of nuclei.

The purpose of the present note is to point out that such a neutron of mass 2 may have already been observed.

Harkins, Gans and Newson², and Curie³, have obtained clear photographs of the disintegration of nitrogen atoms by neutrons. In each set, a photograph has been obtained which is remarkable for the length of the recoil track of the boron nucleus. Assuming the conservation of momentum, the energy of the incident neutron, as calculated from the lengths of the tracks of the fork and the angle between them, is found to be 16×10^6 and 17×10^6 electron volts respectively, values which are twice as great as those given by Curie-Joliot and Joliot⁴.

The peculiarity of the fork obtained by Kurie is that it is due to a neutron which owed its origin to beryllium bombarded by α -particles from polonium. Such neutrons were used by Chadwick⁵ in his experiments on the disintegration of hydrogen and nitrogen, and using the value 5.25×10^6 electron volts for the kinetic energy of the α -particles, he calculated that the maximum energy which could be imparted to such neutrons (assuming that all the energy due to the mass defect involved, together with the kinetic energy of the α -particle, was transferred to the neutron) was 8.0×10^6 electron volts. This value accords well with that of Curie-Joliot and Joliot already mentioned, namely, 7.8×10^6 electron volts.

Kurie, using 5.4×10^6 electron volts as the kinetic energy of the polonium α -particles, obtains a maximum energy for the neutron of 12.3×10^6 electron volts, leaving 4.7×10^6 electron volts unaccounted for. This discrepancy he points out cannot be due to experimental error for the fork is a good one and may be accurately measured.

If, however, we assume the correctness of Chadwick's maximum energy for neutrons of mass 1 from beryllium bombarded by polonium α -particles, namely, 8×10^6 electron volts, the above high energy, 17×10^6 electron volts (probable error 1×10^6 electron volts), is explained by the assumption of a neutron of mass 2 with energy 16×10^6 electron volts.

HAROLD WATKES.

Physics Department,
Washington Singer Laboratories,
Exeter.
July 7.

¹ *Proc. Roy. Soc., A*, 136, 737; 1932.

² *Phys. Rev.*, 43, 584; 1933.

³ *Phys. Rev.*, 43, 771; 1933.

⁴ *NATURE*, 130, 57, July 9, 1932.

⁵ *Proc. Roy. Soc., A*, 136, 699; 1932.

Sakai Marksmanship with a Blowpipe

ON looking through some old note-books, I find that I have preserved a record that may be of general interest, one of Sakai marksmanship with a blowpipe. The subject of the record was a Kampar Sakai whom I met on Cameron's Highlands, Malaya, in March, 1926. As I had seen previously some very poor exhibitions by aborigines with the blowpipe, I asked this man, who was a fine sturdy fellow, to let me see what he could do. The target was a bit of deal-board from the lid of a box, dimensions not noted; but I marked a two-inch bull on it in pencil, stationed the Sakai 50 ft. away, which was the greatest distance possible on account of vegetation, and told him I would give him ten cents for every hit on the target and twenty cents for every bull, the shoot to be limited to ten rounds with unpoisoned darts.

The record was as follows:

- | | |
|----------------------------------|-----------------------------------|
| 1. $1\frac{1}{2}$ in. from bull. | 6. 4 in. from bull. |
| 2. Bull, side of. | 7. $\frac{1}{2}$ in. from bull. |
| 3. 4 in. from bull. | 8. Missed the target. |
| 4. 1 in. from bull. | 9. 1 in. from bull. |
| 5. Bull, centre. | 10. $1\frac{1}{2}$ in. from bull. |

The shoot cost me, in equivalent English currency, 2 shillings and 6.8 pence. I remember that the darts penetrated the target sufficiently to make it difficult to pull them out without injuring them.

68 Chaucer Road,
Bedford.
July 27.

J. B. SCRIVENOR.

Hysteria in Dogs

SOME evidence has been collected (from more than fifty cases) indicating a connexion between so-called canine hysteria and vitamin A deficiency coupled with a substance ('E-substance') occurring in dog biscuits and other cereals.

Fifty-four cases of dogs suffering from hysteria were investigated. Of these, all except one were fed on a preponderantly cereal diet: 26 of these, continuing on the same diet, remained hysterical, while 28, the diet of which was changed to contain more vitamin A, recovered (Fig. 1).

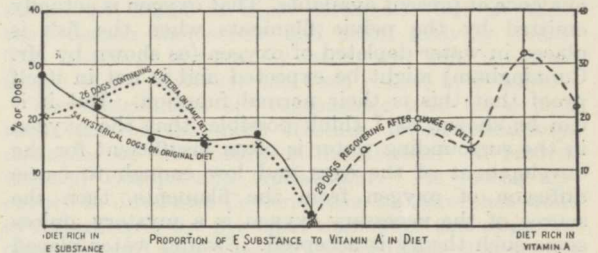


FIG. 1.

In the absence of quantitative data, it is not possible to assess the exact pharmacological ratio of vitamin A : E-substance.

The recent work of Mellanby¹, in which dogs were fed on a cereal diet deficient in vitamin A, is suggestive; symptoms closely resembling canine hysteria were aggravated by the addition of wheat germ².

Mellanby's work, taken in conjunction with the similarity of symptoms, treatment and cure of convulsive ergotism and canine hysteria, make it possible that the cause of the two is the same, or closely allied.

Further work is in progress.

H. D. WALSTON.

King's College, Cambridge.
July 15.

¹ E. Mellanby, *Brit. Med. J.*, i, p. 679; 1930.

² E. Mellanby, Linnaea Lecture, Cambridge (1933).

Pelvic Filaments of Lepidosiren

DR. CUNNINGHAM and Mr. REID¹ were naturally concerned that Mr. Foxon² should dismiss their theory while omitting half of the evidence on which it was based. The function of the pelvic limb filaments of the breeding male Lepidosiren as a source of oxygen for the developing embryos is, of course, probable only if the supply of oxygen from the water in the nest is actually insufficient. That this was the case appeared probable from the work of Carter and Beadle³ on the Chaco swamps, where the Winkler method for oxygen estimation was employed. Mr. Foxon¹ replies that my work on swamps in East Africa⁴ has thrown some doubt on this point, and that the figures for oxygen in the waters investigated may be subject to an error of anything up to 1.0 c.c. per litre.

This error is due to the presence of reducing substances, particularly sulphide, the quantity of which I estimated in some African swamps by iodine absorption in acid solution. By this means, it was possible to calculate the maximum amount of oxygen which could be present in a sample from which a zero figure had been obtained by the Winkler

method. 1.0 c.c. per litre was suggested as the greatest error likely to be caused in this way. In actual fact, water collected from within 2 in. of the surface of a swamp at Kitoma (Uganda) contained no oxygen measurable by the Winkler method, but the maximum amount theoretically possible was 0.56 c.c. per litre. If the oxygen-content of the surface water could be so greatly depleted, it seems probable that the concentration in the lower water approached zero. This conclusion is perhaps supported by the complete absence of truly aquatic plankton from any but the surface layers of the tropical swamps investigated.

This question, however, cannot be settled with the evidence at present available. That oxygen is actually emitted by the pelvic filaments when the fish is placed in water depleted of oxygen (as shown by Mr. Cunningham) might be expected and is not in itself proof that this is their normal function. But if it can be shown, as I think possible, that the oxygen in the surrounding water is often insufficient for the development of the eggs and low enough to cause diffusion of oxygen from the filaments, then the source of the necessary oxygen is a mystery, unless some such theory is accepted. Swamp water placed in pots and holes in the ground in which, as Mr. Foxon points out¹, the eggs and larvæ live happily, forms an environment very different from the swamp itself and is likely to contain a considerable amount of oxygen.

On the other hand, I see no reason why the filaments should not also serve as accessory respiratory organs for the male, as Mr. Foxon suggests. Whether oxygen is emitted or absorbed would presumably be determined by the actual concentration in the surrounding water at a given moment. This may vary considerably under special conditions, though it is my opinion that for long periods of time the lower water is devoid of dissolved oxygen.

On this point therefore we need conclusive evidence. Dr. G. S. Carter is now in British Guiana and will, if the opportunity occurs, estimate oxygen in swamp waters by Alsterberg's modification of the Winkler method, by which the above error is avoided.

L. C. BEADLE.

University of Durham College of Medicine,
Newcastle-on-Tyne.

¹ NATURE, 131, 913, June 24, 1933.

² NATURE, 131, 732, May 20, 1933.

³ J. Linn. Soc., Zool., 37, 251, 205; 1930.

⁴ J. Linn. Soc., Zool., 37, 258, 135; 1932.

I FULLY agree with Mr. Beadle's remarks, with the following exception; there is no reason why the filaments should not absorb oxygen if the concentration of oxygen in the surrounding water were greater than that in the blood of the fish. In fact, I have shown by the experiments recorded in my paper in the *Proceedings of the Zoological Society*, 1932, that, even in the absence of filaments, the skin absorbs oxygen when the concentration in the surrounding water is high and also gives out carbon dioxide very freely. But the evidence we now have indicates that the water in the nest-burrow is almost, if not completely, destitute of oxygen, and the fact that the filaments are only developed during the period when the male is with the eggs or larvæ in the nest-burrow can only be explained by the assumption that the respiration of the larvæ depends on the oxygen emitted by the filaments. To me it is incredible

that the male should be competing in the nest-burrow with the larvæ for oxygen, of which the amount present would soon be reduced to zero if it was not already so when the eggs were first laid.

J. T. CUNNINGHAM.

Pharmacology Department,
London Hospital Medical College,
Mile End, E.1.
July 6.

IN my article on "The Pelvic Fins of the Lepidosiren"¹ I attempted, (1) to outline the history of our knowledge of these structures; (2) to say why I considered them to be of use to the parent rather than to the offspring; (3) to point out why the experiments of Mr. Cunningham and Mr. Reid failed to convince me of the truth of the 'emissive' hypothesis. Mr. Beadle is of the opinion that in addition I should have discussed the question of whether or not the amount of oxygen in the nest is or is not sufficient to meet the needs of the occupants. I did not do so for I consider the evidence at our disposal regarding the conditions in the nest and the requirements of its occupants so scanty as to make such discussion unprofitable.

Mr. Beadle's letter points out that a final estimate of the oxygen content of the swamp water has yet to be made; but even when such figures are obtained, they will be of little use for our purpose unless the oxygen requirements of developing eggs and larvæ are also investigated. That the oxygen content of the swamp water is low is undoubted. That it is too low to support a normally active adult *Lepidosiren* is also beyond doubt. But whether it is too low to support larvæ, which possess large external gills, and comparatively inactive adults, which in the filaments also possess large 'external gills', is not a matter which can be settled without further research.

Finally, it must be remembered that respiration is a twofold process. Those who support the 'emissive' hypothesis are apparently concerned only with the fate of the oxygen, but in maintaining the respiratory hypothesis, I do not forget that one half of the process of respiration is concerned with the elimination of carbon dioxide, and I have no doubt that the filaments of the male form an excellent organ for this function.

G. E. H. FOXON.

Department of Zoology,
University of Glasgow.

¹ NATURE, 131, 732, May 20, 1933.

Scale Structure of the Hair of the Bat

IN connexion with fibre research at this University, I have found it necessary to devise a suitable technique for the photomicrography of the surface scale structure of animal fibres, such as wool¹.

The difficulties of the operation are not peculiar to medullated or heavily pigmented fibres, as will be apparent from the following notes regarding the hair of an Algerian bat (*Miniopterus schreibersii*) kindly supplied by Prof. D'Arcy Thompson. As seen in glycerin jelly or balsam under the microscope, the scales of the fibres present the feathered appearance shown in Fig. 1a. Although commonly recorded in the literature, such an appearance, at least in the case under consideration, is deceptive, and is to be

attributed partly to defective mounting and optical conditions, and partly to the presence and unusual disposition of pigment in the scales.

The true scale structure of the hair of the bat may be revealed either by the method of mounting and viewing which I have devised¹, or by making a celluloid impression in the manner recommended in my later paper². Fig. 1b is a photomicrograph of

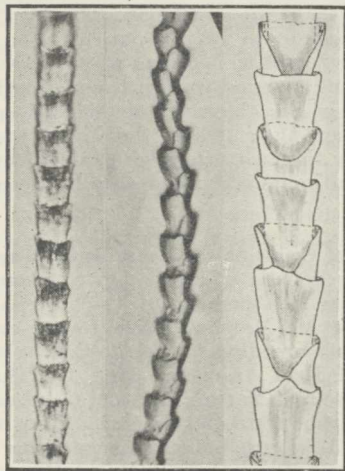


FIG. 1. Hair of bat. a, celluloid impression, $\times 300$; b, $\times 300$; c, drawing, $\times 750$.

such an impression, while Fig. 1c is a drawing of the scale arrangement which is both unusual and interesting.

The root and tip of the hair are commonly free from pigment and, towards the root end, the fibre shows a zig-zag appearance, representing an exaggeration of Fig. 1b.

J. MANBY.

Photographic Department,
University of Leeds.
July 11.

¹ Manby, *J. Text. Inst.*, 23, T.5; 1932.

² Manby, *J. Roy. Micro. Soc.*, 53, 9; 1933.

Occurrence of *Prosopistoma* in Ceylon

THE recent discovery in Java by M. A. Lieftinck¹ of larvæ of a species of *Prosopistoma* (Insecta, Ephemeroptera), which he has named *P. wouteræ*, makes it desirable to direct the attention of zoologists to the existence of this interesting genus in Ceylon. In September, 1928, a single larva was captured by me in a rapid stream at Ougaldowa Estate, Belihuloya, Ceylon, about 5,000 ft., and briefly recorded in the administration report of the Colombo Museum for that year. It was found clinging to a stone in the manner described for the European species, *P. foliaceum*, Fourc.

Through the kindness of Mr. Lieftinck, I have been enabled to examine a paratype of *P. wouteræ* of approximately the same size as my specimen. The Ceylonese species is clearly distinct from it, having both absolutely and relatively a much broader head, and differing in other respects besides. It appears to differ also from *P. foliaceum* in various details of structure, but as I lack any specimen of the latter and have not the complete literature, I must reserve any definite pronouncement on this point.

My specimen is considerably smaller than the type of *P. wouteræ* and is probably not in the last nymphal instar. For this reason, as well as the fact that only a single specimen is available, I refrain from publishing a description pending the capture of further material. Meanwhile, however, I should be very grateful for specimens for comparison of *P. foliaceum*, Fourcroy or *P. variegatum*, Latreille (described originally as a crustacean allied to *Apus*, which, superficially, it resembles), from entomologists in Europe and Madagascar.

The larvæ are flattened and very broadly oval in shape, with a short, segmented 'tail'. They are to be found by day, clinging tightly by suction to the under surface of stones in rapid streams; but at night they detach themselves and swim actively about. The imago is apparently unknown, but the sub-imago of *P. foliaceum* has been reared in France.

The distribution of *Prosopistoma* was, for a long time, one of the most striking, if unsatisfactory, examples of 'discontinuous distribution' on record, namely, Europe and Madagascar. Its recent discovery in Java and Ceylon seems to show that want of collecting is the principal reason for this apparent discontinuity, and it seems very probable that search in rapid streams would reveal its presence in many other countries of the Old World.

G. M. HENRY

(Assistant in Systematic Entomology).

Colombo Museum, Ceylon.

June 20.

¹ Lieftinck, M. A., "A new Species of *Prosopistoma* from the Malay Archipelago (Ephemeropt.)". *Tijdschrift voor Entomologie*, Supplement D1.75, 1932.

Low Auroras and Terrestrial Discharges

INVESTIGATIONS by Trömholt¹, Chant², Johnson³ and myself⁴ have produced evidence which points to the existence of sounds of a hissing, swishing or crackling nature associated with brilliant displays of the aurora. Evidence has also been presented which suggests the existence of luminous effects at low levels accompanying occasional displays. In explanation of these phenomena, the hypothesis has been advanced that there is sometimes present, during auroral displays, an unusual electrical condition of the atmosphere which results in an electrostatic discharge close to the earth's surface. Such a discharge, if real, is probably of a 'secondary' nature induced in some way by processes which take place at great heights⁵ and are responsible for the more conspicuous and familiar aspects of the aurora as investigated by Störmer and his collaborators.

Recently a number of reports have been received from observers in northern Canada who have detected the odour of ozone during auroral displays when the displays were accompanied by sounds. These observations would appear to offer in some degree confirmation of the idea that the sounds and the low level displays are due to electrostatic discharges close to the earth's surface.

C. S. BEALS.

Dominion Astrophysical Observatory,
Victoria, B.C.

June 26.

¹ NATURE, 32, 499, Sept. 24, 1885.

² *J. Roy. Astro. Soc. Canada*, 17, 273; 1923.

³ "Concerning the Aurora Borealis" (printed privately).

⁴ *J. Roy. Met. Soc.*, 59, 71; 1933; *J. Roy. Astro. Soc. Canada*, 27, 184; 1933.

⁵ A somewhat similar suggestion was made by Störmer in 1927 to account for an observation made by Jelstrup, NATURE, 119, 45, Jan. 8, 1927.

Research Items

'Wild Men' in Assam. In a contribution to the *Journal and Proceedings of the Asiatic Society of Bengal*, vol. 27, No. 2, Mr. J. H. Hutton reviews the traditions relating to wild men current in the Naga Hills. Roughly they may be classified under five heads. (1) Little people, pixies, generally unseen but often audible and occasionally caught. To some extent they have the attributes of earth spirits. All tribes have traditions of jungle men who have been caught and kept, eventually becoming the ancestors of existing clans. It is possible that the tradition may be a reference to a race of negritos, who apparently did at one time inhabit the area now inhabited by the Nagas. (2) Ogres, near to the familiar *rakshasas* of Hindustan. They carry off children and fatten them for food. The daughters of these spirits have been known to marry mortals and live on human flesh. The ogre is perhaps the characterisation of a conquering race by the conquered. It is possible that cannibalism was actually practised at one time in Assam. So late as 1879 the flesh of a British officer killed at Khonoma was undoubtedly tasted by some of the young warriors. (3) Tiger-men. There is a widespread belief in the Naga Hills in a village further east where the inhabitants are lycanthropists—tiger-men according to the Nagas, lion-men according to the Kukis; and in tradition this village is nearly always associated with cannibals and Amazons. The belief in tiger-men may be due to a misunderstanding of the totem kin in tribal contacts. It may also be due to contact with pathological cases such as have been recorded in the Malay Peninsula, and for which there is more doubtful evidence in the Naga Hills. (4) Amazons live still further to the east of the cannibal and tiger-men villages. They have marvellous methods of reproducing their kind. The martial aspect of the legend is absent; but the story probably arises from the fact that villages without males do exist. (5) Monstrous races which appear to be due to exaggerated accounts of physical peculiarities such as the ears enlarged by plugs and the extreme platyrrhiny of the Garos.

Pondo Women and European Contacts. A study of changes in the status of Pondo women as the result of contact with European civilisation, by Miss Monica Hunter, appears in *Africa* for July. After reviewing the position of women under the old organisation, it is pointed out that contact has brought about what Europeans at least consider a totally different conception. In economics there is an adjustment in the division of labour owing to changes in the method of earning a livelihood; but economically the woman remains self-supporting. The women still perform a large part of the agricultural work and a class of business-woman is developing. The possibility of earning a living has increased the independence of girls and the marriage age is going up. The unmarried daughter is more important than she was formerly. In property rights, the Roman-Dutch law of community of property works side by side with native law. One effect of this is that where land is congested a woman who goes back to her own people cannot be self-supporting on the land. With regard to *ukulobola* (bride-price) this custom has been retained with tenacity in the face of all attacks. In practically all church marriages, *ikazi* still passes, although the matter of *ikazi* has changed, and goats, sheep, horses,

saddles, guns and money are all used; but they are still called 'cattle'. With the change, however, the religious significance is going. The custom is becoming commercialised. Civil marriage without *ikazi*, however, which is quite frequent in East London location, loosens the marriage tie, increases illegitimacy and thus lowers the status of women. The *umzi*, the social unit in which up to twenty married men and their families live together, is giving way to the individual family, young married women thus being freed from the control of the older and acquiring responsibility at an earlier age; while the single standard of morality for the two sexes, with other factors, leads to a more intimate companionship between man and wife.

Breeding of Corals on the Great Barrier Reef. In describing the gonads and emission of planulae in the Great Barrier Reef corals, Dr. T. A. Stephenson and Miss Sheina M. Marshall have found evidence of discontinuous breeding in *Pocillopora bulbosa* ("The Breeding of Reef Animals. Part 1. The Corals." British Museum (Natural History). Great Barrier Reef Expedition 1928-29. Scientific Reports. Vol. 3, No. 8. 1933). Its breeding seasons occur about the time of new moon in the months of December-April (summer and early winter) and at about the time of full moon during the months of July-August (winter). There is a transition period in May and June. This appears to be the first case on record of transition in spawning from new moon at one time of year to full moon at another. *Pocillopora bulbosa* and *Porites* were the only species which produced planulae whilst under observation. In *Porites* (probably *P. haddoni* in all cases) breeding was going on actively from January until May, 1929. It still continued during June and July, but less actively. There is no indication of lunar periodicity in this coral. The position and structure of the gonads is described in *Favia doreyensis*, *Symphyllia recta* and species of *Lobophyllia*. The first is hermaphrodite and so probably is *Symphyllia recta* and at least one species of *Lobophyllia*. Ova and testes occur intermingled on the same mesentery in *Favia doreyensis*, which apparently just becomes strongly fertile, on an average, when the diameter reaches about 10 cm. From periodic examinations it is concluded that it spawns in early summer (December) after which the gonads become rudimentary, beginning to mature again some time in June. The *Symphyllia* and *Lobophyllia* studied may possibly spawn about the same time as *Favia*.

Genera of May-Flies. Under the title of "Revised Key to the Genera of Ephemeroptera", Dr. G. Ulmer of Hamburg contributes to the *Peking Natural History Bulletin*, vol. 7, p. 195, an article of interest to all students of these insects. In vol. 4 of the same journal, Prof. C. F. Wu published a translation of Dr. Ulmer's previous article on the same subject which appeared in 1920 (*Stett. Entom. Z.*, vol. 81, pp. 97-144). The present contribution, which is written in English, is intended to bring the author's former key up to date by correcting certain errors and by including newly discovered genera and other features. It is illustrated by two plates displaying characters of importance in classification. In view of Dr. Ulmer's status as an authority on these interesting insects, we may be permitted to suggest

that his important article be printed also in a European journal of wide circulation, and so become more readily available to many workers in entomology who have not access to the *Peking Natural History Bulletin*.

Egg-laying Habits of Millipedes. H. F. Loomis (*J. Wash. Acad. Sci.*, vol. 23, No. 2, Feb. 1933) describes the egg-laying habits and the larval stages of a millipede, *Arctobolus marginatus*, as observed near Washington, D.C. The chief egg-laying season was in June. The female enclosed each egg in a pellet composed of coarse material containing fragments of rotted wood and leaves. Regurgitated material was formed by the head into a saucer-shaped mass in the centre of which the egg was deposited; the edges of the saucer were then brought up and kneaded together with the help of feet and head to form an almost spherical pellet about 3 mm. in diameter. The walls of these pellets form the first food eaten by the young millipedes, each pellet containing enough food to last through three of the early stages of growth. The egg is about 1.3 mm. in the longest and 1.1 mm. in the shortest diameter. The first two larval stages are passed in the pellet; the third larval stage eats its way out when nearing the third moult, about five or six weeks after the egg was laid. The first stage larva is a short white grub with short antennæ, soft mouth parts, six well-formed segments followed by a swollen region terminating in an anal segment. On the first three segments small paired tubercles are present where legs will develop at the first moult. In the second stage three pairs of legs are well formed, each leg having six segments and a terminal claw. In the third stage 21 segments are present, each of the first five with a single pair of legs, the sixth with two pairs of legs, but the succeeding segments are still apodous. When nearing the end of this stage the larva ate its way out of the pellet. The fourth stage larva has 26 or 27 segments; the first five of these bear each one pair of legs, the next fifteen or sixteen have two pairs and the last six are legless. In this stage the second segment is extending forwards below the first. Three more stages were passed through before mature individuals were produced.

Forest Flora of Kashmir. The great progress in forestry research work which has taken place in India during the present century has made possible the preparation and publication of brochures confined to information collected for an individual province only. Forest Bulletin No. 80 (Botany Series: Govt. of India Central Press, Calcutta, 1933) is entitled "List of Trees and Shrubs of the Kashmir and Jammu Forest Circles, Jammu and Kashmir State", prepared by Mr. W. J. Lambert of the Indian Forest Service. This brochure comprises a list or index of all the trees and shrubs noted by the author during a stay of five years in the State, with the localities in which they occur. The author does not pretend that the list is complete and his object was to enable members of the Kashmir State Forest Department to make better use of Parker's "Forest Flora for the Punjab with Hazara and Delhi". The area covered by the latter flora bounds the Kashmir and Jammu forest circles in which the author served. Mr. Lambert's list is based on the second edition, 1924, of Parker's "Flora" to which a few species not in the "Flora", but occurring in the region under consideration, have been added. As the author had no jurisdiction in the

frontier districts of Gilgit and Ladakh and had never visited them, they are excluded from the area dealt with in the bulletin. In some respects this is a pity, and it may be hoped that in a future edition of this little work some officer acquainted with the forest flora of these districts will be able to contribute a list of the existing woody plants.

Discharges of the Nile. Measurements of the Nile discharges began at the end of last century, and have been taken continuously at the Assuan barrage since 1902. At earlier dates less accurate measurements by means of floats were taken. By 1912 permanent discharge sites had been established at important points and these have been steadily increased in number since, except for some interruption during the War. Since 1923 the most important tributaries also have been regularly measured. The instrument used is the Price current meter and the velocity at half depth is measured at about twenty points evenly spaced so far as possible across the river. The mean velocity is then taken as 0.96 times the half depth velocity. A number of discharges have also been measured by observing the velocity at various depths at each point. It is calculated that the probable error of a single discharge measurement is about five per cent. The observations at some fifty stations from the sources to Wasta are given in "The Nile Basin", vol. 2, by H. E. Hurst and P. Phillips (Government Press, Cairo, 1932. 50 piastres).

Thermal History of the Earth. In a lecture delivered at Washington last year and now published (*J. Wash. Acad. Sciences*, April 15, 1933, pp. 169-195), Prof. Arthur Holmes systematically reviews the physical assumptions involved in each of the current hypotheses concerned with the earth's thermal history. The distribution of radioactivity below the crust being unknown, two alternative possibilities are considered: *A*, that the interior is so nearly free from radioactivity that the earth can have cooled down as visualised in the contraction hypothesis; or *B*, that the radioactivity of the interior is in excess of this extreme limit. The relations of the downward temperature gradients corresponding to the rise of freezing point with pressure and the minimum rise necessary to permit convection determine whether crystallisation begins (*I*), at the bottom of the substratum or (*II*), near the top, at the base of the crust. Combining the two possibilities (*I*) and (*II*) with *A* and *B*, four different hypotheses are arrived at. *AI* and *AII* provide the physical conditions for alternative forms of the *thermal contraction hypothesis*. Both are rejected on the grounds that earth movements and rates of denudation and sedimentation have accelerated since Pre-Cambrian time. *BI* gives conditions appropriate to the requirements of Joly's *hypothesis of thermal cycles* which is also adversely criticised. *BII* supplies the conditions for the *hypothesis of sub-crustal convection-currents* which is regarded as consistent with a wide range of geological and geophysical data, though it is clearly recognised that it still remains an unproved speculation.

Noise Reduction. *Bulletin No. 14* of the Building Research Board of the Department of Scientific and Industrial Research is devoted to a summary by Messrs. H. Bagenal and P. W. Barnett of the means which have been found most effective in reducing noise in buildings, and will be much appreciated by

architects and others who have to deal with the problem of securing quiet. Modern methods of construction do not permit massive walls and partitions, which are the best means of securing sound insulation, and our knowledge of the insulating properties of lighter structures is still restricted. Attic rooms, protected by a parapet on the street side, of a building are comparatively quiet while rooms just below the cornice are generally noisier than ground-floor rooms. Holes in walls should be avoided and the walls themselves should be non-homogeneous or, if possible, of two separate parts. Double glazing of windows on the street side should consist of dissimilar glasses and if possible in separate frames. Machinery equipment should be silent running and be mounted on rubber or cork. A table of sound reductions effected by walls and floors of more than 120 forms with drawings is collected from the published papers of testing authorities in Great Britain and in the United States.

Some Properties of pure $\text{H}^2\text{H}^2\text{O}$. In a communication on the properties of water containing the heavier hydrogen isotope H^2 , G. N. Lewis and R. T. MacDonald (*J. Amer. Chem. Soc.*, July; see also NATURE,

130, 371, Sept. 3, 1932; 131, 590, April 22, 1933) report that they have obtained in one series of electrolyses a quantity of 0.3 c.c. of water in which the proportion of hydrogen as H^2 is calculated as more than 99 per cent. The specific gravity was found to be 1.1059 as against 1.111 calculated for pure $\text{H}^2\text{H}^2\text{O}$, assuming the same molecular volume as for pure water. Further electrolysis until only 0.12 c.c. remained yielded a liquid of density 1.1053, so that it is assumed that electrolysis had been conducted to constant density, which is taken provisionally as 1.1056 at 25° for pure $\text{H}^2\text{H}^2\text{O}$. The sample is regarded as containing not more than 0.01 per cent of hydrogen as H^1 . The freezing point is $+3.8^\circ$ and the normal boiling point 101.42° . The vapour pressure curve indicates that the heat of evaporation is 259 ± 4 gm.cal. per mole greater than that of ordinary water. The determination of the coefficient of expansion showed a temperature of maximum density at about 11.6° . In the various respects in which water is said to be an abnormal liquid, $\text{H}^2\text{H}^2\text{O}$ seems to be more abnormal, but the differences between the two become smaller with rising temperature.

Astronomical Topics

White Spot on Saturn. It is only at long intervals that any markings are seen on Saturn of a character suitable for the determination of rotation-period; hence advantage should be taken of the opportunity afforded by the appearance of a white spot on the equatorial zone. It was detected on August 3 at $22^{\text{h}} 30^{\text{m}}$ U.T. by Mr. William T. Hay at Norbury, having just passed the central meridian. He immediately telephoned to Dr. W. H. Steavenson at West Norwood, who verified the discovery, and noted that the spot was elliptical in outline, and extended in latitude from the south edge of the North Equatorial belt to the projection of the crape ring. The accepted period of rotation for the equator is $10\frac{1}{4}$ hours, so that seven rotations are equal to 3 days less $\frac{1}{4}$ hour; the following are approximate dates of crossing the central meridian:

Aug. 12	1^{h}	and	$21\frac{1}{4}$
15	$0\frac{3}{4}$	and	$21\frac{1}{4}$
18	$0\frac{1}{2}$	and	21
21	$0\frac{1}{4}$	and	$20\frac{3}{4}$
24	0	and	$20\frac{1}{2}$

Observation in Astronomy. The inaugural lecture of the new Savilian professor of astronomy in the University of Oxford, Prof. H. H. Plaskett, entitled "Observation in Astronomy" (see NATURE, May 6, p. 648) has recently been published (Oxford: Clarendon Press; London: Oxford University Press, 1933. 2s. net.) Prof. Plaskett pointed out that in all ages there have been advocates of the two methods, the observational and the theoretical, of making progress in astronomy. The accurate observations of Tycho Brahe afforded the means of deducing Kepler's laws, which were a step in Newton's discovery of gravitation. To a great extent, Sir William Herschel anticipated modern methods and results. His picture of island universes was very like the modern views on the spiral nebulae, differing only in the adoption of a considerably smaller scale of distances. On this point Prof. Plaskett said the present distances should be received with some caution; he referred to van

Maanen's internal motions in the spirals, which, if verified, would involve much smaller distances.

As a fine piece of purely theoretical work, Prof. Plaskett referred to the results that had been obtained as to the conditions in the interior of stars; regions which will probably never be accessible to direct observation. He then paid a tribute (as Prof. Pio Emanuelli had also done recently) to the value of Sir Norman Lockyer's early spectroscopic work, which led ultimately to the isolation of helium, a gas of transcendent importance in stellar physics. Lockyer's conclusions as to stars of rising and falling temperature did not receive much attention at the time, but were afterwards revived by Prof. H. N. Russell from work on different lines from Lockyer's.

Prof. Plaskett paid a tribute to the energy of his predecessor, the late Prof. H. H. Turner, who in spite of the rather poor weather conditions at Oxford completed his section of the astrophysical catalogue at an early date. He also made the welcome announcement that Congregation had sanctioned the expenditure of £2,400 for a new solar telescope and spectrograph. Work on the sun is less affected by poor skies than work on faint stars.

Occultation of Regulus on April 6. *L'Astronomie* for June contains an interesting photograph of this phenomenon, taken at the Flammarion Observatory, Juvisy, by M. F. Quénnisset. The moon was kept stationary on the plate by hand-guiding, so that there are a series of images of the star on both sides of the moon; the nearest to the moon were exposed $1\frac{3}{4}$ minutes before immersion and 3 minutes after emersion. The phenomenon was observed visually with another telescope. Both phases were absolutely instantaneous, and the bluish-white light of the star contrasted with the yellowish light of the moon.

The clearness of the sky and the sensitivity of the plate are shown by the fact that the earth-lit portion of the moon was photographed, though the moon was nearly four days after first quarter. The sun-illuminated part is much over-exposed, but faint traces of the *maria* can be seen, also craters near the terminator.

Jubilee of Prof. A. d'Arsonval

A GREAT gathering took place on May 27, under the presidency of M. de Monzie, Minister for Education in France, to celebrate the jubilee of the appointment of Prof. Arsène d'Arsonval to a professorial chair. The celebration was arranged by the Society "La Renaissance Française". A representative committee was appointed to arrange the celebration, and the meeting at the Sorbonne, in the presence of the President of the Republic, M. Albert Lebrun, was very impressive. A medal struck for the occasion (Fig. 1) was presented to Prof. d'Arsonval. Speeches were delivered by M. Armbruster, president of the Renaissance Française, by Prof. P. Langevin, by Dr. George Claude of the Paris Academy of Sciences, Prof. d'Arsonval's pupil and dear friend (his "best discovery" as he called him in his reply), by Dr. Belot and by others.

Half a century of professorial work, of unfaltering zeal in laboratory research, developing new instruments and adapting old methods, improving industrial processes and transforming medical diagnoses into precise numerical data—such are the main lines of a life devoted to work for the benefit of humanity. Prof. d'Arsonval studied medicine, and having finished his studies went, at the age of twenty-three years, in 1873, to the laboratory of Claude Bernard at the Collège de France. The very first lecture he attended decided the young man to devote himself to experimental medicine. Claude Bernard's insight enabled him to appreciate the possibilities of the young man, and six months later he appointed him as his assistant. The collaboration was a success and in 1881 d'Arsonval was elected to deliver Brown-Séquard's lectures.

D'Arsonval is a specialist who has never restricted his knowledge to a narrow field. The rôle of physical agencies in life-processes was scarcely known and he took from physics everything that could help in biology. Fifty years ago he knew "electricity to be the most perfect and most sensitive method in physiological research" and this was the reason why

he persisted in "improving this precious method to make it pass from the laboratory to clinical research". Thus he used electricity not only to inquire into the working of the animal body but also to provide treatment for it when its normal working was disturbed. He created thermal, mechanical and optical instruments for examination and measurements of the physical manifestations of life. Thus d'Arsonval has become the father of modern therapeutics. D'Arsonval's galvanometer, with the moving coil system and a permanent magnet excluding the effect of external magnetic fields, is well known in England



FIG. 1.

as the Ayrton-Mather type. His temperature and pressure regulators facilitated the work of Pasteur and have served as models for the pressure-reducing valve, used in the compressed gas industry.

All d'Arsonval's activity has been centred in the Collège de France. Besides Claude Bernard, he learned much from Marey and Brown-Séquard. He met also J. Bertrand, Berthelot, Renan, Pasteur, and some of the younger generation still at work: Marcel Brillouin, Alfred Lacroix, Matignon, Charles Richet, Emile Roux. In his reply to the speeches of congratulation, Prof. d'Arsonval said that he owes his development to this centre and especially to one man—Claude Bernard.

Blowflies

OF the hundreds of flies that are encountered daily, few are so well known as the blowflies. Everywhere they are known by their association with carrion. Were they specific in their choice of carrion as food, they would not be the subject of critical research of an army of highly qualified entomologists and veterinary officers scattered throughout the world. It is as a serious menace to sheep and to the wool and the meat industries that blowflies demand most careful study. What then has caused their attack upon *live* animals? Have they changed their habits? A negative answer to this question is but one of the many interesting and valuable contributions in a recent report on "The Sheep Blowfly Problem in Australia" edited by Dr. R. J. Tillyard and Dr. H. R. Seddon.*

The report is that of the Special Joint Committee

*Council for Scientific and Industrial Research. Pamphlet No. 37 (New South Wales Department of Agriculture, Science Bulletin No. 40): The Sheep Blowfly Problem in Australia. By the Blowfly Committee. Pp. 136+6 plates. (Melbourne: H. J. Green, 1933.) 1s. 6d.

of the Council of Scientific and Industrial Research and the Department of Agriculture, New South Wales, which has been appointed to co-ordinate the activities of the several research workers—entomologists, veterinary officers, biochemists, bacteriologists—engaged on the problem in Australia. It expresses the view that the extension of 'blowfly strikes' among merino sheep is largely, if not entirely, due to the breeding of a more susceptible type of merino sheep, and to the accidental introduction and spread of species of fly of the genus *Lucilia*. Two species of *Lucilia* are classed as 'primary' in attack; one, *Lucilia sericata*, Meig. is, universally, a primary species in sheep blowfly attack; the other, *Lucilia cuprina*, Wied—almost indistinguishable from the foregoing—is responsible for most cases of primary strike in Australia. The problem, however, is not confined to these two flies, for no less than fifteen species are involved. They are grouped as either 'primary' (six), 'secondary' (four) or 'tertiary' (five) in attack.

That a solution to the blowfly problem is

urgently needed is apparent to all acquainted with the situation. To mention that blowflies live so long as three months; they can fly at least ten miles; and a single female can produce 2,000 eggs during its life-time, is but to touch the fringe of the problem. The factor, or factors, which cause initial attraction of blowflies to sheep is a question ever confronting those in search of a solution to the problem. "There is evidence," says the report, "that bacterial activity is an important factor predisposing to blowfly attack". This view clearly opens up new avenues of approach in the control of these pests. Particularly significant is the discovery that susceptibility to blowfly attack is an inherent character among merino sheep. "It may be quite definitely stated," continues the report, "that sheep are not struck simply by chance, for the more the subject is studied the stronger becomes the conviction that there must be a definite susceptibility on the part of the sheep and that the liability to strike is fundamentally dependent upon some factor in the sheep itself. . . . Susceptibility in the great majority of cases is primarily due to some inherited character of the individual sheep." The inherent characters, such as conformation of the body, wrinkling of the skin, condition of the wool, are sufficiently apparent to make it possible to group the members of a Merino flock into 'relatively insusceptible', 'moderately susceptible'

and 'definitely susceptible' according to their predisposition to blowfly attack.

A real advance has been made by demonstrating that by systematic and selective breeding from sheep in these groups the degree of susceptibility to attack may be markedly reduced. Sheep-owners, particularly of the Merino sheep, will await with particular interest the developments of this line of work. Meanwhile, the report offers much by way of recommendation for direct measures of control. Biological methods, through the introduction of parasites, unfortunately hold out little promise of success. It is recognised, also, that so far as direct measures are concerned, the blowfly pest cannot be combated by any one method alone. The recommendations, therefore, include:—crutching, jetting, surgical operation to remove certain body folds, and systematic trapping of flies with meat rendered attractive for a longer period by special treatment. Finally, when sheep are attacked, the following dressings receive special mention: (a) 5 per cent aqueous solution of zinc sulphate, (b) 5 per cent aqueous solution of 'Monsol', (c) 4 per cent phenol crystals in whale oil.

The report is not only a valuable contribution to the sheep blowfly problem in Australia but will also be welcomed by workers in other countries for its suggestions of methods of approach to the problem as a whole.

W. M. D.

Natural Woodlands of Great Britain and Ireland

A SMALL brochure has been issued by the Department of Forestry, Oxford, at the instance of Prof. Troup, entitled "The Natural Woodlands of Britain and Ireland" by Dr. Mark L. Anderson, at the time sylvicultural research officer at the Imperial Forestry Institute (Holywell Press, Oxford, 1932). In a preface, Dr. Anderson states that though detailed information exists on this subject in certain parts of the country he had to draw to some extent on his own experience, which, it may be added, is extensive, in order that the general survey should cover the whole of the British Isles. The second part of the work, for which the author assumes entire responsibility, sets forth a classification of waste-land communities, with the view of facilitating choice of tree species in afforestation work.

In his opening remarks, the author points out the difficulty of the study of climax forests in Great Britain and Ireland owing to the widespread destruction of woodlands through the march of agriculture, the spread of the rabbit, and the extensive demand for timber. After indicating the chief and subordinate and indigenous tree species of the British Isles and the more important of the imported trees, the author states that climate and soil have been the main determining factors in deciding the ranges of the various communities. Owing to the wide variation in topography, in geology and soil conditions, which are so marked when contrasted with other and extensive parts of the British Empire, soil must be regarded as of at least equal importance as climate.

The classification of natural woodlands adopted by the author is mainly based on "The Woodlands of England" by Moss, Rankin and Tansley, with the addition of a few communities which are more typically Scottish.

Fifteen main communities have been established, as follows: (1) beechwood association; (2) ashwood

community; (3) Ash-alder community; (4) ash-birch community; (5) ash-oakwood community; (6) alder-willow community; (7) moist oakwood association; (8) dry oakwood communities; (9) oak-birch community; (10) alder-birch community; (11) Scots pine communities; (12) Scots pine-birch community; (13) birch-rowan community; (14) birch-aspen community; (15) birchwood communities.

Of these, the beechwood association has been fairly well studied, the oakwood communities to a lesser extent. The observations on the rest are based on scattered recorded statements and on the author's extensive personal experience.

The second part of the brochure, based, as the author tells us, on his own research work, is entitled "Classification of Waste Land Types". Dr. Anderson points out that during recent years it has become customary to make considerable use of plant communities, found on bare or waste land which is to be afforested, as indicators of the suitability or otherwise of the site for various tree species. Considerable confusion has arisen owing to the fact that the work of numbers of observers has been confined to comparatively restricted localities with the consequent enumeration of too extensive a number of local communities. The author attempts to deal with this matter on broader lines. The term 'waste land' is explained as meaning any land available for tree planting which has been devoid of a crop of trees for many years or which has never carried such a crop. In examining, with the view of making use of the vegetation on such an area, a necessary warning is rightly given. Amongst other factors, for example, plant communities will be markedly affected on areas subject to grazing animals (especially sheep and rabbits), moor burning (grouse moors) and other factors. Dr. Anderson recognises five arbitrary degrees of soil fertility, each of the five being further

sub-divided into three sub-classes based on the supply of moisture available in the soil under normal summer conditions. These sub-classes are termed dry, moist and wet. A combination of these groupings gives a series of fifteen site classes which are named after the predominant plant species which normally occur upon them. He admits that it might be possible to recognise more than five fertility classes but considers that from the forestry point of view no great advantage would be obtained.

After detailing his table of waste-land communities based on his five fertility classes, the author then discusses each in turn, winding up with a useful table of tree species capable of being used on each, indicating the species which are storm-resistant and frost-hardy as compared with the more tender species in these respects. A curious omission in the table is that of the hornbeam, a tree with similar sylvicultural characteristics to the beech, and replacing it in frosty areas.

Sex-Distribution in *Thalictrum*

DR. ECKHARD KUHN gives an interesting summary of his recent observations upon the occurrence and behaviour of flowers of different sexes in two North American species of *Thalictrum* in *Die Naturwissenschaften* of May 12, 1933.

In *Th. polygamum*, two types of individuals are found growing together, plants with male flowers only and plants which, apart from an occasional flower in the highest order of the inflorescence branch system bearing only stamens, are typically bisexual. The study of a large number of plants showed conclusively that in the male flowers the number of stamens is much larger than in the bisexual flowers, an average of 38-40 compared to 11-12, the frequency curves for the two types practically not overlapping at all. The conclusion would seem to be that the bisexual flowers are to be interpreted as at a stage in the reduction of the androecium on the way to the production of purely female flowers. In the other species studied, *Th. dasycarpum*, the two types of individuals found bear either male flowers or female flowers, though in the latter individuals occasional flowers carry from one to three stamens, sometimes fertile and sometimes in various stages of degeneration.

When the attempt is made to self-pollinate the bisexual flowers of *Th. polygamum* or to cross them with the pollen from the stamens of other bisexual individuals, the yield of seed is very poor, contrasting

with a hundred per cent yield of seed when the pollen of male flowers is employed. This led to a further study of the anthers of the bisexual flowers. Their development appears perfectly normal and the full complement of pollen is present, though with a greater variation in size of the grains than in the male flowers. These pollen grains almost fail to germinate in a cane-sugar agar in which the pollen from the male flowers germinates freely. With this difference in behaviour is correlated an extraordinary difference in the structure of the extine, which shows nine of the usual germ pores in the germinating pollen and none at all in the pollen from the bisexual flowers; in the latter, on the rare occasions when pollen tubes were seen, their emergence was preceded by an elongation of the grain and a consequent bursting of the extine.

In *Th. dasycarpum* the pollen grains from the occasional fertile stamens are similarly free from germ pores. This may be the main factor responsible for a certain physiological further sex differentiation in the flowers of *Th. polygamum*, which superficially are male and bisexual, but behave almost as male and female flowers. On the other hand, genetic factors may be responsible for a still further sterility of the pollen of the hermaphrodite flowers, as in many cases a degeneration of the generative cell has been noted after the original single nucleus of the grain has divided.

Disintegration of Atoms by Protons

M. L. E. OLIPHANT and Lord Rutherford (*Proc. Roy. Soc., A*, July) have made a more detailed examination of the disintegration of atoms by protons first observed by Cockcroft and Walton.

The voltages employed were lower than in Cockcroft and Walton's experiments, but the proton streams were much more concentrated. A discharge tube of a special form gave a powerful beam of protons mixed with hydrogen molecular ions. The beam was accelerated by a potential difference of 20,000-200,000 volts and was passed through a magnetic field. The analysed beam then fell on a target which could readily be exchanged for one of a different material.

The efficiency of disintegration was studied as a function of voltage for a thin film of lithium; disintegration was observed at 40 kv. and the efficiency rose less rapidly than an exponential curve at higher voltages. The further discussion of this function is deferred until higher voltages have been used, but the results are not in disagreement with Gamow's theory. Experiments with the molecular ions gave the expected result that these behaved like a pair of protons lightly bound together. Disintegrations were

investigated with boron and fluorine. No disintegrations were observed with iron, oxygen, sodium, aluminium, or the heavy elements, gold, lead, bismuth, thallium, uranium or thorium. The disintegrations reported by Cockcroft and Walton from uranium seem to have been due to contamination with a light element; Oliphant and Rutherford have experienced strong contamination with boron from pyrex glass.

Oliphant and Rutherford assume that the disintegration of boron (B^{11}) occurs by splitting into three α -particles after absorption of a proton. The most probable mode of disintegration is supposed to be for the three α -particles to escape symmetrically with equal velocities, the probability of other modes diminishing with departure from the symmetrical condition. On this basis, they calculate a range distribution curve for the emitted particles which is in agreement with the curve observed. On this interpretation of the range curve, the energy which becomes available in disintegration is about 9 million volts, while the energy calculated from the masses of the particles is 11 million volts. It is hoped to examine this point later in more detail.

University and Educational Intelligence

LEEDS.—The Cartwright Holmes scholarship, which enables a student to take a three or four years' course of study in gas engineering, has been awarded to Richard G. Parker of Plymouth, at present junior technical assistant with the Plymouth and Stonehouse Gas Light and Coke Co. The Corbet Woodall scholarship for a similar study has been awarded to J. Castle, at present junior technical assistant in the Brighouse Corporation Gas Department.

LONDON.—Mr. Alastair Graham, since 1932, lecturer in zoology in the University of Sheffield, has been appointed to the University readership in zoology tenable at Birkbeck College.

OXFORD.—Dr. W. J. Arkell has been elected to a senior research fellowship at New College. He has been lecturer in geology at the College since 1929.

MR. J. G. LAWN, consulting engineer in England to the Johannesburg Consolidated Investment Co., Ltd., and formerly principal and professor of mining in the South African School of Mines and Technology, now the University of the Witwatersrand, has had conferred upon him the honorary degree of doctor of science of the University.

THE following awards, among others, for the year 1933-1934 have been made by the Salters' Institute of Industrial Chemistry: fellowships renewed to: S. C. Britton, Pembroke College, Cambridge, E. H. T. Hoblyn, Imperial College of Science and Technology, G. Pearce, University of Birmingham, and P. Chisholm Young, Trinity College, Cambridge; fellowships awarded to: N. S. Kelland, St. John's College, Oxford, J. D. Rose, Jesus College, Oxford, F. C. Storrs, Chelsea Polytechnic and University College, London, C. W. Woolgar, King's College, London. The Salters' Institute has also awarded one hundred and ten grants-in-aid to young men and women employed in chemical works, to facilitate their further studies.

THE dissertations of the University of Cambridge approved for the Ph.D., M.Sc. and M.Litt. degrees for the academical year 1931-32, seventy-four in all, are summarised in abstracts, officially approved, and recently published in pamphlet form by the University Registry. The abstracts, varying in length between 200 and 700 words, are arranged in order of faculties. Physics (12), chemistry (10), biology (17), agriculture (7), geology (4), engineering (3) and mathematics (4) account for more than three-fourths of the total number, the remaining seventeen being distributed between English (4), modern and medieval languages (5), oriental (1), history (3), law (1), divinity (1) and moral science (2). Dissertations by members of the Cambridge women's colleges number ten, as follows: in botany 2, geology 2, English 2, history 2, modern and medieval languages 2. The world-wide reputation of Cambridge as a centre for advanced study is reflected in the following analysis: of the 74 candidates, 41 were graduates of other universities—in England and Wales 14, Scotland 6, Australia 9, other Dominions 6, India 1, Denmark 1, Germany 1, United States 2; in physics,

half were from Australia (4) and Canada (2); in biology, 11 out of 17 were graduates of other universities and 4 came from overseas.

THE United States Department of the Interior receives annually from its Commissioner of Education a report for the fiscal year ending June 30. The report for 1931-32 defines the purpose of the Federal Office of Education, of which the Commissioner is the head, as "to find out facts about education in all its various phases throughout the several States and in foreign countries and to disseminate such facts in order to assist the people in the several States to establish more efficient systems of schools". Referring to the devastation caused by the economic depression, the report deplores the "lack of confidence on the part of governing bodies and the general public in the powers claimed for education in general and the need for governmental participation in education or any social regulation in particular". The Commissioner's own budget has suffered a cut of one third, involving a serious curtailment of the efficiency and normal development of his office. Among new movements mentioned is the establishment of nursery schools, which have increased from three in 1920 to three hundred. Another is the development of physical education along practical lines as by means of camps. Vocational guidance is now quite generally accepted in theory as a function of the public school, and some form of industrial education is commonly included in the school curriculum. In response to a growing demand for research and service in the field of educational tests and measurements, a specialist in this subject has lately been added to the Commissioner's staff. Research in higher education is being systematically fostered by conferences. The Commissioner is very emphatic as to the importance of the contribution the universities can and should make to *social*, as they have in the past to *material*, progress. "It is," he says, "up to the sociologists, the psychologists, the schools of business, political science and other social science departments to help remove the curse of Midas from America."

Calendar of Nature Topics

"The Twelfth"

To-day the shooting of red-grouse and ptarmigan opens for a comparatively short season—until December 10. The natural history significance of the 'twelfth' is that it indicates the period when the young, born in late April or May after a three-weeks' incubation, are sufficiently strong upon the wing to have a reasonable chance of survival, in other words, to afford good sport. Much depends upon the season which has preceded the 'twelfth': in a year such as the present, when neither frost nor wet nor lack of food interfered with the development of the broods from egg-laying onwards, coveys should be both numerous and well-developed on the opening day. Every legal close season, however, implies that the tendency to slaughter is greater than is desirable, and accordingly the length of the close season for grouse has varied according to the supposed needs of the time. Thus in a Scottish Act of 1427, partridges, plovers, black-cock, greyhens, moor-cocks (or red grouse) and "sic fowles" were forbidden to be taken by any manner of instruments "fra the

beginning of Lentron quhil [until] August" under a penalty of 40 shillings; whereas the Act of 1707 prohibited and discharged in all time coming the killing of moor-fowls from March 1 until August 20 inclusive, under a penalty of £20 Scots for each offence, the one half to the discoverer, and the other half to be at the disposal of the Judge. The Act which now regulates the shooting of grouse, ptarmigan and other game birds in Scotland (Act 13, Geo. III, Cap. 54) came into force on June 24, 1773.

Summer Plankton and the Colour of the Sea

Dinoflagellates in the plankton are most abundant during the summer months, and the larger forms, such as *Ceratium* and *Peridinium*, usually attain their maximum numbers in the Clyde sea area in August. Certain peridinians can multiply very rapidly and occasionally become so numerous as to give rise to a 'water-bloom'. The sea is coloured, usually reddish, a strong smell is given off and eventually, if such conditions last, fish, and even shore-living animals, are killed off. Such phenomena are commoner in warm and tropical seas than in British seas, although on one occasion (June 1925) patches of 'red water' were reported from Loch Long and were found to contain enormous numbers (about $2\frac{1}{2}$ million per litre) of *Peridinium triquetra*.

Off the coast of South Africa, 'red water' or 'flower water' may be seen several times during the course of the summer, caused by multitudes of *Noctiluca*. In Japan also a 'red tide', said to be highly destructive to pearl-oyster beds, was found to be caused by the peridinian *Gonyaulax polygramma*. Although the discoloration of the water is usually caused by dinoflagellates, the regular occurrence of 'red water' off the coast of Malabar during the late summer and autumn, is due to swarms of a small euglenid flagellate (Hornell, *Madras Fisheries Bull.*, 11, Rep. 2, 1917). This 'red water' appears every year after the passing of the rainy season if there are a few days of fine sunny weather, and it kills off quantities of fish and crabs. It furnishes the explanation for a curious incident in the siege of Cannanore in 1507. After a long siege the Portuguese garrison were reduced to great straits: "On the 15th August however, a miraculous event occurred, seemingly in answer to the prayers of the besieged to the Queen of Heaven whose feast day it chanced to be, for the sea sent forth shoals of crabs and prawns and the garrison again lived in plenty."

'Red water' off the coast of California has been seen to extend so far as 10 miles from shore. When caused by *Prorocentrum micans* (also a peridinian) it was not harmful to fish, but other outbreaks, due to *Gonyaulax polyedra*, were destructive to life (W. E. Allen: *Bull. Scripps Inst.*, 1, No. 15).

Shrimping in California

In August the shrimp catch in San Francisco Bay reaches its maximum of more than half a million pounds weight, but July is almost as prolific; the poorest catches, in a year's total of 2,687,831 pounds (as in 1930), are made in March, April and May. The bulk of the commercial catch is made up of species of *Crago*, but little appears to be known concerning their life-history. Eggs may be found attached to the swimmerettes of the females throughout the whole year, and they contain development stages up to individuals nearly through the zoea

stage. There are no records of young shrimps being taken with the catches. (Paul Bonnet, *Fish Bull.* No. 38, Division of Fish and Game of California.)

The apparatus employed in the fishery may be a cone-shaped Chinese shrimp net, 40 ft. long, or a shrimp trawl of the beam type. The latter takes few species other than the shrimps, but the former catches many different species of immature fish, so that the unrestricted use of the Chinese net gave rise to much controversy and led to the imposition, for a period, of a close season, and to other attempts at controlling its use. Some of the catch is eaten fresh but a large proportion is dried and used as shrimp meat for food or as shrimp meal, consisting of broken and ground shells and meal, for fertiliser and fish food. A considerable amount of the dried meat is exported to China.

Eddies as Factors in Distribution

The occurrence of a moderate flood in small rivers, such as that following a summer thunderstorm, offers an opportunity for observing the distributing action of eddies on the fauna and flora gathered in masses of surface flotsam.

In a case recently seen, a mass of flotsam 4 ft. in diameter swept downstream until drawn into an eddy near the right bank. Here it broke up and was distributed over a circular area approximately 20 ft. in diameter. Presently it reformed into three equal masses, one of which was thrown out of the eddy and remained lodged against the bank. The others were thrown into the main current, which carried them downstream some 300 yds. when they were again caught up by an eddy towards the left bank. Here a similar dispersal and reforming took place, and a single, much-reduced mass was eventually thrown out. This was caught by an eddy half a mile farther along and completely dispersed.

Investigation of the mass driven against the bank showed, in addition to sticks and straws, pieces of the plants *Myriophyllum* sp., *Callitriche* sp., and *Ranunculus* spp; various algae; immature stages of the insects *Simulium*, *Chironomus*, *Bætis* and *Ephemera*; imagines of *Simulium* spp., *Scatophaga* sp., and *Hydropsyche pellucidula*.

Combine Harvesting

A century ago four workers were required to reap, tie, and shock an acre of corn in a day, and the same staff would be occupied for another day in threshing the grain by flail. The combine harvester, with its personnel of skilled workmen, will now do the same work in less than an hour. The harvester-thresher has been used for years in the great grain-producing areas; but it was thought that the method was not practicable in the treacherous harvesting weather of Great Britain. The provision of large-capacity drying plants capable of reducing the water-content of the freshly harvested grain to a safe figure has brought combine harvesting within the scheme of British farming. The standard operations of binding, shocking, carting, and stacking are eliminated. Threshing, which when done in the ordinary way requires a staff of about ten men, is carried out with equal speed as the machine travels round the field. Last year 4,400 acres were dealt with in this way. Clean crops growing not too much straw and standing well and ripe to harvest all favour the new procedure, when about 12 quarters of threshed grain per hour is a good performance for a machine.

Societies and Academies

PARIS

Academy of Sciences, June 26 (*C.R.*, 196, pp. 1933-2062).—D'ARSONVAL: A generator of electrical impulses working at three million volts. Description of an apparatus installed at Ivry in the Ampère Laboratory giving with 3,000,000 volts a 4-metre spark. L. BLARINGHEM: The habitus, or biological individuality of the hybrids of *Hemerocallis* (*H. flava* and *H. fulva*). E. L. BOUVIER: The heterocere moths of the Lonomiæ tribe, terminal group of the family of the Hemileucidæ. ALBERT EINSTEIN was elected a foreign associate in the place of the late A. Michelson. EDGAR BATICLE: The problem of distribution. V. FOCK and N. MUSCHELSVILI: The equivalence of two methods of reduction of the biharmonic plane problem to an integral equation. JULIUS WOLFF: The integral of a holomorph function with real positive part. RAPHAEL SALEM: A property of certain Fourier series. ALEXANDRE GHICA: The prolongation of uniform monogenous functions. JEAN LOUIS DESTOUCHES: Two peculiarities of mechanics in space of wave functions (ψ); (1) Hamilton's principle in point mechanics (ψ); (2) the bases of the method of hyperquantification. ALEXANDRE FAVRE: Hydrodynamic movement in a flat tunnel. The measurement of velocities, periodicities. EDMUND BRUN: The heating of cylindrical bodies in rapid displacement in air. The measurement of the coefficient of thermal exchange between these bodies and the air. A. LAFAY: An effect attributable to turbulence. P. LEJAY and G. COSTES: The use of the gravimeter at a great distance from stations of reference. Application to the establishment of gravity bases in Indo-China. R. GOUDEY: Measurements of gravity made with the Holweck-Lejay apparatus, No. 2. ROBERT ESNAULT-PELTERIE: The application of dimensional analysis to the study of turbulent flow. W. SWIETOSLAWSKI, A. ZMACZYNSKI, I. ZLOTOWSKI, J. USAKIEWICZ and J. SALCEWICZ: An ice calorimeter for measuring very small thermal effects. The apparatus illustrated and described will detect a thermal effect of 3×10^{-5} to 1×10^{-5} cal. per gm. per hour. It is specially designed for the measurement of minute thermal effects produced by continuous phenomena. MLE. M. CHENOT: The high frequency discharge. W. J. DE HAAS, E. C. WIERSMA and H. A. KRAMERS: A method of obtaining an extremely low temperature by the adiabatic demagnetisation of a salt of a rare earth. A tube containing cerium fluoride (CeF_3), placed in a magnetic field of 30 kilogauss, was cooled in a bath of liquid helium to 1.26°K . By the sudden reduction of the magnetic field to 2.5 kilogauss the temperature was reduced to 0.2°K . A. COTTON: Remarks on the preceding communication. The author points out that the theory of paramagnetism published by Langevin in 1905 predicted changes of temperature accompanying magnetisation or demagnetisation of paramagnetic substances. A. D'ARSONVAL: Remarks on the same subject. ST. PROCOPIU: The magnetisation of iron by the superposition of an alternating field on a constant magnetic field. D. CHALONGE and E. VASSY: Comparison between the blue and violet spectra of the molecule of hydrogen. MICHEL MAGAT: Two new Raman bands of water. PAUL MARÉCHAL: Comparison of the transparency band of metallic silver and of colloidal silver. By quantitative photographic photo-

metry it is shown that two different preparations of colloidal silver and metallic silver deposited on quartz by cathode projection give the same absorption for light of various wave-lengths. R. SIKSNA: Two new resonance series in the vapour of antimony. G. REBOUL: The emission of a very soft radiation by electrified insulators. G. DÉCHÈNE: The study in a vacuum spectrograph of the radiation of semiconducting cells. PAUL SOLEILLET: Photometry of the fluorescence of a jet of cadmium atoms. The mean duration of life of the state 2^3P_1 . MLE. R. MACAIGNE: Study of the absorption of the β -rays by a photographic method. The photographic plate and the ionisation chamber both show the total effect of the radiation studied. PIERRE GIRARD and P. ABADIE: The structure of the molecules of the polyalcohols, as shown by their dispersion and absorption in the Hertzian range. Molecular associations. VICTOR LOMBARD and CHARLES EICHNER: The diffusion of hydrogen through palladium. The influence of pressure, temperature and the state of purity of the metal. A. PORTEVIN, P. BASTIEN and M. BONNOT: Remarks on the study of the corrosion of metals and the corrosion of various magnesium alloys. E. HERZOG and G. CHAUDRON: Resistance of certain aluminium-magnesium alloys to corrosion by sea water. PICON: The zirconium sulphides. The preparation and properties of three zirconium sulphides are described, of composition Zr_3S_5 , Zr_2S_3 , and ZrS_2 . L. DEBUCQUET and L. VELUZ: The microdetermination of magnesium as the triple ferrocyanide of magnesium, calcium and hexamethylenetetramine. Quantities of magnesium of the order of 0.1 mgm. can be determined by this method with an error of less than 5 per cent. F. EVARD: The organic molecular combinations of titanium tetrachloride. R. E. BREUIL: Complex compounds of ethylenediamine with the ferrous halides. MARCEL GODCHOT, MAX MOUSSERON and ROBERT GRANGER: The preparation of aminocyclooctanols and their resolution into active compounds. MARCU ROTBART: Some new ether oxide acetals and aldehydes. HENRI BRASSEUR: The structure of the crystallised platino-cyanides. FRANCIS RUELLAN: Two ancient marine levels in the region of Perros-Guirec (Côtes-du-Nord). LOUIS EMBERGER: The botanical exploration of the Sagho (Morocco). W. A. BECKER: The application of vital coloration to the study of cytodieresis. L. MAUME and A. BOUAT: Zones of stability as a function of the pH of various copper compounds of a Burgundy mixture. EMILE SAILLARD and R. SAUNIER: The determination of the ash of molasses by the electrical conductivity. P. VIGNON: The base of the wing in insects. Pseudocostal and transverse formations. J. LEFÈVRE and A. AUGUET: The thermo-regulation of work. Relation of its curves with those of rest. RAOUL LECOQ: The evolution of total B avitaminosis in the pigeon in its relations with the digestibility and nature of proteids in its food. N. BEZSSONOFF and A. DELIRE: The colour reactions of vitamin C. A discussion as to how far the decolorisation of dichlorophenolindophenol can be regarded as a specific reaction for vitamin C. G. DELAMARE: The primary sinusoids with equal loops of the body of the Spirochetes. R. TURPIN and A. CARATZALI: Conclusions from a genetic study of the folded tongue.

CAPE TOWN

Royal Society of South Africa, April 19. E. NEWBERRY and S. M. NAUDÉ: Electrolytic refining of mercury.

A mercurous perchlorate electrolyte is used with a cathode of pure mercury, an E.M.F. of 0.5 volts and a current density of about 1 ampere per sq. decimetre. Two types of apparatus are described for use with, and without, mechanical stirring respectively. The chief difficulty encountered lies in the formation of crusts of solid salt over the exposed surface of the anode. Spectroscopic examination of the product indicates that a high standard of purity is obtained. M. R. LEVYNS: The appearance and spread of a *Senecio* rare to the Cape Peninsula. This species is much like *S. pterophorus*, a species common in the eastern parts of South Africa, and may be that species brought to the Cape Peninsula by human agency. However, it is extremely variable and gradually merges into *S. rigidus* h. on one hand and *S. rosmarinifolius* h.f. on the other, and the possibility of hybrid origin cannot be disregarded. Both putative parents occur in localities where the new *Senecio* is established.

GENEVA

Society of Physics and Natural History, May 4. H. LAGOTALA: The glacial conglomerates of the western Congo. The conglomerates mark a continental episode. H. PAILLARD and A. DEMOLIS: Researches on the preparation of nonylic acid and its catalytic reduction to aldehyde. A methodical study of the preparation of nonylic acid followed by some attempts at the catalytic reduction by formic acid. G. TIERCY and MAX. BOUET: Note on the sub-Alpine depressions. The authors study the field of pressure the trend of which on the southern slope of the Alps is very characteristic. A hypothesis is examined according to which only the isobaric field of evolution is considered, that is to say, the case of an adiabatic reheating of the masses of air during the descent on the southern slope. The field of displacement is then not inactive. G. TIERCY and A. GROSREY: The width of a photographic stellar spectrum for stars of the spectral type A_0 . The authors establish as for the types A_5 and B_5 , a formula giving the width of a spectrum A_0 as a function of the time of exposure and the magnitude of the star. TH. TOMMASINA: The mode of formation and evolution of the stars which explains their limited duration and the unlimited duration of the universe. The mode of formation of all the stellar systems establishes that they have evolved up to the possession of a maximum of energy and then, going over a curve in the inverse sense, lose their energy and dissipate their matter, up to their complete disappearance. Now it is this dissipation which gives rise to nebulae producing new stars, which continually replace those which disappear. The duration of the universe is certainly unlimited.

ROME

Royal National Academy of the Lincei, Feb. 19. Q. MAJORANA: Action of periodic light on thin metallic laminae. S. CHERUBINO: Pseudo-ordinary transformations on real Abelian varieties. P. CLEMENTE: Majoration of the error in the calculation, by the method of least squares, of the periodic solution of an ordinary linear differential equation of the second order. A. MARONI: Minimum order of the linear series containing partially, without fixed residue, a given complete linear series of an algebraic curve. G. ARBIGHI: The evolve of the surface of the centres of buoyancy. SILVIA MARTIS IN BIDAUI:

Properties of a noteworthy linear functional and its calculation by particular analytical functions. G. CASTAGNERIS: Mechanical reproduction of the flight of winged organisms. Experimental results and their comparison with natural effects. By means of an arrangement described, the mechanical reproduction of the dynamic support possessed by birds and insects has been definitely achieved. The results obtained suffice to form the basis of an effective study of aviation by means of beating wings. E. FROLA: A geometrical representation of the theory of inflected beams. The linear integral equations of the Fredholm type used in the study of inflected beams are, in general, derived from the corresponding differential equations which are deduced from the equation of the elastic line, $[ET(x)y''(x)]'' = -p(x)$. This equation is obtained from the theory of elasticity by making various inaccurate suppositions. A method is now given of deducing the integral equation directly, the only assumption made, besides obvious conditions of continuity and derivability, being the principle of the superposability of effects. G. D. MATTIOLI: Theory of turbulence (2). Analytical consequences and comparison with experiment. C. TAGLIACCOZZO: A statistical criterion for the stability of the elastic equilibrium in solids loaded at a point. A. CICCONE: The Hall effect in beryllium. A slight effect, of positive sign, is observed. CARMELA MANUNTA: Metabolism of fats in the caterpillar of *Galleria mellonella*. The dry matter of the chrysalis contains about 52 per cent of an oil, composed almost entirely of triglycerides of saturated and unsaturated acids. The fats are manufactured, probably in the larva, from the wax taken as food, and a mechanism is suggested for the various stages of this transformation. A. FERRARI and C. COLLA: Importance of the crystalline form in the formation of solid solutions (9). Thermal analysis of the anhydrous systems, $\text{CoCl}_2 - \text{SnCl}_2$ and $\text{FeCl}_2 - \text{SnCl}_2$. Cobalt and ferrous chlorides form rhombohedral crystals and should hence be completely immiscible in the solid state with the rhombic stannous chloride. Thermal analysis of the two binary systems confirms this conclusion. A eutectic is formed in each case at about 240°C ., the content of CoCl_2 being 4 per cent and that of FeCl_2 , 2 per cent. S. SORRENTINO: Tectonics of the Fiori mountain and its relation to the folding of the tertiary; anticlinal of Acquasanta. MARIA MARSIGLIA: Action of ethyl alcohol, phenol, veratrin, strychnine, nicotine, and quinidine applied locally to various regions of the heart of *Bufo vulgaris*. These substances exhibit characteristic effects varying with the position at which they are applied.

SYDNEY

Linnean Society of New South Wales, March 29. C. ANDERSON: The fossil mammals of Australia (presidential address). The first known fossil mammals of Australia were found at the Wellington Caves, New South Wales, where fossil bones were discovered in 1830 by George Ranken, of Kelloshiel, Bathurst. He was joined by Major T. L. (afterwards Sir Thomas) Mitchell and collections of the bones obtained were forwarded to Prof. Robert Jameson, of Edinburgh, and to Baron Cuvier at Paris. By these and other experts it was determined that the animals living in Australia in more recent geological times were mainly marsupials, like those still extant. There were certain large bones, however, which were thought to belong to the hippopotamus or the

elephant. These large bones, however, were those of the *Diprotodon*, the largest known marsupial, living or extinct, which equalled the largest rhinoceros in bulk. It is clear that in recent geological time, the late Tertiary and the Pleistocene of geologists, the mammalian fauna of Australia was characterised by the prevalence of marsupials belonging to various families; some of these were of large size and bizarre structure and are now extinct, others were very similar to still living genera and species. R. J. TILLYARD: The may-flies of the Kosciusko region. (1) Introduction and family Siphonuridae. The Australian fauna of Siphonuridae is shown to be very closely related to that of New Zealand. It consists of three groups of forms, the first characterised by fast, free-swimming nymphs with the gills held laterally, the second by slow, free-swimming nymphs with the gills held dorsally, and the third by sedentary nymphs clinging to rocks in rapids, with deeply cleft gills held vertically. P. BROUGH: The life-history of *Grevillea robusta*, Cunn. The organogeny, development of microsporangium and megasporangium respectively, the gametophyte generations, nectar secretion, endosperm formation and embryology are described in detail. Cross-pollination, self-pollination, fertilisation, seed structure, morphology of the wing, the causes underlying sterility and annual variations in amount of seed crop, and the affinities of the Proteaceae are discussed.

VIENNA

Academy of Sciences, March 2. MAGDALENE HABERFELD: Coloration and decoloration of compressed rock-salt crystals. The absorption spectrum of compressed sodium chloride crystals after radium irradiation, and the changes effected therein in the light and in the dark, have been studied. As was found by Smakula for the uncompressed salt, the separation of an electron from the compressed salt requires approximately one quantum. ROBERT TRATTNER: The Wilson chamber as a counting apparatus for α - and H-rays. The percentage law effective in the Wilson chamber is not only different for α - and H-rays, but also appears to be dependent on the mode of production of the H-rays. GEORG KOLLER and GERHARD PFEIFFER: Umbilicic and ramalic acids. For umbilicic acid obtained from *Gyrophora deusta*, the empirical formula $C_{25}H_{22}O_{10}$ given by Hesse is confirmed. The close relationship of this acid to gyrophoric acid, which occurs in the same lichen and contains one CH_2 group less, is pointed out and modifications in the structural formula previously suggested for umbilicic acid are proposed. RUDOLF WAGNER: The whorl-umbel, a new type of the *Botrytis* system. HANS LIEB and MILOŠ MLADENOVIC: Elemic acid from elemi resin.

March 9. ERNST BEUTEL and ARTUR KUTZELNIGG: Sulphide mirrors. A boiling sodium-lead thiosulphate solution deposits on glass previously etched with dilute stannous chloride solution, an adhesive layer of lead sulphide. When thin (less than about 560 m μ), the layer transmits reddish-brown or yellowish-brown light. The Lambert-Beer law holds for deposits less than 160 m μ in thickness. Similar coatings of the sulphides of silver, copper and bismuth are obtainable. A. SCHEDLER and M. TOPERCZER: A short account of the distribution of the terrestrial magnetic force in Austria at the epoch 1930-0. CARLA ZAWISCH-OSSENTITZ: Sebaceous glands in the outer ear-passages of rodents and Insectivora.

March 16. FRITZ RIEDER: Experiments on the Wilson method for the emission of neutrons from beryllium and the disintegration of atoms by neutrons. A large Wilson-chamber arrangement for stereoscopic photography has been used for obtaining pictures of H-rays liberated from beryllium by neutrons. The existence of slow neutrons producing H-rays, with a range of some centimetres at most, is established. HANS POPPER and JOSEF BÖCK: Investigations on the carbohydrates of the aqueous humor of the eye. HANS BENNDORF: The conception of electrostatic capacity. The usual definition of electrostatic capacity, based on Maxwell's capacity coefficient as a measure of the capacity, is regarded as too narrow. In many cases, some of practical importance, it fails to fulfil the true function of the conception of capacity, namely, of furnishing a measure of the ratio between the quantity of electricity supplied to a conductor and the change in potential effected thereby. It is, therefore, proposed to define the capacity C of a conductor by this quotient, $\delta e/\delta v$, and the mean capacity \bar{C} between two potentials V and V^1 by the mean value of C : $\bar{C} = \frac{1}{V^1 - V} \int_V^{V^1} C dV$. For the case of two spheres, the difference between capacity at constant potential and capacity at constant charge is calculated numerically. ARTUR WINKLER-HERMADEN: Accumulation, denudation, and land-formation at the eastern edge of the Alps.

Official Publications Received

GREAT BRITAIN AND IRELAND

Fourteenth Annual Report of the Ministry of Health, 1932-1933. (Cmd. 4372.) Pp. xii+329. (London: H.M. Stationery Office.) 5s. net.

University College of Wales, Aberystwyth: Welsh Plant Breeding Station. An Account of the Organisation and Work of the Station from its Foundation in April 1919 to July 1933. Pp. iv+164. (Aberystwyth.) 3s.

Air Ministry: Aeronautical Research Committee: Reports and Memoranda. No. 1502 (T.3297): Aircraft Turning Performance, Part 1. By S. B. Gates. Pp. 8+8 plates. 6d. net. No. 1508 (Strut. 109): Critical Reversal Speed for an Elastic Wing. By A. G. Pugsley and G. R. Brooke. Pp. 10+5 plates. 9d. net. No. 1517 (L.47): Lubrication in Oxidising Conditions. By R. O. King and C. Jakeman. Pp. 14+11 plates. 1s. net. No. 1524 (I.C.E. 802): Abstract, The Oxidation of Fuel Vapours in Air. By Dr. E. Mardles. Pp. 2. 2d. net. (London: H.M. Stationery Office.)

OTHER COUNTRIES

Scientific Papers of the Institute of Physical and Chemical Research. Nos. 431-434: Markotín and Vitamin C (Fortsetzung), von Sutekiti Maruyama; Chemische Untersuchungen in der Saponinreihe, 4 Mitteilung: Über die Saponine von *Fatsia Japonica* Dene et Plane, von Munio Kotake, Katsuta Taguchi und Teiji Okamoto; Studien über den Feinbau der Seide (1-4 Mitteilungen), von Kametaro Ohara; The Most Probable Values of e/m and h , II, by Kamekichi Shiba. Pp. 93-137+plates 11-14. (Tokyo: Iwanami Shoten.) 80 sen.

Southern Rhodesia: Geological Survey. Short Report No. 23: Notes on Gold Mining in the Victoria District. By B. Lightfoot. Pp. 23+6 plates. (Salisbury.)

Government of India: Department of Industries and Labour (Public Works Branch): Irrigation in India, Review for 1930-31. Pp. iii+53. (Delhi: Manager of Publications.) 1.2 rupees; 2s. U.S. Department of Commerce: Bureau of Standards, Bureau of Standards Journal of Research. Vol. 10, No. 6, June, Research Papers Nos. 561-572. Pp. 705-869. (Washington, D.C.: Government Printing Office.) 25 cents.

Memoirs of the Indian Meteorological Department. Vol. 25, Part 10: Solar Radiation Measurements at Poona in 1931. By Shanti Sroup Kohli. Pp. 327-342. (Calcutta: Government of India Central Publication Branch.) 12 annas; 1s. 3d.

Proceeding of the United States National Museum. Vol. 82, Art. 22: Pottery of the Hopewell Type from Louisiana. By Frank M. Setzler. (No. 2963.) Pp. 21+7 plates. (Washington, D.C.: Government Printing Office.)

Collection des travaux chimiques de Tchecoslovaquie. Rédigée et publiée par E. Votoček et J. Heyrovský. Année 5, No. 6, Juin. Pp. 233-278. (Prague: Regia Societas Scientiarum Bohemica.)

Forty-ninth Annual Report of the Bureau of American Ethnology to the Secretary of the Smithsonian Institution 1931-1932. Pp. vi+8. (Washington, D.C.: Government Printing Office.)

Occasional Notes of the Hong Kong Horticultural Society. Edited by G. A. C. Herklots. No. 2, March. Pp. 47+6 plates. (Hong Kong.) 1.50 dollars.