Editorial & Publishing Offices :
MACMILLAN & Co., LTD.
ST. MARTIN'S STREET
LONDON, W.C.2

NATURE

Telegraphic Address :
PHUSIS, LESQUARE, LONDON

Telephone Number :
WHITEHALL 8831

No. 3515 SATURDAY, MARCH 13, 1937 Vol. 139

Librarianship in Relation to Scientific Research

HUMAN nature being what it is, the continued existence of a collection of books presupposes the existence of a custodian whose primary instinct and duty is defence. So, no doubt, in the fifth or sixth century were the first librarians regarded ; and so, of course, have the members of that profession to-day heavy responsibilities for the safety of priceless literary collections.

Not that all books are to be prized as storehouses of the mind ; some indeed are "no good for reading", whilst others tell us "little that one need know, very much which it would be a positive mistake to believe". There are old libraries that resemble museums of antiquities, where the shelves are so many substitutes for glass cases ; the bindings still a delight to the appreciative eye, and the leaves beckoning us to a near-by arm-chair for the pleasure of a dream in the remoter past. In tune with the atmosphere, we would call the venerable student in whose charge we enjoy these treasures by the name of 'library keeper', feeling the usual designation to be a little too business-like and efficient for our mood. But there are also new libraries which repel or attract us, as may be, with the kaleidoscopic dust-covers of ephemeral fiction purporting to echo the delirium of a feverish modernity ; where the keeper of the books cares nothing for their message (perhaps his sense of values is not so false after all) but counts his task well done when he replenishes his stock for fewer pence than his customers are willing to pay for their entertainment. He, too, is a 'librarian', if the title may still be held by a dealer in books, as it once was also by those who copied manuscripts and by their errors planted the seeds of so much perplexity and polemic in later generations. But to-day, if we exclude popular fiction, fewer books are read for pleasure—such is the pace of life and such the competition of other forms of enjoyment—and more for profit, so that our conception of librarianship has undergone a significant change ; the custodian of books has come to be recognized for what he really is—a custodian of information. Perhaps the scientific library offers to him at once the most difficult task and the most fruitful opportunity of service in the nation's daily work.

Research, whether it be conceived in an academic spirit or planned to achieve some specific utilitarian purpose, needs for its development a basis of existing knowledge as wide and as deep as can be secured. Study of what is already known is the first step in discovering the unknown ; and in that study the research worker needs help in increasing measure as the sources of his information become ever more numerous and heterogeneous. There was a time when the chemist, for example, was both expected and able to read most of the significant original papers in his subject ; now he is fortunate if it is possible for him to keep abreast of part of it with the aid both of a voluminous special literature designed expressly for that purpose and of the extensive facilities provided by special libraries.

Yet a collection of books, journals, and pamphlets, while indeed the foundation, is not the only constituent of a scientific library as it is understood to-day. The service which such a library renders to students, investigators, and teachers alike depends for its efficiency on a human factor, the personality and the competence of the library staff ; and for that reason, matters relating to their training are of some moment both to research workers and to students, particularly to those

who may be fitted to serve their science better in a library than at a bench. Librarianship has already a valid claim to be ranked as a learned profession, the preparation for which is appropriately a concern of the universities. For example, the School of Librarianship at University College, London, is now in its eighteenth session, having been established by the Senate of the University of London on the basis of suggestions received from the Council of the Library Association, and opened in October, 1919. The School is "organised so as to give a systematic training on a broad basis to students who are already employed in libraries, record offices, or documentation centres, or who propose to adopt work of this kind as their profession."

The full-time course leading to the University of London diploma in librarianship occupies two years in the case of undergraduates (whose matriculation certificate must attest proficiency in Latin), or one year in the case of approved post-graduate students, whilst part-time students are required to devote from three to five years or two years, respectively, to the diploma studies, due account being taken also of practical experience in library administration. So much importance is attached to such experience that the diploma course includes a period of practical work to be carried out in selected libraries, a new arrangement which has already proved its value, and it is a condition of the award of the diploma that a substantial period of service in a library shall have been performed.

The University of London diploma is not, however, the only hall-mark which members of the profession may acquire. Fellowship of the Library Association is already recognized as indicating a very high degree of competence and experience, and the courses provided by the University of London School of Librarianship are equally available to persons desiring to take the intermediate and final examinations conducted by the Library Association. Here, therefore, are two avenues by which aspirants and those who have already commenced the journey may seek to demonstrate that they have reached that degree of competence which, combined with opportunity, will put them in possession, not of fame, but of the knowledge that they contribute significantly in advancing the world's work and culture. Perhaps when fuller recognition is accorded to the position which trained and experienced librarians occupy as 'key' men and women in unlocking the stores of accumulated knowledge for our instruction and delight; when both library authorities and senior members of the profession make greater use of such an institution as the School of Librarianship for the recruitment of their assistants, then an enhanced status will be associated with greater material rewards.

To this end, however, there must needs be co-operation between employers and teachers; and if the truth must be told—as indeed it should—there is here room for considerable improvement. The director of the University of London School of Librarianship, Mr. J. D. Cowley, has recently made a substantial contribution. It is his responsibility to see that his students attain such a degree of familiarity with the principles of librarianship as will equip them to accept service under progressive authorities, and such practice in the application of those principles as will commend them to busy librarians who are thus spared much of the burden of instruction. He has therefore reorganized the syllabus in a manner which experience has led him to regard as desirable, and has devoted special attention to the practical aspects of the work. The new course, which is already in operation, provides lectures and examinations in languages, in English literary history, in cataloguing and classification, in administration (including local government organization and the administration of public, university, and special libraries), in bibliography and in palæography. It includes the period of supervised library experience to which reference has already been made, and makes provision for individual studies or research.

The hope may now be expressed that library authorities will, on their part, make a generous contribution to the further success of this scheme of professional training, helping it to serve more effectively not only the needs of the libraries but also the requirements of the reading public. They can do so, for example, by facilitating participation by junior members of their staffs, by regarding it as a principal source of supply of library officers, and by offering such salaries as will both attract the trained candidate and encourage the University of London to permit the School to expand, both in activities and in numbers, parallel with the demands which the profession of librarianship may make upon it in the interests of a community seeking culture, of a nation demanding progress, and of a world sorely needing that sympathy and understanding which fails where knowledge is lacking.

The Imperial Agricultural Research Institute, New Delhi

By Dr. W. Burns, Imperial Council of Agricultural Research

SINCE the time when Voelcker wrote his report "The Improvement of Indian Agriculture" in 1893, it has been recognized that agricultural progress in India must be based firmly on research. Accordingly, when Mr. Henry Phipps, an American philanthropist, came forward in 1901 with a splendid donation of £30,000 to be devoted to some project of public utility, if possible in the direction of scientific research, Lord Curzon, who was then Viceroy, decided to use the greater part of this donation for the construction of an agricultural research laboratory at Pusa. Pusa is in a rather out-of-the-way part of the province of Bihar, and the choice of site was not perhaps the happiest. The earthquake of January 1934, which did great damage to the Institute, brought up the question of rebuilding or shifting it. The second alternative won the day, and the result is the new Institute of Agricultural Research at New Delhi. But the old name Pusa has become very familiar, and those coiners of local place-names, the taxi and tonga drivers of Delhi, have already christened the new Institute the "Pusa College", while many scientific workers in India often refer to it as the "New Pusa".

The early days of Pusa saw the pioneer work of Leather in soil chemistry, of Butler in the realm of fungal diseases of plants, of the Howards in the production of new races of crops, especially wheat, and of Maxwell-Lefroy (whose name is written in the Book of Martyrs of science) in the cataloguing and combating of insect pests.

The Howards' wheats, particularly Pusa 4, Pusa 12 and Pusa 52, are now grown over six million acres in India, and some of the Pusa wheats have a vogue in Australia. Plant breeding for strictly economic ends and also the study of pure genetics have always figured largely on the programme of the Institute. Some useful hybrids between American and Indian tobaccos, wilt-resistant pigeon-pea strains, and better linseed types are some of the economic results, while the inheritance of characters in several important crops including linseed and chillies (*Capsicum*) has been the subject of important memoirs. It should be mentioned that the now world-famous Sugar Cane Research Station at Coimbatore in the Madras Presidency is a sub-station of the old Pusa and of the new Institute.

The site of the new Institute is within the limits of Imperial Delhi, and contains 476 acres of good agricultural land, plus 300 acres, of which part is pasture and part occupied by roads and buildings. About seventy miles from Delhi on the Grand Trunk Road (and also on the railway) is Karnal, where there is a farm that is now a sub-station of the Imperial Institute. Progress with the construction of the Institute was rapid. Lord Willingdon laid the foundation stone of the library on February 19, 1935. The library and laboratories were, in April 1936, ready for internal fittings and equipment. Work in these laboratories actually began in August 15, and the formal opening took place at the hands of His Excellency the Viceroy, the Marquis of Linlithgow, on November 7, as soon as possible after the Government of India came back to Delhi from Simla. Special references were made on that occasion to the late Sir Fazl-i-Husain (who had as Member for Education, Health and Lands been of the greatest help to the Institute) and the late Dr. F. J. F. Shaw, who was director of the Institute during the period of transfer and reconstruction. The total cost of the transfer, including the building of the new Institute and the acquisition and layout of the land, was Rs. 36 lakhs. The climate and soil of Delhi are suitable for growing a much greater range of crops than at Pusa. Part of the land will be cultivated under rainfall and the rest under irrigation water from the Jumna pumped through 12,000 feet of pipe line and open channels.

The New Delhi Institute naturally differs from that of Pusa in its buildings and layout. The Pusa laboratories were located in a central two-story building, divided up into sections for the various sciences and the library. At Delhi each science has its own separate single-story block, giving ample room for the present and opportunity for expansion in the future. The library is housed in a spacious central building with a clock tower. The Institute now possesses 80,000 volumes and is considered to have the biggest agricultural library in the East. It also receives every important periodical dealing with agriculture and its underlying sciences.

The Botanical Section is housed in two blocks. The main one consists of a number of rooms equipped for advanced scientific work. The out-buildings are situated in an area of 50 acres laid out for plant breeding. New developments of this section are to be in the directions of plant physiology and cytology, while the plant breeding activities of the section will be maintained and intensified.

The Chemical Block, housing activities in soil science and agricultural chemistry, contains forty rooms fitted up for work in general analytical chemistry, micro-analysis, microbiology, soil physics, physical chemistry and plant chemistry. In addition, there are underground rooms where even temperatures can be maintained, laboratory workshops, a pot-culture house and lysimeters. A new feature of the Chemical Block is a laboratory for carrying out small investigations on the utility of agricultural products and to devise ways and means for the making of intermediate products. The need for this was recognized in 1921 by the Board of Agriculture in India.

In the Entomological Block are a main laboratory, a parasite laboratory and underground constant-temperature rooms. The rooms containing the collections have about 10,000 species represented by hundreds of thousands of specimens both pinned and in alcohol.

The Mycological Block has similarly rooms for use as laboratories, as constant-temperature rooms, as culture rooms and as herbaria, the last named containing a very valuable collection of fungi.

There is a group of buildings consisting of a dairy cattle byre with modern fittings, a veterinary dispensary, bull runs, sheds for sick animals and for segregation, and sheds for implements.

No mention of the Institute would be complete without a mention of what is a great attraction to visitors, namely, the famous Pusa pedigree Sahiwal herd. This is one of the finest herds of milch cattle in India. It has been in existence since 1904, when fourteen cows and one bull were purchased from the Punjab. It has gradually been selected from homebred stock with occasional fresh blood from outside. The average milk yield per cow per day has risen from 5 lb. in 1914 to 22 lb. in 1934. The bringing of this herd, numbering 172, from Pusa to Delhi was an achievement in itself, a special train being required, taking four days on the journey. There was no break in the recording of milk yields or of the routine of the herd during the transit, and the animals arrived at Delhi in first-class condition.

In addition to the research work of the Institute, there is also its educational activity. This takes the form of two-year postgraduate courses in which the student specializes in one or other of the subjects botany, chemistry, entomology or mycology, and in which the current research work of the Institute is the background of the teaching. Since the inception of this course in 1923, fifty-six students have passed out from the Institute, of which number forty-six have obtained employment either in provincial or State departments of agriculture or under schemes financed in whole or in part by the Imperial Council of Agricultural Research. There is also given a one-year course in farm management, and as occasion or need arises, short courses in special subjects such as the flue-curing of tobacco are arranged.

Lord Curzon, when laying the foundation stone of the original Pusa Institute, remarked that he would like to visit the place in fifty years time and see what it had grown into. He said, "Should I find Pusa the centre of a great organization, with ramifications extending to all parts of the Indian Continent, training a series of students who will devote their acquired knowledge to the practical pursuit of agriculture and able to point to the tangible results of successful scientific experiment, both in the quality of seeds and plants, in the destruction of pests, and in improvement of breeds of cattle ? That is the prospect that I should like to look forward to, and if it be at all realized then we may be assisting at a rather momentous child-birth to-day."

The now twice-born Institute faces the future with the means and the will to carry on to still completer realization this prophetic vision.

Chronological Problems in the Prehistory of North Africa

IMPORTANT questions relating to the antiquity of 'fossil' man in North Africa and to the dating and cultural affinities of the later stone age civilization of North Africa and the Sahara are debated by M. R. Vaufrey, of the Institut de Paléontologie humaine, Paris, in two recently published papers*.

In the first of these, M. Vaufrey has assembled and examined critically the evidence bearing on the age of the skeletal remains and artefacts found in the "escargotières" of Mechta el-Arbi, Tunisia. This midden site was discovered in 1907 ; but knowledge of its content is imperfect. Owing to the dispersal of the collections both of human remains and artefacts made by M. A. Débruge, to whom the exploration of the site was entrusted in 1913 and again in 1923, only one of the four skulls

* Vaufrey, R., "L'Age des Hommes Fossiles de Mechta el-Arbi". *Bull. Soc. Historique et Géographique de la Région de Sétif* (1935). Vaufrey, R., "L'Age de l'Art rupestre nord-africain". *Bull. Soc. Préhistorique Française*, **33**, No. 11.

then found is now available, housed in the Institut de Paléontologie humaine. The remaining three, with an additional specimen, are represented by casts. There are also casts of a maxilla and a mandible, while there are two mandibles at Constantine, of which one probably belongs to the Mechta el-Arbi type. The Mechta el-Arbi type has also been recognized in the skeletons from the Ibero-Maurusian cave of Afalou bou Rhummel.

The archæological material obtained from M. Débruge's investigations is also only imperfectly represented in collections, while the material obtained by the archæological mission of the Logan Museum (Beloit, Wis.) in 1926–27, though on a more extended scale, does not include a fully representative series of characteristic microliths owing to defects in the technique of excavation.

Nevertheless, the industry revealed by these investigations—an entirely microlithic industry—is not Capsian; and when the geometric microliths and the microburins, previously overlooked, are added, it conforms with the industries of Aïn Rhilane, Relilaï and a number of other sites of the same culture in the region of Sétif. These all belong to the upper Capsian—the middle Capsian being a purely hypothetical culture, which has never been described anywhere—or to a neolithic with Capsian tradition.

It follows that no greater antiquity than that of this culture can be ascribed to man of Mechta el-Arbi. In other words, Mechta el-Arbi man belongs to the Mesolithic age. Further, it also follows that Capsian man is still unknown. Other skeletal remains, such as those from Djebel Rocknia and Djebel Fartas, and the skeletons secured in 1890 by M. Pallary from caves in the neighbourhood of Oran, do not go back beyond the neolithic of Capsian tradition.

This neolithic of Capsian tradition marks the point when a neolithic culture with pottery, polished axes, querns for corn-grinding, and bifacial arrow-heads, broke in on an upper Capsian culture at the moment when the local industry was on the way to developing the arrow-head with transverse cutting edge. One result of the impact was the magnificent efflorescence of naturalistic rupestral art. This impact came from Egypt across Libya with the time-lag natural in all colonial development.

The age and affiliations of this culture, as found in association with the rupestral art in North Africa, are discussed further by M. Vaufrey in the second of the papers to which reference is made above. It opens with the critical examination of a statement made by M. M. Reygasse, which claimed a relatively high antiquity for certain rock engravings of the Sahara on the evidence of the discovery here for the first time of the spiral with figures of a fauna now extinct, or no longer found locally, such as, for example, the hippopotamus. M. Reygasse had argued further that this evidence showed that the spiral in the Sahara was independent of the Mediterranean, and that in the Hoggar and Tassili des Adjers it was older than the classical spiral of the eastern Mediterranean; while in addition it indicated that these engravings were much more ancient than the paintings showing the Garamantian vehicles.

M. Vaufrey compares the engravings of the Hoggar and Tassilli des Adjers with those from Oued Chreaa in southern Oran, suggesting that these may well be the work of the same artists and belong to the same epoch. He maintains, however, that the extinction of the fauna, which is made the basis of the argument, may not have taken place at so remote a date as stated. It is frequently advanced on the evidence, *inter alia*, of the occurrence of a neolithic industry rich in green stone necklace beads in a cave in the central Sahara, that the desiccation of this region is of relatively recent date; while faunal evidence has been adduced in support of a neolithic pluvial phase in the Sahara extending from the middle of the sixth to the middle of the second millennium B.C.

It has been established by an investigation of a number of stations in Oran, some thirty in all, that the culture associated with the rock engravings is the neolithic with Capsian tradition. By the action of time and weather, this culture is not always represented in its entirety; the pottery, in particular, has usually disappeared. It is, however, better represented in more sheltered conditions, such as are found in the caves of El Arouia, north-north-east of Brézina, where a microlithic industry is associated with a class of pottery, in which the fundamental element is a type with pointed base, richly ornamented with incised decoration and frequently provided with lugs. There is also an abundance of polished axes of various kinds of stone, cylindrical or lenticular in section, as well as querns and mullers for grinding corn. In one of these caves was a naturalistic representation of one of the Equidæ and of a member of the ox family engraved on a stone. This industry was found in the north on the very borders of Oran, and from the evidence of the skeletons found by M. Pallary in 1890, its authors are known to have been of the type of the men of Mechta el-Arbi.

The pointed vases afford a new chronological element. They belong to the type found in the Gerzean culture of Negadeh in Upper Egypt of the predynastic epoch. In the same culture are found the earliest spirals, which appear on the painted ware with rounded base and with lugs,

dating approximately from 4,000 B.C. Among a number of other indications of affiliation is the Libyan sheath, shown on figures at Fedjet el Khaïl and Kharrouba, which links with the Amratians, the predecessors of the Gerzeans, dating from 5,000–4,000 B.C., while an individual at Kharrouba holds a boomerang, which appears also among the Badarians of predynastic Egypt. Finally, the polished axes, the biface arrow-heads, and the harpoons and the fish-hooks of bone, which in North Africa extend as far as Mauretania, also appear in the earliest neolithic civilization of Egypt, the Tasian of the Fayum and Merimde, while the arrow-heads with transverse cutting-edge are found in the Amratian culture.

The neolithic with Capsian tradition of Oran is thus seen to comprise a number of features which derive from Egypt, but are found there as elements in cultures which succeed one another in a period extending from 6,000 to 4,000 B.C. In the Sahara these features appear more or less contemporaneously, as is shown not only by surface finds, but also on stratified sites. Hence the impression left by this neolithic culture of Capsian tradition is that it has been built up on a Capsian foundation by a succession of borrowings from the neolithic cultures of Egypt. It is a colonial culture, and like all such, is affected by a time-lag. Thus, for example, the head of a ruminant surmounted by a disk first appears in Egypt in the Amratian culture. The same figure, accompanied by bovides and ovides, appears in North Africa, but probably dating from the Middle Kingdom. Another example of the same kind is the painted representations of vehicles, which have been attributed variously to the Garamantes and other sources. The simplest explanation is that these paintings are the work of natives who had been in contact with Egypt under the New Empire, but certainly after the introduction of the horse and chariot into Egypt by the Hyksos. This would give a dating for the culture associated with these paintings, or of those representing the horse alone, such as that at Oued Chreaa, of 1,500–1,000 B.C.

While 3,500–4,000 B.C. would thus represent the extreme upward limit of dating for the neolithic culture of Capsian tradition, the gap which exists between this culture and the Mousterian or Aterian in southern Oran and probably throughout the whole of the Sahara, leads to the conclusion that no naturalistic engraving in the whole of this region is older than the neolithico-Capsian culture which is found in association with this North African school of art.

Natural Colour Eclipse Photography

THE first natural colour photograph of a total eclipse of the sun ever reproduced appears in the February issue of the *National Geographic Magazine*. The original photographs were taken on June 19, 1936, at Ak Bulak in Siberia, by Irvine C. Gardner, leader of the National Geographic Society and U.S. National Bureau of Standards Joint Eclipse Expedition.

Dr. Gardner, in his very interesting article describing the general circumstances of the observations, states that six exposures on Dufay colour plates (of 1, 2, 4, 8, 16 and 8 seconds respectively) were made with a specially designed lens of 9 inches aperture and 19-feet focal length. The camera was fixed, being pointed directly at the eclipsed sun, and the plate holder moved to compensate for the solar motion. The solar image had a diameter of almost two inches. One of the photographs is reproduced in colour among the illustrations to the article.

It is perhaps scarcely fair to judge the original photographs by the reproduction, though there is no mention in the text of any differences between the original and the reproduction. The detail shown is, as one would expect, less than in the usual 'black and white' pictures, but all the main structure of the corona is visible, and the image extends to about a solar radius from the limb of the sun. The sky background is reproduced as a brownish-grey, rather than indigo, and the corona itself is distinctly pink, though it is pearly white to bluish to the eye. The prominences show whitish to blue, and this seems to be nearer the truth than the common idea of a vivid scarlet.

The precise object of these photographs is not stated in the article, which is a popular account, but despite these defects as pictures corresponding to direct eye observation, these pioneer attempts at colour photography of eclipses are of enormous interest, for to the astronomers it matters little whether the photograph looks like the original. The important thing is whether there exists a one to one correspondence between the spectral composition of the radiation reaching us from the corona and prominences and the radiation transmitted by the photograph ; or, to be more exact, can the spectral intensity curve of the source be deduced from the spectral absorption curve of the photograph ?

Of course, such 'mosaic' processes as the Dufay colour, and nearly all natural colour processes, do not seek such a correspondence between source and image, but only that the image should closely resemble the source to the eye. As a given hue to the eye may be produced by more than one combination of homogeneous radiation, it does not follow that a colour photograph satisfactory to the eye would be equally satisfactory to the spectroscope, and so far no commercial process satisfies this latter test. But at least a 'mosaic' colour photograph can have the same sort of value that a set of ordinary photographs taken through filters has, and represents a coarse spectro-photometric survey.

Dr. Gardner in his article does not state explicitly whether any steps were taken to make photometric measurements, but by implication something of the sort was contemplated. If it should prove practicable—and these first results of Dr. Gardner's hold high promise—to conduct even rather rough eclipse spectrophotometry in this fashion, then a new technique of great value will be at our disposal. It is too early to express any opinion on the possibilities of this method, but Dr. Gardner is to be congratulated not only on his luck in obtaining clear skies at Ak Bulak, but also on his enterprise and his technical skill in securing these photographs.

Obituary Notices

Dr. W. Maldwyn Davies

BY the sudden and tragic death on February 17 of Dr. W. Maldwyn Davies of Bangor at the age of thirty-four years, entomology, and notably economic entomology, has suffered a grievous loss. Dr. Davies graduated with first-class honours at the University College of North Wales, Bangor, in 1925, and after two years at the Rothamsted Experimental Station he returned to the College in 1927 as adviser in agricultural zoology for North Wales, an appointment which comprised not only duties of a purely advisory character but also to no small extent investigation and research. For this post Davies, with his intimate knowledge of Welsh farmers and Welsh farming, was exceptionally well qualified, as evidenced by his work in connexion with the warble fly, in which science and practice were so happily combined.

Even more outstanding, however, was the research work that Davies was able to carry out in the brief period of ten years. Most notable perhaps was his contribution to our knowledge of the ecology of the aphis *Myzus persicæ* and its relationship to the spread of the virus diseases (mainly leaf-roll) of the potato. Starting from the discovery made by his colleagues, especially Dr. T. Whitehead, that in certain parts of North Wales potatoes could be grown from year to year without the introduction of fresh seed and without appreciable increase in the incidence of virus disease, Davies began a study of the aphis vectors of these diseases. By investigating the population of the aphides in the field, he was able to show that there is a significant difference in the numbers of aphides on farms where healthy seed potatoes could be grown and on those where they could not, a difference which in itself explained the varying incidence of virus disease. At the same time, the important discovery was made that the source of infestation each year was not overwintered eggs on various species of Rosaceæ, but aphides in the apterous stage overwintering on Brassicas, particularly Savoys, and it was concluded that winter Crucifers provide the main source of *M. persicæ* in spring.

The next step was to discover the factors that control the aphis population, and by a combination of laboratory and field work, Davies was able to show that the numbers of aphides in any district depend in part on the proximity of winter host plants but even more on the climatic conditions during the periods of migration. It was found that the aphides are unable to fly when the atmospheric humidity exceeds a certain maximum, owing to the effect of moisture on the wing membranes. It was also found that strong winds, instead of favouring migration, cause the insects to remain *in situ* on the host-plant. The potato-growing areas of North Wales could thus be differentiated on purely meteorological grounds into districts in which the transmission of virus disease would be facilitated by the presence of abundant vectors and those where it would not.

The last stage of the investigation, to establish whether the facts that held good in North Wales were also true of Great Britain as a whole, was already under way, and a visit to Scotland last year was to have been followed this year by a trip to Devon and Cornwall. This conclusion of the work must now be left to others, but Davies's contribution will remain a model of what such an investigation should be, and it is likely to rank as classic in its particular sphere.

Davies was not concerned only with the insects that attack plants, and his work upon the pests of farm animals, notably upon the sheep maggot flies, was of little less importance. At the instance of the Agricultural Research Council, he had recently had the co-operation of a biochemist (Dr. R. P. Hobson) in an investigation of these latter pests—a collaboration that had already produced valuable results and held out great promise of further success.

Davies's official work was thus primarily concerned with agricultural entomology, for which he had a special flair, but his interests nevertheless were not confined to this aspect of his subject. His earliest publications dealt with certain species of Collembola as pests of agricultural crops, and he was so attracted by these insects that he also found time to establish for himself a wide reputation as an authority upon them; many of the collections made by recent expeditions overseas passed through his hands for identification. He had in course of preparation a systematic key to the identification of the British species, which it is hoped is sufficiently advanced to render publication possible.

As a man, Davies was beloved by all who knew him, and he will be greatly missed by entomologists everywhere, and notably by his colleagues and friends in the agricultural services. J. C. F. F.

WE regret to announce the following deaths:

Joseph Auclair, *correspondant* of the Section of Mechanics of the Paris Academy of Sciences.

Prof. Cyrus R. Crosby, professor of entomology in Cornell University, on January 11, aged fifty-eight years.

Prof. J. H. F. Douvillé, formerly professor of palæontology in the National School of Mines, Paris.

Sir Albert Kitson, C.M.G., C.B.E., director of the Geological Survey of the Gold Coast in 1913–30, on March 8, aged sixty-nine years.

Prof. C. J. Lewis, emeritus professor of public health in the University of Birmingham, on February 6.

Prof. F. P. F. Ransom, formerly professor of pharmacology in the University of London, on February 22, aged eighty-seven years.

News and Views

Sir Joseph Barcroft, C.B.E., F.R.S.

SIR JOSEPH BARCROFT retires this year from the chair of physiology in Cambridge to which he succeeded on the death of Langley in 1925. Throughout an active life, Sir Joseph has played a prominent part in maintaining the high tradition of the Cambridge school of physiology. He has made many important contributions to knowledge, and has taught others to do the same, but his greatest contribution to physiology has been through his indirect influence on younger men. His enthusiasm, his good humour, his attractive style of writing and speaking, and his unusual gift for putting the results of profound thought into simple language, have inspired many with a love of physiology which has influenced them throughout their lives. As head of a large laboratory, he has found time to take a friendly interest in many different investigations without actively interfering with the natural development of the ideas of his colleagues.

THOUGH he is not a medical man, much of Sir Joseph's work has been with human subjects, and much of it has had a dramatic quality that has made him widely famous. His early investigations were concerned mainly with the carriage of oxygen by blood, and with the chemical changes in organs such as the salivary glands and the kidneys which were found to use more oxygen during activity than during rest, and to liberate metabolites which controlled their blood supply. In order to study the gases in small samples of blood, or other tissues, he invented a differential manometer which is widely known as the Barcroft apparatus. For many years, he represented Cambridge against Oxford in favour of the view that the passage of gases through the epithelium of the alveoli of the lungs was a simple physical process and that, even under adverse conditions, the lungs could not take up oxygen unless the oxygen pressure in the air was greater than that in the blood. In support of this conclusion he led expeditions up high mountains, and exposed himself to low oxygen pressures for many days in a glass box in Cambridge. In more recent years he has shown, by striking experiments, that the spleen plays an important part in the circulation as a reservoir of blood, which is released in emergencies, and he has added much to our knowledge of the oxygen supply to the fœtus *in utero*, and other allied subjects.

Prof. E. D. Adrian, F.R.S.

PROF. E. D. ADRIAN, who succeeds Sir Joseph Barcroft to the Cambridge chair, has also spent all his scientific life in Cambridge, where he is now a Foulerton research professor of the Royal Society. Before the Great War he worked with Keith Lucas on the problems presented by the impulses in motor nerves. He then left Cambridge, obtained a medical qualification, and quickly showed that he could have been a very successful clinician. He was R.M.O. at the National Hospital, Queen Square, and during the War he had experience of the treatment of shell-shock. In 1919, he returned to Cambridge and started his well-known work on the physical basis of sensation. All knowledge depends on the brain's analysis of impulses arriving in sensory nerves. Adrian took advantage of the new methods for amplifying small electric currents and tapped the messages in the nerves. He has thus analysed the activity of sense organs in a way that was not previously possible. In recognition of this work he received, with Sir Charles Sherrington, a share of the Nobel prize for medicine in 1932. He is now called upon to spread his interests more widely than in the past, and to devote his clear brain and ready understanding to helping investigations in many branches of physiology.

Prof. M. N. Saha, F.R.S.

PROF. MEGHNAD SAHA, who, as is recorded elsewhere in this issue, has been elected president for the current year of the National Institute of Sciences of India, is among the foremost of Indian physicists. He is chiefly known for his theory of stellar spectra, which he put forward in 1920 during a period of research with Prof. A. Fowler at the Imperial College of Science, London. In that theory, which began with a consideration of the solar spectrum and was afterwards extended to the spectra of the stars in general, Saha brought together the thermodynamical theory of ionization of atoms, at that time little known in England, and the observational indications of various degrees of ionization in stellar atmospheres found by Prof. Fowler and others. This formed the starting-point of a vigorous attack on the problems of stellar atmospheres, in which Profs. R. H. Fowler and E. A. Milne in England, and H. N. Russell in America, have taken a prominent part. The result of this work has been not only a partial solution and the establishment of a definite viewpoint for the further examination of stellar atmospheric problems, but also the creation of a closer relationship between laboratory and astronomical physics, for in the light of Saha's theory certain atomic properties, for example, the duration of the excited state of an atom, can be determined from astronomical observation as well as, if not better than, from terrestrial experiments. Prof. Saha has also made other useful contributions to theoretical physics, and is the author of an imposing text-book on the subject.

British Chemical Industry and European Affairs

EUROPEAN affairs in relation to the chemical industry, and particularly to the British chemical industry, recently formed the subject of an address by Dr. H. Levinstein to the Institution of Chemical Engineers. If and when war comes it would, he said, be sudden and overwhelming, whilst industries unprepared for war could not be switched on to the requirements of war without great delay and immense cost. In 1914, war was not expected by the British chemical industry. Dr. Levinstein outlined some of the urgent requirements which the industry then had to face, and referred to some of the great deficiences, delays, and difficulties with which it had to contend. That it eventually surmounted these difficulties and removed these deficiencies is attested by military history, but, said Dr. Levinstein, "I have said enough to show the terrible delay, prolonging suffering and death, inevitable to going to war with our chemical industries as they were in 1914". On the other hand, "the German Government had the nucleus of a strongly centralised and organised industry for the chemical side of the production of munitions of war". The formation of Imperial Chemical Industries, Ltd., and the establishment of the Institution of Chemical Engineers are two developments of importance in the present organization of British chemical industry. "We may be thankful," he said, "for it is of great national importance, that the chemical industry is to-day more closely knit. . . . We are not so unprepared in all matters as may sometimes be thought. At least in the chemical industry we are stronger in every branch; more compact in structure, more complete in scope, with large units ably directed." The chemist has his responsibility, as a citizen, to help in removing the causes of war; but likewise his responsibility for ensuring an adequate defence against aggression is great. Dr. Levinstein has assured us that in Great Britain the chemical industry is not asleep.

Royal Commission for the Exhibition of 1851

IN consequence of the Government's decision in 1935 to forgo any further contributions from the capital resources of the Royal Commission for the Exhibition of 1851 towards the cost of new buildings for the Science Museum, and owing to other factors that have lately tended to stabilize the Commissioners' income for some years to come, the Board of Management of the Commission has been able to set aside sufficient to provide for an additional annual scholarship of two or three years' duration. This will be used to extend to India the scheme of science research scholarships for overseas universities, each of which is of the annual value of £250–£280. To those who have watched the growth of post-graduate studies in India this decision has naturally given great satisfaction, and the allotment of even a single scholarship has been warmly appreciated by the Indian universities. Indian students have, of course, always been eligible for the coveted senior studentships, of which five are awarded each year by the Commissioners to advanced students of science nominated by universities in Great Britain. But until now they have had no chance to participate in the benefits of the overseas scholarships, which have been the means of training in the methods and technique of research and thus equipping for responsible positions in the scientific service of the Empire so much first-rate talent from the universities of Canada, Australia, New Zealand, South Africa and the Irish Free State. Moreover, these awards, of which eight have been made each year, provide a valuable link between research scholars of this country and the Dominions. From this point of view also the inclusion of India in the scheme is of considerable importance.

THE Commissioners' research scholarships scheme, since it was first established in 1891, has, through its beneficiaries, achieved a noteworthy reputation. Of some six hundred past scholars, the majority now occupy positions of the highest rank in almost every branch of scientific activity. University life in Great Britain and the Dominions has been greatly enriched by the men and women trained under the auspices of the Commission. If rather more than half the scholars have distinguished themselves as principals, professors or lecturers in the academic world, the heads of many industrial laboratories and of Government technical establishments at home and abroad have also been recruited from the same source. No less than forty-one scholars have been elected to

fellowship of the Royal Society and four of them have received Nobel prizes. This side of the Commissioners' work—and it is by no means the only side—is perhaps the most notable of their achievements since under the inspiring lead of the Prince Consort they set themselves their first task of developing as a great educational centre the property purchased at South Kensington with the proceeds of the Great Exhibition.

The Institute of Metals

Two important announcements were made by the president of the Institute of Metals, Mr. W. R. Barclay, at the annual general meeting on Wednesday, March 10. The first dealt with co-operation with two sister institutes. As a first step in a scheme of co-operation with the Iron and Steel Institute, members of each Institute can become members of the other without formality other than written application. Combined annual subscriptions and entrance fees have also been arranged. The present scheme of co-operation follows one recently completed by the two Institutes with the American Institute of Mining and Metallurgical Engineers whereby members, associates and student members of the British Institutes may, if under the age of thirty-three years, become junior foreign affiliates of the American Institute of Mining and Metallurgical Engineers on specially favourable terms, the arrangement being reciprocal in the case of members of the American Society. The president also announced that the Council had decided to issue an appeal for the creation of an Endowment Fund, to be invested for the support and extension of the work of the Institute. For the last few years the margin between income and expenditure in the annual accounts had been very narrow, and had afforded little or no opportunity to strengthen the Institute's financial reserves. Economies had been effected wherever possible, but these could not be extended without seriously curtailing the service the Institute renders to its members and to the industry in general. In the judgment of the Council the time had arrived when, on the basis of the record and achievements of the Institute, an appeal could and should be made to the non-ferrous metals industry for a substantial capital sum which it was hoped would appreciably lessen the anxiety constantly felt by the Council and its committees as to the financial future. He was glad to be able to announce that promises or actual contributions amounting to about £14,000 had already been received.

Prehistoric Cultures and Chronology in North Africa

THE most recent contribution of M. R. Vaufrey to discussion of a group of chronological and cultural problems in the archæology of North Africa, of which an account appears in another column of this issue of NATURE (see p. 432), is of more than local interest in its bearing on questions of wide import in the study of prehistoric civilizations. M. Vaufrey, the distinguished anthropologist who occupies a chair in the Institut de Paléontologie humaine in Paris, has explored extensively over a number of years among the prehistoric sites of North Africa, and his studies in the classification of the cultures and in the prehistory of that region are accorded the authority due no less to his meticulous precision as an investigator in the field than to his ability in the analysis of archæological evidence recorded by others. In his latest contributions to a subject upon which no one is thus better qualified than himself to speak, M. Vaufrey has two main objectives.

IN the first place, M. Vaufrey's aim is to determine with such precision as the case warrants the cultural association and dating thereby of the 'fossil' man of Mechta el-Arbi, a problem of no little moment in the history of the development of early types of 'modern' man in the Mediterranean area; and secondly, to determine the age which should be assigned to the characteristic art form of prehistoric North Africa, the rock engravings of varied forms of animal life in naturalistic style, a question long a matter of controversy among archæologists, of which the suggested solutions have ranged from the palæolithic to the Iron age or later. By his conclusions that this type of early man belongs to the Mesolithic age and even later, the early Neolithic, while the cultures with which he is associated, by correlation with the early civilizations of the Nile valley, can be fixed in terms of years at a period extending from the beginning of the fourth millennium, down to the middle or even the end of the second millennium B.C., M. Vaufrey arrives at a result which will be of the first importance when brought into relation with the study of mesolithic and early neolithic cultures throughout the whole range of cultural distributions in the ancient world.

Prehistoric Caves in Kent

A RECENT subsidence of earth at St. Mary Cray, Kent, has revealed the existence of a subterranean cavity, which, it is thought, may prove to be the entrance to a considerable system of caves, similar to that at Chislehurst, two and a half miles away to the south, where thirty miles of galleries have been explored since the caves were rediscovered in 1902. Marks of deer-horn picks, still clearly visible, show where prehistoric man cut away the chalk. Although it will not be possible to attempt to explore the caves at St. Mary Cray until the fallen subsoil has been removed, entrance to two chambers, it is stated in *The Times* of March 4, has been made by Mr. Gibson-Cowan and Mr. Geoffrey Edwards, who found them to be about five feet high by thirty feet long. Probing with a pole ten feet long at the end of the farther chamber failed to encounter obstructing chalk, and it may be concluded, therefore, that they extend in this direction, while the existence of an earlier subsidence a quarter of a mile away, suggests that there may be a system of connected caves of considerable extent. The Chislehurst caves have produced few archæological relics; but as an Elizabethan villa has been shown to have had direct access to the caves by means of a stair, and the caves were used as refuges,

disturbance must have been considerable. At St. Mary Cray, there is no evidence of occupation, at least since Roman times. It is possible, therefore, that they may serve the needs of the archæologist to better effect, and it may be, throw further light on the prehistoric excavators of the chalk, to whose activities the dene holes, notably near Croydon, bear witness. Exploration of the newly discovered caves will begin as soon as the subsided clay has been removed and the roof of one of the chambers has been supplied with the necessary shoring.

Modern Developments in Broadcasting

IN a paper read before the Institution of Civil Engineers on February 16, Sir Noel Ashbridge traced briefly the growth of broadcasting transmission and television, and referred to some of the recent developments arising from the researches carried out by the B.B.C. The paper dealt at some length with the design of studios and the effect of size, shape and materials upon their acoustic properties. The advantages of the ribbon microphone over its predecessors were referred to, and the principal methods of sound recording were described. Improvements in the design of transmitting stations are broadly covered by schemes for economizing the power required for producing a given radiation output, and by the use of high vertical aerials, which tend to concentrate the radiation in the horizontal plane so as to give the most efficient service area. Sir Noel remarked on the difficulty of accommodating all the European broadcasting stations within the available wave-length band, and described the expedient of sharing wave-lengths between two or more transmitting stations by synchronizing their carrier waves. Next, a reference was made to the Empire broadcasting service, and the reasons which necessitated the use of short waves for this purpose were outlined. As a result of research carried out on the design of short-wave aerials to give the most efficient radiation, a considerable improvement is to be expected in overseas reception when the new short-wave transmitters of the B.B.C. are brought into operation in the near future. The paper concluded with a brief description of the methods and technique being employed for the transmissions from the London Television Station on ultra-short waves. The results of field strength surveys round London were given, and reference was made to the effect of interference from motor-cars and electrical apparatus.

Ultra-Short Wave Broadcasting

THE broadcasting service from the Alexandra Palace television station has already illustrated the suitability of ultra-short waves as a medium for the transmission not only of high-definition pictures but also of speech and music of very high quality. The latter achievement arises from the fact that in the ultra-short wave-band, the permissible band width available for the modulation frequencies is many times that obtainable amidst the present congested conditions in the medium and long-wave broadcasting bands. It is rather natural to suggest, therefore, that more use might be made of the ultra-short wave-lengths for high-fidelity sound broadcasting. This matter was referred to in a note in *The Times* of February 18, in which it was pointed out that this aspect has been under consideration by the B.B.C. for some time past. Indeed, experiments were carried out some years ago with a transmitter installed on the roof of Broadcasting House and operated on a wave-length of six metres. Further experiments are being conducted, but it is stated that no plans have yet been made for the development of a public service on these lines. A large-scale extension of the ultra-short wave broadcasting of sound would be complicated by at least two factors. First is the fact that the B.B.C. is not the only user of the band of wave-lengths below ten metres, for some other national services already have vested interests there. Secondly, there is the difficult problem of interference from the ignition systems of motor-cars, which cause very unpleasant noises in neighbouring receivers working on ultra-short waves. It would seem to be unlikely that broadcasting on these wave-lengths will become really popular until the fitting of suppression devices to such ignition systems is made compulsory.

Radio-Elements as Research Tools

IN a lecture to the Society of Chemical Industry on March 1, Prof. F. A. Paneth discussed "Radio-Elements in Chemical and Biological Research". Owing to the extreme sensitivity of electrometric methods it is possible to detect radio-elements in much smaller concentrations than any other chemical substances; and as they are isotopic with ordinary elements we can in many investigations substitute a radio-element for its inactive isotope. Such use of 'radio-elements' as indicators is frequently of great help if the behaviour of an element in very small concentration has to be investigated. Perhaps of even greater importance is a slightly different application. By mixing a fraction of a stable element with its radioactive isotope we can differentiate this fraction from the rest of the element, and then study the exchange of atoms of identical chemical properties. It is especially this use of 'indicated atoms' which opens the door to otherwise insoluble problems. Since the discovery of artificial radio-elements, almost every chemical element can be obtained in the form of its radioactive isotope, and the use of radio-elements as indicators has been greatly extended.

AMONG the problems to the solution of which radio-elements have contributed are the determination of the solubility of very slightly soluble compounds, the preparation of the volatile hydride of bismuth, the study of the permeability to air of almost completely airtight gas-mask fabrics, of the formation of alloys at low temperatures, the rate of solution of exceedingly thin films, and electro-deposition from extremely dilute solutions. With the help of 'indicated atoms' the diffusion of lead into lead, the determination of the surface of adsorbing crystalline powders, the exchange of atoms of one and the same kind in

chemical reactions have been studied for the first time. The active isotopes of carbon, phosphorus, sodium, calcium and other elements of special importance in biology make it possible to investigate the metabolism of these atoms. The use of radio-elements as indicators is steadily increasing and it is to be expected that in future many chemical, physical and biological laboratories will avail themselves of the great possibilities offered by this method in the study of an infinite variety of problems.

Bird Preservation

THE British Section of the International Committee for Bird Preservation, of which Dr. Percy Lowe is chairman and Mr. D. Seth-Smith treasurer, is appealing for support. It is governed by a committee of sixteen drawn from the Royal Society, the Royal Society of Edinburgh, the Zoological Society of London, the British Ornithologists' Union, the Royal Society for the Protection of Birds, the National Trust, the Society for the Promotion of Nature Reserves and the Society for the Preservation of the Fauna of the Empire. The British Section is not only representative of bird protection interests in Great Britain but, in addition, is in direct communication with similar sections of twenty-six nations. Its work is essentially international in character and deals with problems which can only be solved by scientific and even 'political' work on a very wide front. These include the drafting of a new international convention for the protection of European birds; the destruction of birds by waste oil at sea; the protection of the quail, which is caught in thousands during the breeding season for export to European countries; the conditions under which live birds are transported by sea; and an inquiry into the status of the Anatidæ. This latter, which is regarded as vitally important by scientific workers and sportsmen throughout Europe, includes investigations ranging from the conditions obtaining in northern breeding grounds to the diminution of *Zostera marina*. Of paramount importance is a scheme for ringing duck in order to trace their lines of migration. To carry out this work adequately it is essential that the income of the British Section should be greatly increased. All persons interested are therefore invited to become either patrons at three guineas or associates at 10*s*. 6*d*. a year. Subscriptions should be sent to the Secretary, Miss Phyllis Barclay-Smith, British Section, I.C.B.P., c/o Zoological Society of London, Regent's Park, N.W.8.

Town Planning and Decentralization

THE relationship of man to his work and his environment was explored from various aspects at a conference held by the Garden Cities and Town Planning Association, at the Housing Centre, 13 Suffolk Street, S.W.1, on February 27. Dr. Norman MacFayden, former medical officer of health for Letchworth, showed statistically that the satellite town has proved its great value from the health point of view; his comparative figures for tuberculosis and pneumonia were particularly convincing. He stressed the close relationship between man and Nature which is taken into account in the planning of garden cities, but which the modern congested cities, for example, London, Manchester, Glasgow, cannot provide. The case for the satellite town was further strengthened by papers presented by G. L. Pepler, Colin Clarke and Dr. D. H. Smith. Dr. Smith gave a full account of the uncontrolled location of industries in the Lea Valley on the outskirts of London, and pointed out that in the great majority of cases there was no reason why the factories should not have been located at a greater distance, within satellite towns. He listed a number of problems: noise, traffic congestion, traffic control, vulnerability in war time, journeys to work, as well as health and æsthetic aspects which should be further investigated and could be solved by decentralization. Mr. Colin Clarke estimated the change in the proportion of workers employed in manufacturing industries for 'export' and as compared with local industries and services, and concluded that the increase in the latter, following upon an increased standard of living, will also favour decentralization during the coming decades.

Electricity Supply in Great Britain

ON March 3, in reply to a question by Sir M. Macdonald, Mr. Hore-Belisha, the Minister of Transport, said that his Majesty's Government has decided to adopt in principle the recommendations of the McGowan Committee for a reorganization of electricity supply of the country. A few minor modifications would be added, which he understood would be generally acceptable. In the report it is stated that any attempt to carry through a scheme of reorganization on a voluntary basis would fail, and legislation must confer definite and adequate compulsory powers. It is also stated that schemes of reorganization should make provision for the possibility of ultimate public ownership of all undertakings, including those not at present subject to purchase by the local authorities. Complete standardization of systems and voltages and of methods of charge, as well as amalgamation of a large number of small undertakings into a smaller number of large ones will be necessary. As a result of such reorganization, considerable further development of rural areas should be possible. The scheme recommended by the McGowan Committee should result in a general, though necessarily gradual, reduction in costs. It rejects nationalization as a solution of the distribution problem, at least in the present stage of the evolution of the industry. It prefers to proceed by the gradual method of overhaul and consolidation and a more efficient grouping of existing undertakings. In a report published last December by P E P (Political and Economic Planning, 16 Queen Anne's Gate, S.W.1), the problem is summed up by saying that the public expects that the supply industry will hasten towards a future where the residential consumer, the farmer and the industrialist will have full freedom to use electricity to the greatest advantage. This will obviously take several years.

Nationalism and Use of Land

IN an article on "Nationalism and Land Utilisation in Britain" in the *Geographical Review* of January, Dr. Dudley Stamp directs attention to some of the results of a nationalistic policy in agriculture. Agricultural returns for 1935 and 1936 show an increase in arable acreage and in the total area of improved land, due to protective tariffs, marketing subsidy and, above all, the wheat quota. These schemes lead to excessive specialization in the commodities thus favoured, and they may, by bringing hill slopes under the plough, do more harm than good by the promotion of soil erosion. Again, the general application of, say the wheat quota, throughout the country overlooks the fact that though very little of the country is definitely outside the limits of wheat cultivation, a great part of it is not favourable, and would be harmed by constant soil disturbance. Another important consideration that is overlooked is the very small area of really first-class soils suitable for intensive arable farming such as market gardening, and yet near London and other great towns, where these products are most required, building is allowed to spread regardless of the value of the soil. Furthermore, in the 'reconditioning' of the land, or regrading to a fuller use, it is necessary to supplement the economic standard of judgment, cost per unit, by a standard of nutritional value, and pay more attention to meat and dairy products, poultry farming, and fruit and vegetable production.

Experiments in Resuscitation

A REPORT by the Soviet Union Year Book Press Service relates that ten years ago Dr. Sergei Briukhonenko carried out the following experiment. He removed the head of a dog and attached to it an apparatus which he called the autojector for artificial circulation of the blood, with the result that the severed head was kept alive for six months, reacting to all stimuli. Some years later, Dr. Briukhonenko succeeded in resuscitating a whole animal. A dog had its thorax opened and the action of the heart stopped. Death set in, but the animal was revived by the autojector. In 1936 the Institute of Experimental Physiology and Therapy was created to assist Dr. Briukhonenko in his researches. The result has been that not only has resuscitation been effected so long as half an hour after death, but also life has been maintained so that dogs which were put to death in various ways in August and September 1936 and then resuscitated are still alive and in excellent condition.

Lambeth Degrees

AN interesting note on these degrees, by Dr. Cecil Wall, appears in the "Brompton Hospital Reports", vol. 5, 1936. The power to grant such doctorates in any faculty was given to the Archbishop of Canterbury in 1534 through the Act of Supremacy and Succession. A number of degrees in medicine and science, apart from other faculties, have thus been conferred. The Lambeth doctorates were usually conferred for eminent service on those who were unable to conform with the university regulations for internal degrees. Among the men of science who received such degrees on the dates mentioned were Robert Hooke, physicist and secretary of the Royal Society (1691), John Woodward, geologist (1695), and Peter Dent, botanist (1678).

Books on Industrial Management

THE Management Library (23, Bloomsbury Square, W.C.1) has issued a list of forty-seven recommended books on industrial organization and management arranged under such headings as scientific management, finance and accounting, production management, distribution, advertising, commercial and industrial training. The Library contains some further three thousand volumes, and detailed lists, constituting a catalogue, are available free on (1) general management; (2) production; (3) accounting and company secretary; (4) distribution, including retailing; (5) rationalization; (6) psychology; (7) economics; (8) industrial biographies. Short critical reviews are published to keep members up to date as well as an annual cumulative subject-indexed guide to book selection.

Astronomical Society of the Pacific

AT the annual meeting of the Astronomical Society of the Pacific held in San Francisco on January 30, it was announced that the Catherine Wolfe Bruce Gold Medal for 1937 has been awarded to Prof. Ejnar Hartzsprung, director of the University Observatory, Leyden, Holland. In announcing the award, the president of the Society for 1936, Prof. A. O. Leuschner, gave an account of Dr. Hertzsprung's outstanding contributions to astronomy. Announcement has been made by the Director, Dr. W. H. Wright, of provision for an annual appointment to be known as the Alexander F. Morrison Memorial research associateship in the Lick Observatory. Appointments to the research associateship will be made by the regents of the University of California. "The appointee shall be an astronomer, or an authority on some other subject intimately related to astronomy, of wide and admirable repute by virtue of contributions of great value which he has made to the science of astronomy. The holder of the Research Associateship will reside at Mount Hamilton as a guest member of the staff for a certain portion of a year as would be agreed upon." Prof. Hertzsprung has accepted an invitation to be the first visitor under the new foundation.

A New Comet

A COMET of about the seventh magnitude was discovered during the evening of February 27 at the position R.A. $0^h\ 35{\cdot}3^m$: Dec. 19° 22′ N. (at $18^h\ 25{\cdot}1^m$ U.T.). It was first reported to the Central Bureau at Copenhagen by Prof. A. Wilk of the Cracow Observatory, Poland, but apparently the comet was discovered almost simultaneously by observers elsewhere. From observations made since February 27 at Warsaw, Meudon, Copenhagen, in England and elsewhere, two preliminary orbits have been com-

puted, but the one given by Whipple and Cunningham of the Harvard College Observatory appears to fit the observations the better. The elements of this orbit give the date of perihelion as 1937 Feb. 21·73 U.T. and perihelion distance as 0·620 ($\omega = 32° 9'$: $\Omega = 57° 3'$: $i = 25° 57'$). Thus during the present week the comet is receding from the sun, but its distance from the earth is decreasing. In consequence its brightness has remained nearly stationary, though possibly it may reach a maximum about March 13 or 14; although the comet is not a naked-eye object, it should be within the range of binoculars. On February 27, the comet was near the borders of the constellations of Pisces and Andromeda; since then it has been traversing the latter constellation, being near the bright star β Andromedæ in the evening of March 10; the comet's path, continued through Perseus, will have entered Cassiopeia on March 24. In Great Britain the comet has been photographed two or three times by Mr. G. F. Kellaway of Yeovil, Somerset; a short tail to the nucleus is shown on the photographs. Dr. A. C. D. Crommelin thinks that it is worth while to examine the possibility of identity of the present comet with that of the comets of 1532 and 1661.

Announcements

HONORARY membership of the Royal Asiatic Society has been conferred upon Prof. Jules Bloch, of the University of Paris, Prof. Carl Brockelmann, of the University of Breslau, and Prof. J. Ph. Vogel, of the University of Leyden, in recognition of their eminent services to Oriental research.

THE Royal Society of Edinburgh has awarded the Gunning Victoria Jubilee Prize for the period 1932–36 to Prof. C. G. Darwin, master of Christ's College, Cambridge, formerly Tait professor of natural philosophy in the University of Edinburgh, for his distinguished contributions in mathematical physics; and the Makdougall-Brisbane Prize for the period 1934–36 to Dr. E. M. Anderson, formerly of H.M. Geological Survey (Scotland), for his paper "The Dynamics of the Formation of Cone-sheets, Ring-dykes, and Caldron-subsidences", published in the Society's *Proceedings* within the period of the award.

ACCORDING to *Science and Culture*, at the annual meeting of the National Institute of Sciences of India held at Hyderabad on January 5, the following officers were elected for the current year: *President*, Prof. M. N. Saha; *Vice-Presidents*, Prof. S. S. Bhatnagar and Lieut-Colonel R. N. Chopra; *Foreign Secretary*, Prof. B. Sahni; *Secretaries*, Prof. S. P. Agharkar and Dr. A. M. Heron; *Treasurer*, Dr. S. L. Hora.

AT the annual general meeting of the Geological Society of London held on February 19, the following officers were elected for 1937–38: *President*, Prof. O. T. Jones; *Vice-presidents*, Prof. W. T. Gordon, Mr. J. F. N. Green, Prof. W. J. Pugh, and Prof. H. H. Swinnerton; *Secretaries*, Dr. L. Hawkes and Prof. W. B. R. King; *Foreign Secretary*, Sir Arthur Smith Woodward; *Treasurer*, Mr. F. N. Ashcroft.

AT the annual general meeting of the Society of Public Analysts and Other Analytical Chemists held on March 5 the following officers were elected for 1937: *President*, G. Roche Lynch; *Vice-Presidents*, A. L. Bacharach, H. E. Cox, B. S. Evans, A. R. Tankard, J. F. Tocher; *Hon. Treasurer*, E. B. Hughes; *Hon. Secretary*, Lewis Eynon.

THE International Commission of Zoological Nomenclature has elected Mr. Francis Fleming to be secretary in succession to Dr. C. W. Stiles, who has resigned on account of ill-health. The Secretary's address is: British Museum (Natural History), Cromwell Road, London, S.W.7.

BEGINNING on April 1, the Victoria and Albert Museum, including the India Museum, and also the Science Museum, South Kensington, are to remain open on Thursdays, Fridays and Saturdays until 8 p.m. At present the Museums close at 6 p.m. The Museums will remain open until 8 o'clock on the Monday bank holidays at Easter, Whitsun and August.

THE University of Lille has accepted the 15,000 francs awarded to Dr. Cloudesley Brereton for his book on France by the Commission du Tourisme, for a prize to be awarded in alternate years for the best essay on the works of M. Izoulet, of the College of France, and on Mr. Branford's work, "Eros and Psyche" (University of London Press).

JEAN CHAZY has been elected a member of the Section of Astronomy of the Paris Academy of Sciences in succession to the late M. Hamy.

PROF. HEINRICH GLOËL, of Wetzlau, has been awarded the Goethe Medal for Art and Science.

PROF. P. RIVET, professor of anthropology in the Museum of Natural History, Paris, has been created a Commander of the Legion of Honour.

PROF. L. VAN ITALLIE, of Leyden, recently delivered an address before the French Society of Clinical Biology, after which he was awarded the Pasteur Medal.

PROF. KARL BEURLEN, professor of geology and palæontology at Kiel, Prof. Albert Dietrich, professor of pathology at Tübingen, and Prof. Hans Seger, director of the Silesian Museum for Art and Antiquities, Breslau, have been elected members of the Imperial Leopold Caroline German Academy at Halle.

THE Rockefeller Foundation has made a grant of 10,000 dollars for the investigation of filterable viruses under the direction of Dr. George P. Berry, professor of bacteriology and associate professor of medicine at the University of Rochester (U.S.A.), and one of 6,400 dollars for the study of the biological effects of heat by Dr. Stafford L. Warren, associate professor of medicine and radiology.

NATURE

SUPPLEMENT

No. 3515 SATURDAY, MARCH 13, 1937 Vol. 139

Science and Industry in the Eighteenth Century

Matthew Boulton

By H. W. Dickinson. Pp. xiv + 218 + 15 plates. (Cambridge: At the University Press, 1937.) 10*s*. 6*d*. net.

ADVENTITIOUS insertion of obituary anecdotes in lectures and text-books has done much to create a pardonable prejudice against the historical approach to science. This is regrettable for two reasons. The first is that some of the most fruitful hypotheses have been built with a scaffolding of analogy and metaphor the significance of which lies buried in a forgotten social context. The other is that the history of science, which is also a record of the positive constructive achievements of the human reason, is largely neglected by official historians. Hence the social culture of the twentieth century does little to reinforce confidence in man's power of rational co-operation. Of late, there has been a new orientation, signalized in Great Britain by the publication of Hessen's much-debated essay, Prof. Woolf's book on seventeenth century science and technology, a new appreciation of Hooke's work, Crowther's "British Scientists of the Nineteenth Century", and a series of memoirs in the *Economic History Journal*. The most notable of the last-named are: one by Lennard, who has edited the "Heads and Enquiries" into the prosperity of British agriculture issued in the first decade of its existence by the Royal Society, and an article on the relations of science to early English capitalism by Prof. G. N. Clark.

In one way or another, these authors show a new interest in the growth of science as a department of social history. They are less concerned with the admitted capabilities and domestic idiosyncracies of the principal actors than with the social circumstances which enlisted their interests, provided them with problems for inquiry and supplied the means of solving them. The influence of technical, ideological and institutional changes on the momentum of scientific research and the impact of new discoveries on the progress of technology, social habits and social organization are now being recognized as the professional business of the historian of science. Inevitably this makes more exacting demands than the serial obituary method. It also creates the need for a *genre* of social history which has not yet been written.

The history of science may therefore prove to be a substantial bridge between naturalistic and humanistic studies, and the beginnings of a truly scientific humanism. Many years must elapse before an authoritative work ranging over so wide a field as Whetham's "History of Science" can be undertaken with due regard to the fact that science is a social institution and that scientific workers are members of a social group. Meanwhile, the more modest task of compiling case histories concerning organizations and persons with a pivotal relation to the application of science in social life can do much to provide the necessary materials. Matthew Boulton is pre-eminently such a person, and Mr. Dickinson deserves our gratitude for a work of ripe scholarship and rich entertainment. Such is the new biography which he has given us.

It is a curious circumstance that much more has been written about the relations of science and industry during the seventeenth and nineteenth than during the eighteenth centuries. The outburst of zeal for the prosecution of scientific inquiry in Stuart times was predominantly related to navigation and the beginnings of capitalist farming. London as the centre of English mercantilism was also the centre of a highly localized culture directly or indirectly related to mercantilist policy. During the subsequent struggle between the chartered monopolies and local manufacturing interests, London forfeited its pre-eminence. Edinburgh, with the brilliant coterie which included Black, Francis Home, Playfair, Hutton and Roebuck; Birmingham, with its Lunar Society of Boulton,

Erasmus Darwin, Wedgwood, Priestley and Watt; Manchester, with Henry, Dalton and James Watt, junior; and Bristol, with Beddoes and Davy, were foci of flourishing local activity in scientific research during a period when the official organs of education fully justified the pessimism finally ventilated in Babbage's tract on the "Decline of Science in England". As yet, none of them has been exhaustively explored for material relevant to the task of the historian of science.

For Birmingham the materials are most accessible. Not the least valuable part of Mr. Dickinson's biography are the opening chapters which trace its industrial development and personnel through what Nef ("Rise of the British Coal Industry") calls the first industrial revolution of Stuart times. Already in 1538, wrote Leland, "a great part of the Towne is maintained by Smithes who have their Iron and Sea cole out of Staffordshire". There the pottery industry, already flourishing in the seventeenth century, was destined to provide an early market for the partnership of Boulton with Watt. The propinquity of the Potteries proved important in more ways than one. Mr. Dickinson mentions the fact that Boulton's project to adapt the Newcomen engine for pumping water from the tail race to feed a mill-wheel "had been already adopted by other persons". From a recent article by Thomas in the *Transactions of the Ceramic Society*, it appears that it was first done by the master potter John Turner a few years before Boulton discussed the possibility with Benjamin Franklin. Extracts from this correspondence establish an interesting link between the Philadelphia Academy, the Lunar Society and the Edinburgh centre. Small, a Scots physician who had been professor of natural philosophy in the College of Williamsburg, Virginia, returned to his native country with an introduction from Franklin to Boulton, and was directly responsible for introducing Watt to the latter.

The close relations between the Edinburgh centre and the leaders of the Industrial Revolution in the eighteenth century would repay further search. The references to Black in the letters of Watt and the Wedgwood-Playfair correspondence included in the biographies of Smiles bear eloquent testimony to the unity of Scottish theory and English practice at this period. Mr. Dickinson gives us some relevant information about the business relations between Boulton and Roebuck (of sulphuric acid fame) and between Boulton and Keir, another Scots chemist, who set up an alkali factory about the same time as the introduction of the Leblanc process. The part which Birmingham played in the rise of chemical industry (in the modern sense) is not so widely known as its place in the history of power production. Watt himself was instrumental in getting bleaching powder produced on a commercial scale, and Murdoch's installation in the Soho factory started the commercial production of coal gas. The craze for 'bone china' sponsored by Spode at this period created a commercial demand for bone ash and possibly nursed into being the match industry.

James Watt, junior, who represented his father's interests in Manchester, is a direct link between the groups which respectively included Priestley and Dalton. How the new social need for theoretical guidance made it possible for them to pursue "knowledge for its own sake" has been sufficiently documented by Smiles. In the initial stages of the Industrial Revolution, chemistry was the science in greatest demand. Such was the social context in which chemical science was re-established on new theoretical foundations. It is a curious obliquity of vision to isolate the individual passion for truth from the historical circumstances which decide whether it is encouraged and along what paths it is guided.

Mr. Dickinson notes in his preface that no separate biography of Boulton has appeared since Smiles wrote "Lives of the Engineers: Boulton and Watt" in 1865. It will be recalled that the same author also wrote a life of Wedgwood. Mr. Dickinson, who has already given us a separate volume on Watt, would perform a great service if he added new materials to our knowledge of the social milieu in which Priestley worked. A companion volume on the Prince of Potters would be a welcome supplement. If a less spectacular figure than Boulton, Wedgwood, who co-operated with Boulton in providing financial backing for Priestley, was a more focal personality in relation to the scientific renaissance of their time. His scientific interests in pyrometry and geology, as well as in chemistry, closely followed the technical needs of the Potteries and ranged over a much wider field. There is a mine of new material at the library of the University of London in a recent unpublished dissertation by Thomas on the rise of the Staffordshire industry.

Mr. Dickinson writes with enthusiasm which merges into hero worship, and pardonably so. Men such as Boulton, Wedgwood and Roebuck were the finest flower of a stage in social evolution when the *entrepreneur* still discharged a creative function in organizing prosperity and encouraging the advancement of knowledge which makes prosperity possible. The book is beautifully illustrated with photographs of Boulton's products and mechanical diagrams. A feature which will commend it to students of economic history is the account of Boulton's relations with the Mint and the technical problems of coining in his time.

L. H.

Place-Names and their Study

(1) The Place-Names of Warwickshire
By J. E. B. Gover, A. Mawer and F. M. Stenton, in collaboration with F. T. S. Houghton. (English Place-Name Society, Vol. 13.) Pp. li+409. (Cambridge: At the University Press, 1936.) 21*s*. net.

(2) The Concise Oxford Dictionary of English Place-Names
By Eilert Ekwall. Pp. xlviii+520. (Oxford: Clarendon Press; London: Oxford University Press, 1936.) 15*s*. net.

(1) THE volumes issued by the English Place-Name Society steadily increase in interest as the series lengthens. This is due in no small degree to the added skill which comes from experience in dealing with the material. The Warwickshire volume, it is true, is only the second excursion of the Society into the Midlands; but apart from the adventure of new country, the names on the whole have not the intrinsic attraction which is attached, for example, to the wealth of evidence relating to paganism in the volumes for Surrey and Essex, to name the most recent issues, nor can Warwickshire make a contribution equal in interest to that of the latter of these two counties in the study of early Saxon settlement.

The earliest reference to the name of the county is in the Anglo-Saxon Chronicle under the year 1016 in the form Waerincwicsir. It appears in a later reference as Waeringscir. That the area of the present county is not a homogeneous unit is indicated by the character and distribution of the place-names, which preserve the distinction, political indeed, but determined by geographical conditions, affecting the character of settlement, rather than by any adjustment of racial boundaries.

So long ago as the seventeenth century the famous Warwickshire antiquary, Dugdale, noted the distinction between the northern and southern areas of the county. This is to be seen in the fact that in the north, where are such names as Birmingham, Tamworth, Polesworth, settlement is of the hamlet type, whereas in the south there are large villages with the open field system, as around Oxhill and Tysoe. The settlements of the north are typical forest clearings. The Hwicce advancing into the south from the west, and founding their settlements along the valley of the Avon, found themselves on the edge of the great forest of Arden, which joins on practically continuously to the great Royal forests of Feckenham, Morfe and Cannock. Here they halted; and this northern area was left to the settlement of the Mercians, who advanced along the valley of the Nene. For them the forest determined that the form of their settlement should be the isolated farm and hamlet and not the village with its open field. The boundaries of the ancient sees of Worcester and Lichfield preserve the older civil distinction. In the Lichfield diocese, Mortimoe, near Radway, has been traced to an earlier form Mercna Mere, "the boundary of the Mercians".

Among the references to early conditions preserved in place-names one of the most interesting is Tysoe. This, the "hoe" or "hob" of Tiw, is the first reference to be encountered in the survey of the name of the old English pagan god of war. It clearly associates his worship with a spur of the Cotswolds, which forms the south-eastern boundary of the Vale of the Red Horse. Although no early reference to the latter name has been found, as the editors point out, it affords strong probability that the hills bordering the vale were once marked with a symbol appropriate to the war god. In any event, the name proves that the Hwicce were still sturdy pagans when they reached this point of their advance.

References to either Britons or Norse are not numerous. Walcots and Bretford are among indications of the former, while the latter appear only on the eastern boundary, as, for example, in the name Kirby, being confined here, as elsewhere, to the eastern side of Watling Street. Celtic derivations appear most numerously, as usual, in connexion with rivers and streams as in Anker, Avon, Arrow, Itchen and Leam.

Memory of the exploitation of the salt mines of Droitwich lingers in the name Salt Street, which appears three times on the line leading in the direction of Stratford.

Neither Norman-French nor purely French names have left a strong mark on the county. Among the latter is Beaudesert, the name of a castle in France, and among field names occur such as "le commun champ" and "le novel gardin".

(2) The volumes of the English Place-Name Society, while satisfying the need of general interest, are planned with the requirements of scholarship in view; but they have not yet covered the ground, nor will they do so for some

time to come. In the meantime Dr. Ekwall's admirable "Concise Oxford Dictionary of English Place-Names" is available as a source of information and instruction, both for those counties with which the Society has still to deal, and to meet the needs of those who are interested in the subject without being specifically students in this or related branches of research. Here the place-names are set out in alphabetical order, each with an indication of its component elements and derivation. Although the list is not complete, it is sufficiently full to meet all but an exceptional test. As a corrective of the uninstructed enthusiasm of the place-name mythologist, Dr. Ekwall provides a preface in which he has set out the main principles to be followed in the study of place-names, and indicates the principal provinces of study—archæology, local and national, and social and racial history—in which it has proved an invaluable aid to research.

Accidents

Accidents and their Prevention

By Dr. H. M. Vernon. Pp. ix +336. (Cambridge : At the University Press, 1936.) 15*s*. net.

INCREASING attention is being paid to industrial accidents and their prevention throughout the world ; the question has indeed become one of scientific study and inquiry into the proneness and incidence of accidents in relation to personal qualities and environmental conditions.

In Britain, in all good factories, the immediate treatment of minor injuries is being encouraged so as to minimize the time lost by absence from work. Systematic inquiry is being made into the cause of all accidents, and it is customary to hold a regular 'court-martial' into the more serious ones. Careful statistics are kept and exchanged with other firms, and trade associations give special attention to problems which are common to their industry. The Home Office is at all times helpful in a variety of ways.

Accidents are in the main due to human error, but it is the duty of the employer to remove so far as possible all temptations to err. The subject in some of its aspects occupied a session at last year's Chemical Engineering Congress, when the interesting fact was brought out that in Germany the after-care of the injured falls on the firm, whereas in Great Britain it falls largely on the insurance company.

In the main, in large establishments a great deal is being done, though this must be regarded only as a step towards even better conditions : in small factories and working establishments, there is doubtless still much to do, and it is these which require legislative stimulus to make them realize their responsibilities. The slogan "Safety First" is widely preached and the nation is slowly being educated to develop a safety habit of mind, though it would be obviously bad if all of us in consequence became over-cautious and were unprepared to take justifiable risks.

Enough is known about the generalities of the subject to make it possible to write about them in text-book form, and we know of no one more capable (both from his past experience and sympathetic attitude) to do this than Dr. H. M. Vernon. His book should be widely read, and will prove of particular value to safety officers and those others who are concerned in protecting their operatives. It deals, however, with much more than factory accidents, which are, as we know, only a small proportion of the total—there are accidents in the home, on the railways and most of all on the roads. Whereas the factories can be reached by legislation, the prevention of accidents elsewhere depends on a number of factors.

The question of the causes of the terrible loss of life and limb on the roads is far too thorny a one to be discussed in a review. It is a world problem and so serious as to constitute a major problem : it is known that it is receiving careful study on the lines discussed by Dr. Vernon in three of his chapters. The public at large is so obsessed with the desire for speed as to be unmoved by a casualty list which would spread horror in war time.

As against the danger of the roads, the railways have been rendered entirely safe by attention to the elimination of the risks. The air is relatively safe as the result of stringent regulations based on scientific study. The loss of life on an ill-found ship is followed by a searching inquiry and the fixing of responsibility.

There is very definitely a science of accident prevention, and it is to be hoped that this informative and valuable book will come into the hands of the largest possible number of readers.

E. F. A.

Cinematographic Anthropology

We, the Tikopia:
a Sociological Study of Kinship in Primitive Polynesia. By Dr. Raymond Firth. Pp. xxv + 605 + 25 plates. (London: George Allen and Unwin, Ltd., 1936.) 30*s*. net.

THE cinema is characteristic of the age. It responds to a craze to see from an arm-chair an exact likeness of the reality in which we daily move. This spirit has invaded the social sciences. Archæology is giving up the attempt to *explain* civilization; its highest ambition is to photograph it at any given period. Anthropology has caught the infection in the most virulent form, because it is fatally easy to visit some obscure tribe, bring back continuous verbal pictures, and reel them off in volume after volume.

While we sit in our arm-chair, there pass before the mind's eye "sullen grey days with lowering clouds", the "sun-bleached thatch of sago palms", "down-drooping velvet-surfaced leaves of the taro". We can hear a servant's quavering laugh of fright, chubby little things welcoming father home, and (twice, p. 174 and p. 239) mother being notified of baby's lapse from propriety. As Dr. Firth sagely remarks, "banality about a tropic dawn is difficult to avoid when the scientist tries to range himself with the writers of fiction and belles lettres" (p. 51); but the temptation to indulge in belles lettres about the South Seas is too strong, and we have to resign ourselves to sit through an interminable "series of vignettes" (p. 110) for the sake of an occasional one which may be valuable because it serves for generalizations.

We have to sit through much that we might see at home. Read Cornwall, Manitoba, Peru for Tikopia in par. 1, p. 89, par. 3, p. 128, par. 3, p. 160, etc., and it will apply. Do we really send expeditions to the Antipodeans to come back and tell us that they are men who eat, work by day, and sleep by night, whose children cuddle up to them, and who may be good or bad parents?

So many of these "slices of life" (p. 89) are trivial. By that we do not mean small. An accent is a small thing, but it is not trivial because it has laws, alters sounds and affects etymology. Dr. Firth's excursion into "that unprofitable study, the etymology of Polynesian words", might have been more profitable if he had noticed the laws of Polynesian accent (p. 70). But to know that Sukimataranga is a bit of an acrobat (p. 14) is no good to anyone, and therefore trivial.

These vignettes are indeed accompanied by a commentary designed to bring out their scientific value. Unfortunately, the commentary often takes the place of the facts. The oft-repeated excuse is that space is lacking for complete "documentation". Surely room could be made by jettisoning lists of points there is no space to discuss (for example, pp. 429, 432), fine writing, trivialities, jettisoning even some of the texts. Text *S*.11, p. 244 might figure in a grammar, but the fact that it was heard used by a mother to her son does not make it a kinship phrase. Thus ample room could have been made for more of those illuminating statements by natives which Dr. Firth distributes all too sparingly (pp. 113, 191, 305, 332). His very valuable documents on conception (pp. 480 ff.) reward us for much long-suffering. Chapter xiii is one of the most useful because there Dr. Firth comes nearest to following his own advice that "the observer's theoretical explanations should be separated from the account of the actual happening" (p. 423).

Interpretations are no substitute for the "documents". Dr. Firth's interpretation is that for Tikopians English phrases have a talismanic value, but what Pa Tekaumata said was that they are a useful monopoly (p. 39). We should have liked to hear a Tikopian comment on the lines "your sky stands in the ocean" (p. 289), but the voice is Dr. Firth's in a 'belletristic mood'. A more prosaic interpretation is possible: "sky" in parts of Polynesia means "tomb". Compare these commentaries with Miss Alice Fletcher's "Hako" and it will be seen how much anthropological workmanship has fallen off in the last thirty-two years. As there is no vocabulary, we cannot check the translations.

Considered as contributions to theory, some of Dr. Firth's reflections are worth pondering, for example, on avoidance of kin (p. 322), and of the mother-in-law in particular (p. 314), on kinship and procreation (p. 247). Too many, however, are platitudes inflated with an uncouth phraseology. We knew that different societies have different marriage rites; the only thing we did not know was that it could be expressed as having "each their own mechanisms for dealing with the problem of transferring the major allegiance of a woman from her parents to her husband" (p. 574). It sounds more profound than it is to say that "a system of ownership of land is a mechanism of

social stability" (p. 407), while to say that Tikopia "is not a community where the differential possession of wealth is an overt feature in the social structure" is longer but conveys no more than "there is no pronounced inequality of wealth" (p. 372). The functional school has fallen under the spell of the social science jargon of America, where it conceals the poverty of ideas.

Ideas are not the strong point of this book; facts might have been if the Tikopians had been allowed to speak for themselves throughout.

A. M. Hocart.

Fifty Years of Plant Physiology

An Introduction to the Principles of Plant Physiology

By Prof. Walter Stiles. Pp. xviii+615+5 plates. (London: Methuen and Co. Ltd., 1936.) 27*s*. 6*d*. net.

THE publication of this book is, in some respects, a noteworthy event, as it is the first reasonably complete treatise on plant physiology published by a British author since the work of Vines in 1886. The enormous development of the literature of the subject during that period is illustrated by the long list of references included in this volume. This consists almost entirely of the more important papers published since that date. The present volume, therefore, deals almost exclusively with the plant physiology of the last fifty years.

It is of interest to compare the more noteworthy advances which are evident. The concepts underlying all branches of the subject have, of course, gained greatly in precision and, usually, they can now be illustrated by quantitative data. Especially noteworthy are the great advances in our knowledge of the properties of the leaf pigments and to balance this, a comparable clarification of the dynamics of photosynthesis. We can now distinguish mentally the role of diffusion, of photochemical change and of 'dark' reaction, even though the details of these stages in plants may still lack precision. Equally well advanced, in the relative sense, is knowledge of the absorption and conduction of water and of solutes by plants. The principle of osmosis had indeed already been established fifty years ago. But though we may now at least conceive (if with some misgivings) how water may be transported up a tree, we have been presented with still another problem in the physiology of conduction, that of accounting for movement of solutes through the phloem at rates of the order of tens of thousands of times greater than those observed in diffusion.

Again, although enormous strides have been made in understanding the mechanism of respiration, particularly in yeast and other fungi, the possible connexion in plants between fermentation and ærobic respiration, already suggested fifty years ago, is still not conclusively proved or disproved. In spite of much research, the problems involved in nitrogen and fat metabolism in plants still largely defy simple or comprehensive treatment; and considering the advances made in genetical knowledge, we are still curiously ignorant of the cell nucleus as a biochemical or physiological unit. Similarly, though very considerable advances have been made in the description and dynamical analysis of growth and of tropistic movements, it is only quite recently that much success has attended inquiry into the mechanisms underlying these phenomena.

In order to discuss such a variety of subjects adequately, Prof. Stiles, of necessity, has had to limit his treatment. He has done it by assuming a general knowledge of chemistry and by dealing mainly with the cardinal principles involved. These are considered under four main headings; (1) the general physiology of the plant cell (including respiration); (2) metabolism; (3) the physiology of growth and development; and (4) that of irritability and movement. In the introduction, the author expresses the hope that the book will be useful to undergraduates reading for pass and honours degrees. There is no doubt that this will be the case, and the treatment is, moreover, sufficiently comprehensive to make it also a valuable source of information to botanists in general. The author's name is a sufficient guarantee that it is well written, that its material is reliable and its conclusions well founded. In fact, only one slip, that in the formula for γ-fructose on p. 151, has been detected.

To some extent, the limitations imposed in choosing and compressing the available material must rightly tend to stifle criticism. Such a work as this must be viewed as a whole and not as a series of isolated chapters, and there are few who could or who would care to deal adequately with so many and such varied topics. One reader might prefer to see more space devoted in the chapter on salt absorption to recent work on the energy relations of this process. The fundamental

property of plant cells of accumulating ions against the concentration gradient seems to demand this treatment. Again, there are certainly some workers who would prefer to use the terms protease and peptidase rather than to employ pepsin and erepsin, on the grounds that the latter terms are not necessarily applicable to the majority of proteolytic enzymes in plants. The reference to cytochrome may possibly be regarded as somewhat brief, and the paragraphs dealing with sexual reproduction suggest that reference to recent work on sex differences might also be included. These features, however, detract from neither the broad scope nor the general utility of the book, and might well be allowed to be matters of individual preference. W. H. P.

Biological Control of Insects

The Biological Control of Insects: with a Chapter on Weed Control. By Prof. H. L. Sweetman. Pp. xii+461. (Ithaca, N.Y.: Comstock Publishing Co., Inc., 1936.) 3.75 dollars.

MUCH that has been written on the subject of biological control is of a scattered and rather fragmentary character. Some of these writings record successful application of the method; others are biological studies more or less incidental to practical issues; while a few are attempts to formulate the general biological principles involved The factors governing success or failure, where biological control is put into practice, are generally manifold and complex. We do not understand the operation of these factors sufficiently to be able to forecast an end-result with any certainty. Each project is of the nature of an experiment in itself which may, or may not, give the desired practical outcome.

The amount of information and data now available fully justifies judicious sifting and embodiment in book form. Prof. H. L. Sweetman is, consequently, to be congratulated on being the writer of the first text-book solely devoted to biological control. It had its inception, he tells us, in some teaching courses on the subject which he gave at the Massachusetts State College. The book is essentially scientific in outlook and acquaints the reader with the life-cycles, habits, methods of manipulation and of utilization of various organisms employed, or likely to be utilized, in schemes of biological control. It is, therefore, not wholly devoted to parasitic and predaceous insects. The general principles of parasitism and other phenomena come in for discussion, while the biological control of noxious plants forms the subject of a separate chapter.

Without going further into detail, the book is to be recommended as a sound introduction to the subject, which is treated from a broad point of view. It is both well arranged and well illustrated, while the literature is adequately covered in the 30 pp. of bibliography. Admirable as the book is, one cannot overlook the fact that it has been compiled to some degree by lifting whole paragraphs bodily from the writings of others. These excerpts bear neither parentheses nor reference numbers to the literature concerned. They are either copied verbatim or with some trivial alterations only. Such practices do not militate seriously against the undoubted value of the book, but they are disconcerting, and so is one of the portraits, which is not that of the person it is stated to represent.

A. D. IMMS.

Principles and Practice of Fruit-Growing

Hardy Fruit Growing By Sir Frederick Keeble and A. N. Rawes. Pp. xi+334+21 plates. (London: Macmillan and Co., Ltd., 1936.) 16*s*. net.

THIS is not a text-book, and it is certainly not a scientific treatise, but it is nevertheless one of the most valuable additions to horticultural literature we have had for some time. It is merely an unusually lucid, explanatory account of the practice of fruit-growing and an exposition of the scientific principles underlying the art. Chapter and verse for the statements made are not given, indeed only one reference to an original paper is quoted in the whole book, but so thorough and complete is the knowledge and so authoritative its presentation that one is left with the feeling that, even in subjects where controversy does exist, the methods advocated by the authors will at least give excellent results. The Worshipful

Company of Fruiterers, to whom the book is dedicated, is owed a debt of gratitude for conceiving the idea of so happy a collaboration. It is safe to predict that this volume will be the standard guide and reference book for many years to all who grow outdoor fruit.

The book is divided into three sections; Section 1 deals with the making and maintenance of the orchard and fruit garden, and comprises the main reading matter of the volume, in contrast with Section 2 which is intended for reference only. In this first section, the treatment of the subject of pruning requires special mention. All too often in works on practical horticulture this subject is treated in one or other of two ways. Either an attempt is made to describe in detail, often with complicated figures, the precise point at which any particular type of shoot should be cut, without more than a half-hearted effort to explain the why and wherefore, or else an involved account is given of the objects of pruning and the novice is left to infer for himself what to do in particular cases. In the book under review, the subject is treated in logical order, beginning with what pruning does and then explaining very clearly how to do it.

The chapter on where and where not to plant is also very well done, for advice on where not to plant is of as much importance as its more positive opposite, but is rarely to be found.

Section 2, however, will be to the experienced grower as well as the novice the most permanently valuable part of the book. It gives in condensed form details of culture, propagation, choice of varieties, and the more important pests and diseases and their control, for each kind of fruit separately. The amount of condensed information is astonishing. As would be expected from one who knows varieties so intimately as Mr. Rawes, the selection of varieties for different purposes is admirable and displays far more critical appreciation than in any previously published lists.

Section 3 is intended to serve as an introduction only to commercial fruit-growing. It is very short, and admittedly far from complete. Perhaps the best piece of advice in it is the indispensability to the commercial grower of Seabrook's "Modern Fruit Growing". The separate chapter on strawberries under glass is presumably added as information on this specialized line is difficult to get.

The format of the book is attractive and the print and paper of the usual high standard to be expected of the publishers. If a criticism may be made it is that more illustrations might usefully have been included. Those given are very good and mostly helpful, but refer mainly to apples. There seems no obvious reason why pear scab should have been picked out as the only fungal disease to be illustrated. However, it is refreshing to find that the usual valueless illustrations of one or two of the best-known apple varieties to be found in every other book of the kind have been omitted.

R. H. S.

Gem-Stones

A Key to Precious Stones

By Dr. L. J. Spencer. Pp. vii+237+8 plates. (London, Glasgow and Bombay: Blackie and Son, Ltd., 1936.) 5*s*. net.

DURING the past thirty years or so, much more interest has been taken, both by those in the jewellery business and by those who purchase their wares, in that part of mineralogy which is concerned with the stones used in jewellery. The former have found it imperative to be better informed about the stones that come into their hands, because of the increasing number of minerals which are being drawn upon for ornamental purposes. This moderately priced book is the latest on the subject, and comes from one whose career has well equipped him to write it. Dr. Spencer spent his official lifetime in the service of the Trustees of the British Museum, retiring as keeper of minerals, and in 1904 he gained an extensive grounding in the subject by translating Max Bauer's great treatise on precious stones.

The book is arranged on the usual plan. The first part, which is slightly the shorter of the two, deals with such portions of physics, chemistry and geology as are required for the proper appreciation of the properties of gem-stones, and the second part is concerned with the description of the several species. In his preface, Dr. Spencer points out that the determination and naming of the stones can be correctly done only with some knowledge of the principles of mineralogy.

Considering the long experience enjoyed by the author, it is strange that this book, which purports to be the key to the subject, should lack the lucidity and accuracy in the information wanted in practice. The characters generally used for the discrimination of cut stones are the specific gravity and the refractivity, especially the latter. In

describing the use of heavy liquids in the determination of specific gravity, Dr. Spencer gives details of the elaborate set of tubes which he says that he has used for thirty years; but omits any reference to the diffusion column which is so convenient for a rapid test. A much more serious matter is the incomplete and inaccurate description of the refractometer and its use. He appears to have had little personal experience with this instrument; otherwise he would not state that in doubly refractive stones the greatest and least of the refractive indices may be found only if the facet under test is cut in a certain direction, whereas, as is well known to students of the subject, any facet will serve. Two interesting chapters on the geological occurrence and origin of precious stones and on their mining are included in this part of the book.

In the second part the properties and occurrence of the mineral species that have been used as gem-stones are discussed in twelve chapters. In order to keep the number of chapters so small, the second rank of species are grouped in pairs—spinel and chrysoberyl, beryl and topaz, garnet and tourmaline, zircon and olivine—and a host of minor minerals appear in the penultimate chapter, the final one as usual being devoted to the organic gems. In view of their importance, diamond and corundum with its well-known varieties, ruby and sapphire, are discussed in separate chapters, and both quartz and jade have been segregated. Opal has been linked with silica-glass; the author joined an expedition to the Libyan Desert to study the origin of the latter substance, a fact which perhaps explains the space devoted to its description, as it is unlikely to fill more than a humble place in jewellery. At the end of each chapter is appended a useful summary of the characters of the several species.

The book is illustrated by many drawings which appear in the text as well as by plates. There is also a plate in colour showing the principal gem-stones, but by a curious whim of the publishers it is printed on the dust-jacket. Considerable difficulty is still experienced in achieving a faithful reproduction of gem-stones in colour, and that in the present instance the result is far from true is not surprising. The key to the plate appears on the end-papers front and back. A good index adds to the value of the book.

Radio Communication for the Student

Wireless Engineering

By Prof. L. S. Palmer. Pp. xii+544. (London, New York and Toronto: Longmans, Green and Co., Ltd., 1936.) 21*s*. net.

PROF. PALMER'S book on wireless was published in 1927 under the title "Wireless Principles and Practice"; the present edition bears the title "Wireless Engineering". This change of title is a consequence, we are told in the preface, of a rearrangement of the book and of the introduction of new matter. Comparison of the two editions, however, shows that as regards arrangement the new edition is very like the old, the heads of chapters and sections being almost identical.

As the arrangement of matter seems open to serious criticism, we summarize here the contents of the chapters to show their order: wave motion, theory of oscillatory circuits, description of miscellaneous apparatus and of aerials, theory of some special circuits, theory of thermionic tubes, description of spark and arc plant, theory of triode oscillators and descriptions of plant, wave propagation, detection of oscillatory currents, amplification, telephony and directional wireless. This order of presentation inevitably leads to difficulties in exposition and to the multiplication of forward and cross references. Also, clearly, the interpolation of a chapter dealing with a miscellany of apparatus between two chapters on the theory of oscillatory circuits cannot facilitate the task of learners. Similarly, the intrusion of a chapter on ancient spark and arc plant into the midst of the theory of triodes and triode oscillators produces another awkward break. Again, the chapter on directive aerials at the end of the book suffers by its distance from the section dealing with aerials in general. We had hoped that the opportunity of rearrangement opened by the call for a new edition would have been taken more wholeheartedly.

This lack of logical order in the chapters is often echoed inside them. For example, in the chapter on wireless circuits and aerials we find brief statements about dielectric losses, square law condensers, measuring instruments such as thermo-couples, the self-capacity of coils, selectivity, together with photographs of great masts. It is to be regretted that these various items were not transported to happier positions during the preparation of this second edition. Similar comment may be made on the chapter on the detection of

high-frequency currents, for this winds its tortuous way from coherers and crystal detectors to mercury arc plant for power stations, from the heterodyne method and the forgotten ticker to loud-speakers and the acoustic design of their horns.

These defects of arrangement do not, however, prevent a wireless expert from appreciating the general accuracy and wide variety of the information afforded, and the lucidity of the descriptions and explanations. But the wealth of small detail is sometimes fatiguing, and the procession of facts is sometimes packed so tight as to give an air of breathless haste. This, though useful as a memory refresher for the experts, may offer difficulties to the students for whom the book is intended, especially as the living and growing tissue is not distinguished from the dead wood.

In bringing a book on wireless engineering up to date, some authors would be influenced by the fact that in these days the number of wireless engineers concerned with apparatus for receiving signals is vastly greater than the number of engineers working on transmitting gear. But Prof. Palmer has not bothered about this; and therefore, we think, he has given far too little attention to, say, filter circuits, the matching of circuits, the use of padding condensers for yielding a constant-frequency difference between two varying circuits, decoupling connexions, and variable selectivity devices, all of which are necessities to the practising engineer, and, moreover, form instructive exercises for students. Further, in the chapter on thermionic tubes, the screen grid tetrode, perhaps the most important of all modern inventions in this field, gets short shrift, and the variable mu valve passes without any blessing. As for the great series of modern forms of tube, ranging from the pentode to the octode, and including such combinations as the duo-diode triode, these all remain unhonoured. Even such an important modern receiver as the superhet, of which hundreds of thousands are in use, gets less attention than the long-discarded arc transmitter, of which only odd examples survive.

Many wireless engineers and many students will no doubt feel that it would have been more helpful to them if these matters had been given some of the space allotted either to obsolescent things or to the analysis of the ionosphere, even though this last is admirably done and has intrinsic interest for physicists.

Infancy of Chemistry

Prelude to Chemistry:
an Outline of Alchemy, its Literature and Relationships. By Prof. John Read. Pp. xxiv + 328 + 64 plates. (London: G. Bell and Sons, Ltd., 1936.) 12*s*. 6*d*. net.

THE early ages of chemistry possess a romantic glamour unshared by those of any other major science, which perhaps explains why chemists are so generally interested in the history of their subject. Prof. Read's interest reaches the level of enthusiasm, and though he expressly disclaims to have attempted to add to the formal literature of chemical history, his book—which may be appropriately classed among the *belles lettres* of chemistry—could have been written only by a scholar deeply and widely read in both primary and secondary authorities. His guiding principle has been to show the cultural relationships of alchemy, examining the numerous points of contact it made with religion, philosophy, mysticism, magic, mythology, literature and even music, and exhibiting it in proper perspective against its general social and intellectual background.

This treatment of the early history of chemistry is something quite new, and in Prof. Read's hands has resulted in a book of peculiar charm. An easy style, a nice sense of words, and a whimsical humour that never descends to facetiousness, add attractiveness to a story that has often been told, but rarely, if ever, in so delightful a manner. The professional historian of chemistry will, it is true, find few facts here that he did not know before, and may perhaps regret, according to his personal preferences, that certain periods and persons have received disproportionately small attention; but he will nevertheless enjoy the colourful tapestry of medieval alchemy which Prof. Read has woven with characteristically delicate skill. The general reader may be happy in the assurance that nothing of significance in recent work on the history of chemistry has escaped Prof. Read's notice. He mentions, for example, Prof. A. J. Hopkins's ingenious colour theory of alchemy, Prof. Tenney L. Davis's notable researches on Chinese alchemy, and Prof. J. R. Partington's investigations of chemical origins, as well as the work of Prof. Julius Ruska and others on Arabic chemistry; and in every case—as throughout the book—he is eminently successful in selecting the points of real interest and importance.

A further source of pleasure is provided by the admirable collection of illustrations, including a coloured frontispiece of the exquisite "Peacock in the Vase of Hermes" from a British Museum MS. of the "Splendor Solis". Alchemy relied very largely upon pictorial representation, so that its tenets cannot be properly appreciated without continued reference to such graphic aids; the "Mutus Liber" (included in Manget's "Bibliotheca Chemica Curiosa") claims indeed to set forth the whole of Hermetic philosophy in a series of unannotated pictures.

Count Michael Maier (1568–1622) pressed another of the arts into the service of alchemy, setting to music—presumably of his own composition—Latin epigrams on secrets of "Chymical Nature". Prof. Read had the excellent idea of persuading a St. Andrews choir to learn and to sing some of these alchemical fugues, and since their rendering has been perpetuated in a gramophone record, anyone who wishes may hear it. In this part of his work he has had the assistance of Mr. F. H. Sawyer and Prof. H. J. Rose, whose modern chemical canon, "Hydrogenesis", written and composed in imitation of Maier's, shows 'a pretty wit': "*Aëre cum crasso tenuis componitur aër; adde Iouis fulmen, fit sonus, unda manet.* With a dense gas a thin gas is mixed; pass the electric spark, and pop! you have water." But it must have been Prof. Read who so thoughtfully added: "$2H_2+O_2=2H_2O$"!

E. J. Holmyard.

Quantitative Organic Microanalysis

Quantitative Organic Microanalysis of Fritz Pregl

By Dr. Hubert Roth. Third English edition translated from the fourth revised and enlarged German edition by E. Beryl Daw. Pp. xvi+271. (London: J. and A. Churchill, Ltd., 1937.) 18*s*.

THE brilliant yet painstaking investigations of the late Prof. Pregl have placed quantitative organic microanalysis on such a sure footing that not only have such methods been widely adopted but also improvements and additions are constantly being introduced. Indeed, to-day, practically all the analytical procedures which the organic chemist is likely to require have been made available for him on the micro scale. This rapid development of the subject has made necessary a further edition of Pregl's well-known manual, which has now been brought up to date by Dr. Roth and translated into English by Miss Beryl Daw.

The book has been considerably enlarged and revised and, as hitherto, it opens with a section on the microchemical balance. To the matter in previous editions there have been added descriptions of a new Kuhlmann aperiodic balance, of two of the latest Bunge types, while a brief mention is made of ultra-microchemical balances.

The section dealing with elementary analysis has not been greatly modified. A method of estimating carbon in the wet way is given, while the micro-Kjeldahl determination of nitrogen has been revised and a detailed description given of Friedrich's incineration with hydriodic acid. Other new procedures include a wet decomposition of halogen derivatives; the determination of iodine as iodate; the estimation of sulphur in the presence of nitrogen, chlorine and bromine.

It is in the sections dealing respectively with the general groups and physical methods that the greatest alteration has been made, numerous new methods being included. These comprise the determination of active hydrogen by the Grignard reagent; the titration of amino acids; the volumetric determination of alkoxyl, alkylimino and S-alkyl groups; the estimation of C-methyl and of isopropylidine groups; catalytic microhydrogenation processes. New physical methods which are given include the microscopic determination of melting points; the adaptation of Schleiermacher's principle to 'micro-boiling points'; the determination of molecular weights by Barger's method of isothermal distillation; the photoelectric measurement of absorption spectra; the determinations of molecular refraction and specific rotation.

In the descriptions of the various procedures, there is given first a brief historical survey of the estimation, after which the apparatus and materials used are discussed. Then follows a very lucid and detailed summary of the course of the determination, while, finally, an actual sample analysis is given.

The translator has performed her task quite creditably, although a number of small errors have been allowed to creep into the text. Fortunately, these are relatively unimportant, and do not detract from the great value of the book both to the organic chemist and to the analyst.

G. R. D.

Short Notices

Archæology and Anthropology

The Dawn of the Human Mind:
a Study of Palæolithic Man. By R. R. Schmidt. Translated by Prof. R. A. S. Macalister. Pp. xxix + 256 + 50 plates. (London: Sidgwick and Jackson, Ltd., 1936.) 12*s*. 6*d*. net.

Dr. Schmidt in this elaborate and detailed study of the growth of mentality in primitive man, and more especially of *Homo sapiens* as he first appears as Cro-Magnon man, argues from both structure and the products of man's mind preserved in the archæological record. On one side, function is inferred from the development in organic evolution attained, more especially in growth and character of the brain, by the various early types of man from *Pithecanthropus* to *Homo sapiens*; and on the other, the basis of inference is the product, the artefact, interpreted as an indication of the mentality required to produce it, as well as of the cultural associations—social organizations, cults and the like—implied in its production. The analogy of peoples of backward culture of the present day support the argument with certain reservations.

Both lines of argument are familiar, though Dr. Schmidt is both bolder and more thoroughly logical than most in their application. The pioneer quality of his work, however, lies more particularly in the introduction of a third element into his analysis. This is interpretation through evidence afforded by a recapitulation in the child of the mental evolution of the race, analogous to the prenatal embryonic recapitulation of the phases of organic evolution. The argument is precarious, and in fact it is possible that no two observers would agree in drawing the line between this 'race-memory' and environmental influence. Nevertheless, by the aid of his theory Dr. Schmidt has produced an excellent and stimulating analysis of the culture of palæolithic man. Within its compass, his account of palæolithic art and his interpretation of it are as good as anything at present available. Prof. Macalister's translation of a difficult text is excellent.

Stone Age Africa:
An Outline of Prehistory in Africa. By L. S. B. Leakey. Pp. xii + 218 + 14 plates. (London: Oxford University Press, 1936.) 7*s*. 6*d*. net.

Dr. Leakey's Munro Lectures for 1935–36, here expanded into book-form, present in summary a review of the evidence for the Stone Age in Africa. After a brief survey of the climatic and geographical conditions and the regional distribution of the distinctive fauna, recent and modern, the author gives an account of the cultural successions in East, South, North and West Africa, pointing out in dealing with the last-named that evidence at present is almost non-existent.

Recent progress in the study of African archæology has been rapid, and a correlation of this kind was badly needed. The task, however, is one for which an intimate knowledge of widely differing conditions is a necessity. In this respect there are few who are better qualified than Dr. Leakey. Nor is he afraid to assert an independent judgment, as will be noted in his critical attitude towards the work of his fellow archæologists in South Africa. In criticizing their system of nomenclature he raises a difficult question, on which for the moment it is perhaps best to reserve judgment. The extension of stone-age archæological studies to a world-wide field demands an open mind in approach to this question, until chronological and typological correlations have been more fully worked out.

Dr. Leakey does full justice to the valuable work of M. Vaufrey and other French archæologists in North Africa; but it is in East Africa, where he is on his own ground, that he is at his best. While accepting for the moment the criticisms which have been levelled at his chronological evidence, he argues inferentially for the early appearance of *Homo sapiens* in East Africa.

Misprints and slips in names and dates are regrettably frequent.

Naven:
a Survey of the Problems suggested by a Composite Picture of the Culture of a New Guinea Tribe drawn from Three Points of View. By Gregory Bateson. Pp. xviii + 286 + 28 plates. (Cambridge: At the University Press, 1936.) 18*s*. net.

'Naven' is a ceremonial of the Iatmul, a head-hunting tribe of the Sepik River, New Guinea. Its preformance on occasions of importance in the life of an individual, more especially when something is done for the first time, as, for example, when a head is taken, has afforded Mr. Bateson the material for an elaborate study of the culture of the Iatmul people, in which different aspects of the one ceremony are made the basis of a detailed analysis of structure, emotional attitude and social relation.

Anthropologists who are interested in the origins of custom and religious ideas will find here much on which to exercise their theoretical faculty. This, however, is a branch of inquiry which Mr. Bateson deliberately eschews. His treatment is synchronous, and his theoretical interest is directed to the development of method in sociology and cultural anthropology on lines suggested by his investigation of 'naven'. The method here elaborated differs from the functional method of Prof. B. Malinowski, in so far as this is based upon the satisfaction of human needs. This the author consistently emphasizes, admitting, however, at the same time, that it is a development arising out of the practice of the functional school. So far, however, from discrete or

classifiable needs affording the guiding principle, a single cultural element, such as the 'naven' ceremony, may be regarded from a number of aspects. Of these, three are considered here, the structural, the emotional and the sociological, and made, as it were, the matrix from which emanate lines of inquiry to embrace an analysis of the whole pattern of behaviour and the social complex. It deserves, and no doubt will receive, the careful consideration of all field anthropologists.

Biology

The Microscope

By Prof. S. H. Gage. Sixteenth edition, revised and enlarged by the addition of a Chapter on Micro-Incineration. Pp. viii+617. (New York: Comstock Publishing Co., Inc., 1936.) 4 dollars.

THIS standard work passes to its sixteenth edition, which is thoroughly revised. Probably earlier editions are in the laboratories of every university and research institute, but there is not as much evidence in respect to their use as might be expected. Indeed, few laboratories can place at the disposal of their research workers the full equipment necessary for the microscopic examination of any animal or plant tissue. Teachers may explain the structure and use of a microscope, but cannot do more, since microscopy is a subject which can only be learnt by extended experience. The sole comparison of animal and plant tissues that have been killed, fixed and stained is out of date, and attention is concentrated first on the living tissues rather than on their artificial pictures; the final result has to be a composite, derived from all available means of observation.

As to the instruments, the bright-field microscope is generally mastered, but the dark-field, so invaluable for living organisms, is too little used largely because laboratories have no adequate illuminant for such. The polarizing and ultra-violet microscopes have limited use but must be available. The latter depends on the fluorescence of the substances, for example, chlorophyll giving red, and the living cells can be studied while the rays are affecting them; its use should be greatly facilitated by Dr. Gage's recent invention of an aluminium-vapour reflector, the film being deposited on polished quartz discs. No reference is needed to the chapters dealing with drawing, projection, mounting, section-cutting and other accessory technique as they show no great advances; for hæmatoxylin staining care should be taken that the Canada balsam used for mounting be alkaline.

Lastly, there is a useful chapter dealing with micro-incineration, as to which we first learnt as a practical process about four years ago, when a study was made of the distribution of the inorganic salts in the early development of the chick. The plan here is to eliminate the organic matter without unduly disturbing the mineral matter, which can be most conveniently studied on a dark-field; here spectrographic methods should also be useful.

Nature in Britain:

an Illustrated Survey. Introduced by Henry Williamson. With Contributions by R. St. Barbe Baker, E. G. Boulenger, L. C. Bushby, R. and E. Gathorne-Hardy, Seton Gordon and Frances Pitt. (The Pilgrims' Library, Vol. 3.) Pp. v+250+97 plates. (London: B. T. Batsford, Ltd., 1936.) 5*s*. net.

THIS book, containing no less than 143 illustrations from photographs of animals and plants, written by experts in their several lines, is a remarkable production. Inevitably there must be compression, and the various chapters contain little more than brief descriptions and the more recognizable identification marks and habits of Britain's wild life. This, too, is necessarily unequal. While Miss Pitt tells us something about every one of our mammals, and Mr. Boulenger about our reptiles and amphibians, Mr. Seton Gordon cannot in thirty pages mention every British bird, or Mr. Bushby every one of several thousand insects.

As an introduction to the wild life of Britain which will compel even the blasé to take an interest, however, the book can be thoroughly recommended. It is simply written. The chapter on pond life is enough to send every boy off with a jam jar and net to the nearest pond. The illustrations are wonderfully clear, and give a good idea of the astonishing advances made in this department of photography. Where all is so good, it seems churlish to criticize, or to single out any particular chapter for praise. Nevertheless, the reviewer would have liked a little more information about certain quite common creatures; for example, there is no mention of the grass snake's offensive defensive, while "Do dragon-flies sting?" is a question only too frequently asked, and it is not answered here. Still, the amount of information given, and pleasantly given, is wonderful. If the youth of to-day is no longer interested in Nature, it is not for lack of inspiring and inspired naturalists.

The Eggs of Mammals

By Prof. G. Pincus. (Experimental Biology Series.) Pp. ix+160. (New York: The Macmillan Co., 1936.) 14*s*. net.

THE subject of this book is the behaviour of mammalian eggs from the time of their genesis in the ovary to their implantation in the uterus. It opens with a discussion of the origin of the ovum, its growth and that of the follicle, and then passes on to its main theme, the physiology of fertilization, parthenogenesis and cleavage.

The mammalian ovum offers many special problems because of its close dependence on a particular environment, that of the maternal uterus, which is itself under the influence of various hormones elaborated in other parts of the body. These relationships are not yet by any means cleared up, but a promising beginning has been made in their investigation, largely by Dr. Pincus himself, many of whose results are here published for the first time. The author has also been responsible for important advances in the technique of handling and cultivating mammalian eggs outside the body, and has been

able to initiate parthenogenetic development. It may be hoped that the remarkable phenomenon of ovarian atresia, the data on which are fully summarized, will throw some light on the conditions of activation of cleavage.

As is natural in a subject which has only recently been submitted to experimental analysis, the value of the book lies more in the questions which it raises than in any answers it may suggest; as the author states, "this is a book of interrogation, not explanation". It will be extremely valuable to those few who are already working in this field, and one may hope that it will lead to an increase in their number.

C. H. W.

The Principles of Bacteriology and Immunity

By Prof. W. W. C. Topley and Prof. G. S. Wilson. Second edition. Pp. xv+1645. (London: Edward Arnold and Co., 1936.) 50*s*. net.

It is not possible in a short review of this book to deal in any detail with the very extensive revision which has been carried out so successfully by the authors. Whole chapters have been rewritten and rearranged in order that the results of the very rapid advances which have taken place in bacteriology during the last few years could find their place. It is only necessary to read such chapters as those dealing with antigen-antibody reactions and virus immunity and to note the extensive additions which have been made in chapters on the Streptococci, *Brucella*, etc., to have some idea of the magnitude of the task undertaken and so thoroughly carried out.

The book has always been a really valuable work of reference, and we feel that the new edition will give it an even higher place in bacteriological literature. It will be more than a mere book of reference.

Part IV, which deals with applications of bacteriology to medicine and hygiene, will, we hope, be read by many who are not specialists in bacteriology. It might be considered as a thoroughly up-to-date textbook dealing with the practical problems of disease in man and the lower animals. To many of us this will be the most valuable, though perhaps not the most interesting, part of the book.

It is a book which every worker on the subject of bacteriology should possess and read and re-read. Our only criticism is that it is too bulky to read comfortably in an easy chair. We heartily congratulate the writers on the production of this excellent second edition.

J. M. Beattie.

The Animal's World

By Prof. Doris L. Mackinnon. Pp. xv+272. (London: G. Bell and Sons, Ltd., 1936.) 7*s*. 6*d*. net.

Too often the spoken word is lost. It was in response to many written requests by listeners to a series of broadcasts on simple biology in which Prof. Mackinnon took part that this entrancing book came to be written. As she explains in her modest preface, the author leans more to things zoological than botanical, and it is only when animals and plants become interdependent on one another that plant biology is introduced—hence the title.

Prof. Mackinnon has that rare combination—a wide and exact scientific knowledge with a facile and sympathetic pen. How animals move in air, in water, on land; how they breathe and why; how they talk to one another; what the world looks like through their eyes; why honeysuckle smells sweeter in the evening; why the heart beats; these and a hundred other questions she answers in the simplest and most direct language, such language that a child can understand and yet a grown-up can enjoy and learn from all the time.

Some of the most interesting chapters are on the senses of animals, especially those which deal with hearing and the ways in which animals communicate with one another. In connexion with the latter, an interesting example of the use of the microphone is given.

The book is profusely illustrated with many photographs of outstanding interest and beauty. In addition, there are drawings and diagrams which help to explain the text. There is also a comprehensive index.

G. M. V.

British Grasshoppers and their Allies: a Stimulus to their Study

By Dr. Malcolm Burr. Pp. xvi+162+6 plates. (London: Philip Allan and Co., Ltd., 1936.) 6*s*. net.

The sub-title of this little booklet expresses very neatly its purpose as a stimulus to the study of British Orthoptera, and there can be no question that it will serve the purpose in an admirable way. Although there are thirty-one species of Orthoptera and Dermaptera on the British list, they remain one of the most neglected groups of insects, and the distribution of the different species, to say nothing of their habits and ecology, are most imperfectly known. Determination of the recognized British species, and of such few as may be expected to occur in the British Isles, is very easy with the aid of short descriptions and figures of outstanding characters. Distributional maps are given for each species, but they serve mostly to show the lamentable paucity of records. General remarks at the beginning of the book, and scattered throughout its text, contain a host of suggestions for studies, both valuable scientifically and mostly easily carried out by any serious amateur naturalist.

The booklet, which is compact, well produced and cheap, should rapidly find its way into the pockets of field naturalists, with the desired stimulating effect on the accumulation of knowledge about this sadly neglected, but in many ways fascinating, group of insects.

B. P. Uvarov.

Aquariums and Fishponds

By A. Laurence Wells. (Warne's Information Series.) Pp. 64. (London and New York: Frederick Warne and Co., Ltd., 1936.) 1*s*. 6*d*. net.

Here are the main principles of fish-keeping and of the plants and animals suitable to an aquarium. Let it be square; cover the bottom with sand, then loam, and plant it with carefully sterilized vegetation.

Scatter the surface with pebbles, fill up and place it in the best light, taking care to cover with a glass plate to keep out dust—the organisms prefer vita-glass. When growth has commenced, introduce a few snails as scavengers, change ten per cent of the water weekly and remove debris. When all is well, introduce the fish, which must not be crowded. A pond may be constructed on the same principles and has the great advantage that the small crustaceans, insect larvæ, worms and other life will provide the necessary fish-food. For an indoor tank recourse must be had to dried foods, the best of which consist of the natural food dried, with small parts of meat, biscuit, egg and vegetable powder. We also catch live crustaceans —but any good food will do, provided that too much is not given. Chapters deal with the food and ailments of fish—we have found flavine most useful for fungus—and the plants are shown in thirty illustrations. This is a charming little book.

Cosmetic Dermatology:
with Dictionary of Ingredients; Discussion of Anatomic, Physiologic and Pharmacologic Bases of Cosmetic Application; "Shelf-tested" Formulary; and Appendices on Odor and Color in Cosmetics. By Dr. H. Goodman. Pp. xv+591. (New York and London: McGraw-Hill Book Co., Inc., 1936.) 36*s*.

THIS encyclopædic work, which forms a valuable addition to dermatological literature, is divided into two unequal parts. The first, which is entitled "Dictionary of Ingredients", contains separate descriptions of the official drugs of the United States Pharmacopœia and of the unofficial drugs used in the treatment of skin diseases. The second part, which forms the bulk of the work and is devoted to practical cosmetic dermatology, consists of fifty-four chapters in alphabetical order (acne–vitamins) containing an account of various skin diseases and modes of treatment. There are three appendixes dealing respectively with cosmetic colours, perfumery and weights and measures.

Color Changes of Animals in relation to Nervous Activity
By Prof. G. H. Parker. (University of Pennsylvania: Leidy Memorial Lectures.) Pp. ix+74. (Philadelphia: University of Pennsylvania Press; London: Oxford University Press, 1936.) 7*s*. net.

THIS volume is a somewhat extended form of the Joseph Leidy Memorial Lecture in science delivered in March 1936. Prof. Parker's recent work has led him to the conclusion that the chromatophores in fishes are controlled by neurohumors which are liberated by nerves. They may be divided into two classes—the hydrohumors, such as the substance liberated by the pituitary gland, which are carried in the circulation, and the lipohumors, which are oil-soluble substances liberated by nerve endings in the skin and diffusing slowly from one area of skin to another. The book describes the experiments on which these conclusions are based. It is well illustrated and attractively produced.

Chemistry

Industrial Chemical Calculations:
the Application of Physico-Chemical Principles and Data to Problems of Industry. By Prof. O. A. Hougen and Dr. K. M. Watson. Second edition. Pp. ix+487. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1936.) 22*s*. 6*d*. net.

THE title on the cover of this excellent book is a very modest one, and gives little indication of the wealth of information and instruction to be found within. The objective of the book is the development of concise and logical methods by which complex industrial chemical problems may be solved from fundamental scientific principles. Its study is intended not to replace but to supplement a course in physical chemistry, and to prepare the student for advanced courses in chemical engineering. The first nine chapters of Part 1 deal with the more ideal low-pressure system in which simple algebraic methods can be used, and the last five chapters treat non-ideal cases by more general and complicated methods, involving considerable use of the calculus. The first four chapters deal with weights and compositions, stoichiometry, ideal behaviour of gases, and vaporization and condensation respectively. Thermo-physics and thermo-chemistry are the subjects of the next two chapters, which are followed by chapters on industrial reactions, fuels, weight and heat balances of combustion, and chemical and metallurgical processes. A detailed analysis is made, for example, of the chamber acid process and of a blast furnace. Part 2 of the book deals with entropy, free energy, and the other thermodynamic potentials, and their application to the study of chemical equilibria. Here the method of treatment is most helpful to the industrial chemist who desires to make use of all the assistance thermodynamics can give but who lacks the technique.

Detailed solutions of typical problems illustrate the application and combination of the various principles which receive treatment, and emphasis is placed on the necessity of giving each individual step in the calculation, clearly labelled, in order that a correct result may be reached, capable of quick verification. At the end of each chapter, problems are presented for solution by the reader, since only through actual practice can skill in analysing and solving problems be attained. There are more than twenty tables which provide useful physical data for a whole range of chemicals, and there are nearly a hundred figures. The price should place this book within the reach of every industrial chemist who feels the need of a more exact and quantitative approach to his problems. R. T.

Elements of Chemical Engineering
By Prof. W. L. Badger and Prof. W. L. McCabe. (Chemical Engineering Series.) Second edition. Pp. xvii+660. (New York and London: McGraw-Hill Book Co., Inc., 1936.) 30*s*.

THE first edition of this book was noticed in NATURE of October 10, 1931. Time has proved its utility

in America to the increasingly large number of chemical engineers who have received a college training. Now that the Imperial College of Science is starting a full undergraduate course in the subject leading to a degree at the University of London, chemical engineering may be expected to attract more students in Great Britain.

The new edition follows the old closely, with the new work incorporated; the principal changes are to be found in the chapters on flow of heat, evaporation, drying, distillation, gas absorption, extraction and filtration. Such technical works are necessarily full of symbols, the precise meaning of which it is difficult for the reader to retain: it is therefore convenient to find at the end of each chapter a list of all the symbols used therein. It is stated that, so far as possible, these correspond to the recommendations of a Committee of the American Institute of Chemical Engineers.

The book contains an introduction by Arthur D. Little, who has passed away in the interim: he was the gifted and inspired leader of the movement to make chemical engineering a science of its own.

(1) Recent Advances in Physical Chemistry

By Dr. Samuel Glasstone. Third edition. Pp. viii+477. (London: J. and A. Churchill, Ltd., 1936.) 15*s*.

(2) Recent Advances in General Chemistry

By Dr. Samuel Glasstone. Pp. ix+430. (London: J. and A. Churchill, Ltd., 1936.) 15*s*.

(1) Dr. S. Glasstone has earned the gratitude of many chemists by writing his "Recent Advances in Physical Chemistry"; the appearance of a third edition within five years is sufficient testimony to the widespread recognition of the value of his reviews of modern work. The new matter in this edition is largely concerned with the application of wave mechanics to problems of molecular structure, and gives an account of the valency bond and the orbital methods as applied to a number of structural problems as well as a discussion of resonance phenomena in organic molecules.

(2) The new companion volume on "General Chemistry" opens with an account of atomic disintegration, and includes articles on deuterium, on electron diffraction and on free radicals. It also includes the discussions on solubility and on acid-base catalysis which had been omitted from later editions of the "Physical Chemistry" owing to lack of space. It is, however, the chapters on statistical methods and on the mechanism of reactions in solution which the reviewer has most admired. For entirely different reasons both subjects are difficult to deal with in a limited space, but Dr. Glasstone has succeeded in giving a clear and readable account of the fundamental theory of the former, whilst the discussion of reaction mechanism is an excellent survey of theory and experiment.

Chemists will find the new volume as helpful and as interesting as the earlier "Physical Chemistry"; it would be difficult to give it higher praise than this. S. S.

Physical Chemistry

By Prof. F. H. MacDougall. Pp. ix+721. (New York: The Macmillan Co., 1936.) 17*s*. net.

This text-book follows more or less traditional lines in the order in which the subjects are presented, but it possesses some special features worthy of note. Thus the thermodynamical aspect of physical chemistry is given more emphasis than in most English text-books of a similar standard, and the exposition of the first and second laws and their application to chemical problems is admirably clear and concise. Electrode processes and the theory of the E.M.F. of cells are also dealt with thoroughly and without the ambiguities which often mar the treatment of these subjects. Much modern work is included and the sections on extranuclear atomic structure and on theories of strong electrolytes may be mentioned as clear and useful introductions to these topics. S. S.

Disperse Systems in Gases:

Dust, Smoke and Fog: a General Discussion held by the Faraday Society, April 1936. Pp. 1041–1300. (London and Edinburgh: Gurney and Jackson, 1936). 12*s*. 6*d*. net.

An article on some points raised in the general discussion organized by the Faraday Society on "Disperse Systems in Gases" appeared in Nature of May 2, 1936. The papers, which are now available, are considered under the general properties of such systems and their industrial aspects, the latter being quite a short section though of great importance in relation to the amenities of life. We are all plagued by dust, by fog and by the deposition of dirt from smoke; many of the ills of the flesh are a consequence of their preventable existence. Dust produced in industry is the subject of legislation where it causes occupational diseases, but dust produced in the streets or in our homes, which we breathe laden with bacteria, is no one's concern. Nor is there any serious effort to restrict the production of smoke except by factory chimneys, in spite of the fact that so many alternative smokeless fuels to raw coal are available.

The Faraday Society was more concerned with the theoretical aspects of the question, the size of particles, their movement and the cohesion between particles. Many very useful papers are collected under the sub-heading of mist, cloud, hygroscopic nuclei, town and country fogs.

The discussions were most valuable and it will prove useful to have them in book form for reference.

A Text-Book of Inorganic Chemistry

Edited by Dr. J. Newton Friend. (Griffin's Scientific Text-Books.) Vol. 6, Part 5: Antimony and Bismuth. By W. E. Thorneycroft. Pp. xxviii+249. (London: Charles Griffin and Co., Ltd., 1936.) 18*s*. net.

The volume of Dr. Friend's well-known text-book dealing with antimony and bismuth maintains the high standard of the series. The chemistry of these two elements is particularly difficult, and the author has wisely adopted a rather conservative attitude,

in which the compounds are regarded as containing the element existing in one of two valency states, 3 and 5. The information includes the mineralogy and technology of the elements as well as the pure chemistry, and the physical constants of the elements and compounds are given in detail.

It is regrettable that a higher standard of accuracy in historical information is not generally required in text-books; in the present volume, two names are incorrectly given in one line on p. 14, for example. References to analytical methods are adequate. The literature appears to have been very well covered until about 1933, but there do not seem to be many references after this date. It should be noted that neither Thenard nor Regnault should be written with an accent.

Geography

The Preservation of our Scenery:
Essays and Addresses. By Dr. Vaughan Cornish. Pp. xiii+92+12 plates. (Cambridge: At the University Press, 1937.) 7*s*. 6*d*. net.

To Dr. Vaughan Cornish beauty of scenery is no mere luxury but a factor in the formation of national character, and he regards its preservation as essential to national well-being. Fortunately, there is a growing, but not yet sufficiently influential, body of opinion that subscribes to this view. The study of the mechanism of Nature is less important than its philosophical contemplation, and wild Nature must be protected from both the devastation of the builders and road makers and the frenzy of the collectors who may be termed the criminal classes among Nature lovers.

In the volume before us, Dr. Cornish has collected six papers and addresses which he has given to various societies on the subject of the preservation of the scenic amenities of Great Britain, and he has illustrated the volume with several of his charming sketches. One of the papers discusses the types of scenery suitable for national parks in England and Wales and the relative value of certain areas from this point of view. Another contains a strong plea for the preservation of English cliff scenery, and this is an even more urgent matter since the destructive hand of the bungalow builder is making serious inroads on some of our cliffs, notably in Cornwall.

All who value the beauty of our countryside will welcome this volume. It may be too much to hope that the vandals of our natural heritage will realize their iniquity from its pages, but the indifferent may be persuaded to abandon that attitude.

Markets and Men:
a Study of Artificial Control Schemes in some Primary Industries. By J. W. F. Rowe. Pp. ix+259. (Cambridge: At the University Press, 1936.) 7*s*. 6*d*. net.

One of the solutions for the economic troubles, which have recently 'depressed' production throughout the world, has been some form of control. The schemes have varied greatly. They have involved a world limitation of output to a percentage of the normal—tin, copper, rubber; paying the farmer not to produce certain products—cotton, wheat, hogs; actual destruction of the crop—coffee.

After a preliminary chapter on the origin and growth of artificial control schemes, the author describes those for coffee, wheat, sugar, American cotton, rubber and tin, and discusses the troubles which give rise to restriction schemes.

The language is simple, and the book is a useful record of experiments, the success or propriety of which is to-day a matter of keen controversy in political and economic circles.

Geology and Mineralogy

Rutley's Elements of Mineralogy
23rd edition, by Prof. H. H. Read. Pp. viii+490. (London: Thomas Murby and Co.; New York: D. Van Nostrand Co., 1936.) 8*s*. net.

The homely saying that the proof of the pudding is in the eating is well exemplified by this well-known text-book, now in its twenty-third edition, which has guided the footsteps of so many generations of students of mineralogy.

In Part 1, which deals with the properties of minerals, the chapters on crystallography and optics have been rewritten and a new chapter on the occurrence of minerals has been added. In the discussion of the elements of crystallography the treatment has been kept as simple as possible. Nothing, for example, is said about the reflecting goniometer, and only the eleven more prominent of the thirty-two classes of crystal symmetry are considered; possibly the number might have been expanded slightly so as to include the cuprite class in the cubic system, the chalcopyrite class in the tetragonal system, and the sulphur class in the orthorhombic system. Prof. Read follows all writers, except some in Great Britain, in the use of the Bravais symbols in the hexagonal system in place of the original Millerian indices. From the excellent account which is given of the optical properties of minerals the student can acquire the fundamental knowledge necessary in the determination of minerals by means of their optical characters, particularly in thin sections of rocks. The chapter on the occurrence of minerals is really an introduction to petrology and the subject of ore deposits.

In the second part, which comprises the description of minerals, the usual chemico-crystallographical classification originated by Dana has been given up in favour of one based upon economic and chemical considerations, the minerals being grouped according to the useful element contained in them and the order following the periodic classification of the elements. Care has been taken to retain the important rock-forming silicates in their natural families. Under each mineral the properties are clearly stated and attention is directed to the discriminative characters which serve to distinguish it from others with which it might be confused.

The usefulness of the book is greatly increased by the large number of excellent illustrations which are interspersed in the text and by the copious index. It is, indeed, a book which may be commended to every student of mineralogy, from whatever angle the subject be approached.

Getting Acquainted with Minerals

By G. L. English. Pp. xi+324. (New York and London: McGraw-Hill Book Co., Inc., 1934.) 15*s*.

THE veteran author of this book has long been known to those interested in the acquisition of minerals. In 1886–1904, he was actively engaged in mineral dealing under the trade name of George L. English and Co.; for the following nine years, until 1913, he was monazite expert to the National Light and Thorium Company; and finally he returned to his old life, first until 1921 as manager of the mineralogy and petrography department and then until 1934 as consulting mineralogist of Ward's Natural Science Establishment. Thus for forty-eight years he has dealt with minerals, and many of the American specimens obtained by collectors during those years have come to them through his agency.

In this book the author gives the amateur collector the benefit of his long experience. It is not and is not intended to be deeply scientific. In the first part a general but superficial account is given of the physical and chemical properties of minerals, which will serve to induce the reader to take still greater interest in the specimens already in his collection and those he hopes to acquire. Part 2 is devoted to the descriptions of minerals. As the Dana system of classification which is normally used in mineralogical text-books demands considerably more scientific knowledge than the author expects of the ordinary reader, he has adopted a classification in which the species are arranged according to the most important elements in their composition, a cross-reference being given where necessary, while the important group of rock-forming minerals are brought together in the second section. In Part 3 the rocks are briefly considered in three sections: igneous, sedimentary, and metamorphic. Part 4 is an important and original feature of the book. In it an attempt is made to identify any mineral specimen by means of three simple and obvious characters: lustre, hardness, and colour. It is a method which may be expected in skilled hands to yield good results. A novel feature of the book is the pronouncing vocabulary at the end.

The author has added to the usefulness of the book by introducing in the text a large number of drawings and illustrations from photographs, and the ample index is a great advantage.

Interpretative Petrology of the Igneous Rocks

By Prof. H. L. Alling. Pp. xv+353. (New York and London: McGraw-Hill Book Co., Inc., 1936.) 24*s*.

THE igneous rocks arise by processes taking place in the physical chemical system of the magma, and the study of the genesis of these rocks is largely concerned with the application of physical chemistry to these systems. Few geologists, however, have this fundamental knowledge—their training has been too broad. It is the aim of this book to present to the geologist those principles of physical chemistry that will enable him to interpret the life-history of these rocks. The phase rule and its application to igneous systems are the basis of the treatment.

The principles of equilibria, solid solution, isomorphism and polymorphism are first examined, and then the various groups of the igneous rock-forming minerals are considered as solid solutions of end-members, or *minals*, and their thermal diagrams and optical properties dealt with. Then follows a series of what may be called essays on numerous topics of petrogenesis, such as the crystallization of magmas, diversification of igneous rocks, magmatic assimilation, end-stage processes, and many more.

Whether or not the author has succeeded in his intention of making physical chemistry plain and easy for the geologist—and opinion will certainly be divided on this point—he has at least written a book of great interest to petrologists already learned in this subject. He has, too, provided refreshing and stimulating essays on all those theories that make modern petrology so entertaining. The small scale of some of the illustrations, and a few rather awkward misprints mar an otherwise well-printed book.

Mathematics

An Illustrated Historical Time Chart of Elementary Mathematics:

for Senior and Secondary Schools, Training Colleges and Universities. By E. J. Edwards. In 5 sections, each 31in. × 22in. (London: University of London Press, Ltd., 1936.) Thick cardboard, varnished, 21*s*. net.

MANY teachers of mathematics recognize the advantage of associating the subject with its history, but find difficulty in doing so in the time available. If they decorate the walls of their classrooms with Mr. Edwards's attractive charts, they will have available a stock of interesting information, illustrated with diagrams, maps and portraits, to which incidental reference can be made when appropriate.

The first chart (Beginnings of Mathematics) deals with primitives, Babylon, Egypt and China up to 2000 B.C. The second (Early Mathematics of Egypt, Babylon and China, 2000–1000 B.C.) sketches the development of integers and fractions, and of intuitive and practical geometry. The third (Ancient Greece, 1000–30 B.C.), perhaps the best of the five, deals with the work of seventeen famous mathematicians. The fourth (Dark Ages, Arab School) brings the account up to 1000 A.D. The fifth (Decline of Arabian and Beginning of European Mathematics. Modern Mathematics, 1000–2000 A.D.) attempts too much. Up to the time of the invention of the calculus the chart is good, if overcrowded (a fault emphasized by the lettering, which is more artistic than legible), but it would have been better to have omitted all reference to the eighteenth and nineteenth centuries

rather than give such a meagre account, ignoring even Euler and Lagrange. The publishers might fill up the blank space (nearly a column) with matter selected from H. W. Turnbull's "The Great Mathematicians" (especially p. vii), or the works of F. Cajori and G. Prasad. H. T. H. P.

(1) Logarithmetica Britannica:
being a Standard Table of Logarithms to Twenty Decimal Places. By Dr. Alexander John Thompson. Part 7: Numbers 70,000 to 80,000. (Issued by the Biometric Laboratory, University of London, to commemorate the Tercentenary of Henry Briggs' publication of the "Arithmetica Logarithmica", 1624.) (Tracts for Computers, No. 20.) Pp. vi+102. (London: Cambridge University Press, 1935.) 15*s.* net.

(2) Tables of the Higher Mathematical Functions
Computed and compiled under the direction of Harold T. Davis. Vol. 2. (Published as a Contribution of the Waterman Institute for Scientific Research, Indiana University.) Pp. xiii+391. (Bloomington, Ind.: The Principia Press, Inc., 1935.) n.p.

(1) This part, the seventh to be issued, contains the logarithms of numbers from 70,000 to 80,000, leaving two parts still to appear. There are some interesting reproductions to illustrate the relation of Henry Briggs to Napier's "Constructio Canonis".

(2) The first volume of these tables appeared in 1933 and was reviewed in Nature. The present second volume maintains the high standard attained by the first. Tables 13–28 give the first four derivatives of the psi functions at varying intervals and from 10 to 19 decimal places. There is here some overlapping with Vol. I of the British Association Tables which appeared, as the director observes, when his work was far advanced. Tables 29–39 are concerned with Bernoulli's and Euler's numbers. Tables 40–49 give data for polynomial approximation up to the 7th degree. The volume gives errata to Vol. 1, and if the list is reasonably complete, the authors are to be congratulated on the small number of errors in so large an undertaking.

L. M. M-T.

Mathematical Snack Bar:
a Collection of Notes and Results. By Norman Alliston. Pp. vii+155. (Cambridge: W. Heffer and Sons, Ltd., 1936.) 7*s.* 6*d.* net.

This is a very unusual book and therefore somewhat difficult to review in a short notice. It comprises a collection of miscellaneous notes and conclusions in both geometry and arithmetic. As the author points out, a roving investigator accumulates a considerable amount of original material; but gleanings here and there do not necessarily provide the ingredients for a connected thesis. The apt title of the volume gives some clue to its contents, in so far that no single theme is systematically developed.

The text touches upon Diophantine analysis, Heronian triangles, theory of numbers, residues and many geometrical problems off the beaten track. Although the mathematical treatment is quite elementary, some very interesting facts are presented, notably in the determination of rational parts of a triangle, the expression of a biquadratic as a square, problems on tangencies and Fermat problems. There are indeed so many really valuable mathematical 'snacks' in the book that it is a great pity there is no reference index. A few minor inaccuracies in the print are noticeable; for example, index omitted on p. 2; sign in line 25, p. 25 and n for x on p. 87, line 3.

Elementary Analytical Conics
By Dr. J. H. Shackleton Bailey. Pp. v+378. (London: Oxford University Press, 1936.) 7*s.* 6*d.*

This interesting volume, by the headmaster of the Royal Grammar School, Lancaster, provides an elementary course in analytical conics for the use of pupils preparing for the various Higher Certificate Examinations and for scholarships. It opens with a lucid introduction showing that the conics are really plane sections of a cone—a vital point so often overlooked. Then follow seven chapters on the point, straight lines, equations and the transference of axes, the circle, parabola, ellipse and hyperbola. Chapter viii is devoted to a discussion of oblique axes, whilst the final section contains one hundred examples from recent Higher Certificate papers.

The course is thoroughly sound, and develops an admittedly difficult subject for beginners in a very stimulating way. The various parts, so often dealt with piecemeal, are here woven into a coherent whole, and special emphasis has been rightly laid upon parametric representation. The text is excellently printed and arranged, the principal formulæ being summarized at the end of each chapter.

The book may be confidently recommended, for the author has well fulfilled his aim by providing a sound foundation of the elements of co-ordinate geometry in a very attractive way which is admirably suited to the needs and age of sixth form pupils.

Interpolation and Allied Tables
Reprinted from the Nautical Almanac for 1937. Pp. ii+44. (London: H.M. Stationery Office, 1936.) 1*s.* net.

There is no wholly satisfactory text-book on interpolation, especially on the practical side. The Nautical Almanac staff have a wide experience of interpolation and sub-tabulation, and they have developed methods which appear to be superior to those generally known. This pamphlet will serve a useful purpose in making such methods more widely known, and the explanations are full enough to make it a working manual of interpolation for those who have an elementary theoretical knowledge of the subject. The method for inverse interpolation is new, and possibly more convenient than any of those already published. Special attention is directed towards 'critical tables', which are used without interpolation and have a maximum error of only half the usual amount. H. T. H. P.

Metallurgy

(1) The Journal of the Institute of Metals
Vol. 58. Edited by G. Shaw Scott. Pp. 325+30 plates.

(2) Metallurgical Abstracts (General and Non-Ferrous)
Vol. 2 (New Series). Edited by G. Shaw Scott. Pp. vii+889.

(London: Institute of Metals, 1936.)

(1) "Metallic Wear" formed the subject of a general discussion at the last annual meeting of the Institute of Metals. The opening paper by Dr. H. W. Brownsdon is given in this volume, together with a record of the discussion, in which no fewer than twenty-one experts expressed their views on this important subject. Following the presidential address of Mr. W. R. Barclay, in which he dealt with organized development in the non-ferrous metal industries, are fourteen papers and related discussions, including "Effect of Molten Solder on Some Stressed Materials", "Test for Zinc Coating on Wire", "A Deep Drawing Test for Aluminium", "Magnesium Copper Alloys", "The Physical Properties of Nickel Silver Alloys" and "Experiments on the Electrical Resistance of Copper Wires". The volume concludes with an account of Mr. C. C. Paterson's May Lecture on "The Escape of Electricity from Metals: Its Practical Consequences". The author traces the effect which the liberation of the electron from metals has had on the trend of electrical engineering during the past twenty years.

(2) The second volume of "Metallurgical Abstracts" is larger than its bulky predecessor by ninety pages—a fact indicative of the ever-increasing volume of metallurgical work that is being published all over the world. The field covered includes properties of metals and alloys, corrosion and protection, electrodeposition, refining, analysis, apparatus and instruments, testing, temperature measurement and control, foundry practice, scrap metals, furnaces and fuels, refractories, heat-treatment, working, joining and the cleaning and finishing of metals. The present volume contains upwards of 10,000 abstracts, the index to which alone occupies 146 pages. It is indispensable to everyone concerned in any way with the use or application of metals and alloys. One omission which is still noticeable is a list of publications from which abstracts are regularly prepared.

Corrosion Resistance of Metals and Alloys
By Robert J. McKay and Robert Worthington. (American Chemical Society Monograph Series, No. 71.) Pp. 492. (New York: Reinhold Publishing Corporation; London: Chapman and Hall, Ltd., 1936.) 35*s.* net.

The remedy for corrosion in many cases is the use of the right alloy in the right place. The authors have taken this as a text in writing their book, which summarizes up-to-date information on the corrosion resistance of all the ferrous and non-ferrous alloys of any importance at all.

The first part of the book sets out to classify and explain the important points of the theory or mechanism of corrosion. The second and longer portion consists of detailed data on the corrosion of individual materials in given conditions. Chapters are devoted to: magnesium and its alloys, aluminium and its alloys, zinc and zinc coatings, cadmium plate, tin and tinplate, lead, iron and steel, molybdenum alloys, chromium alloys, chromium plate, nickel-iron alloys, nickel, nickel-copper alloys, copper, and high copper alloys. Each chapter gives a general discussion of the behaviour of the material, followed by a documented survey of knowledge of its resistance to a wide range of corrosive conditions, and an extensive bibliography.

In employing this method of presentation, metal by metal, the authors realize that it has the shortcoming that the answer to the question "What metal is best to use?" or "Is copper better than lead for sulphuric acid?" may not readily be apparent. But a uniform system of presentation enables a rapid comparison to be made once a preliminary selection of likely materials has been effected. The latter process is facilitated by a form of master-chart giving a cross-section of corrosion rates for each metal group in each of seven typical corrosive conditions. If the data given are then interpreted on the basis of the fundamental considerations set out earlier the reader will be able to obtain a clear idea of the material best suited to his purpose. It will thus prove invaluable to all metallurgists, chemical engineers and others who are faced with the problem of selecting materials to withstand particular conditions.

Miscellany

Changing Man:
the Education System of the U.S.S.R. By Beatrice King. Pp. 319. (London: Victor Gollancz, Ltd., 1936.) 10*s.* 6*d.* net.

Not even political prejudice can conceal the fact that the communist Russia to-day represents an immense social experiment of far greater interest and significance in political and social thought than the reversion to autocracies represented by modern Fascism. The success or failure of Communism under the conditions of to-day, whether in the execution of its successive five-year plans, or in the vastly enhanced extent to which the scientific worker has been placed in control, or again in the attempt to make the service motive a driving force comparable with that of the profit motive elsewhere, depends as much on education as on any one factor. In this book we are given a survey of the education system of the U.S.S.R., which should at least assist in judging as to the chances of success.

The survey is admirably done and apart from the larger question, the scientific worker will find much to interest him in the account of technical and professional education, of educational research, of higher education, discipline and examinations, etc. On many points of detail it is clear that the practice of Soviet Russia might well be adopted to some extent in our own educational system, as for example,

in the efforts made to regulate the number of students entering different types of technical schools in accordance with industrial requirements, so as to prevent dislocation of industry or of social life. Similarly, the course of social science which is compulsory in university education might perhaps be adopted with advantage in our own system.

The author has given us a book which cannot well be passed over by anyone who, whatever his political creed, is interested in the impact of science on society and the capacity of man to adapt himself to new conditions.

The Philosophy of Religion *versus* The Philosophy of Science:
an Exposure of the Worthlessness and Absurdity of some Conventional Conclusions of Modern Science. By Albert Eagle. Pp. 352. (Manchester: The Author, University; London: Simpkin Marshall, Ltd., 1935.) 5*s*.

THIS book is a somewhat emotional outburst written in an extremely unconventional style and evidently intended for the non-scientific reader. The author is a mathematical lecturer but he is violently opposed to 'relativity' ideas in physics and astronomy. He raises an interesting question too often overlooked by mathematicians—Is not mathematics merely a shorthand of symbols? Are not the fundamental realities of space and time based on the structure of our own minds and not on facts independent of us but observed by us? Is there a fundamental distinction between what Bergson calls 'duration', which is real time, and mathematical time, which is a convenient fiction? Was T. H. Huxley right when he said that mathematics is not a science but a machine?

Another object of the author's attack is the materialistic philosophy as preached by some biologists. It is well known that quite a number of biologists do hold the view that all the peculiar features of life are to be accounted for by the chemical composition of protoplasm, but this is not true of all; and as the author says, the most distinguished physiologists repudiate this conclusion. Dr. Eagle especially objects to a recent book on popular biology by some of the younger biologists—all of them specialists in narrow fields—in which occur dogmatic statements about materialism being the ascertained conclusion of science, and also on the nature of heredity and the method of evolution. Such a book is calculated to injure the cause of science by associating it in the popular mind with 'mechanistic' philosophy and morals.

E. W. M.

The Digestive Tract:
a Radiological Study of its Anatomy, Physiology and Pathology. By Dr. Alfred E. Barclay. Second edition. Pp. xxxvi+427. (Cambridge: At the University Press, 1936.) 36*s*. net.

IT is not surprising that within a very short time a second edition of a book of such outstanding merit as Barclay's "The Digestive Tract" should be called for. The foundation laid by the first edition is, however, so solid that, little being required in the way of alteration, the author can be content with merely bringing the book up to date. He introduces notes on the latest developments in technique, such as X-ray cinematography, a branch of the science of radiography, at present in its infancy, which should prove of great utility in investigations of the movements of the digestive organs in health and disease.

The author has for many years been concerned about the safety of workers in X-ray departments; it is reassuring to find that he now allows a higher safety limit of exposure than that laid down in his first edition.

The book not only has an appeal to the systematic reader who wishes to study the subject in its entirety, but also it will undoubtedly give many hours of pleasure to the more casual reader who merely wishes to 'browse'. It is written by one who is not content with blindly accepting the 'dicta' of his predecessors, who not only looks at his subject from widely different angles, but who also consistently probes beneath the surface. The illustrations throughout the book are of the highest quality and much may be learnt from a perusal of these alone.

Whilst appreciating that the book represents a radiological study of the anatomy, physiology and pathology of the digestive tract, one cannot help feeling that its value would be enhanced by a fuller account of the clinical aspects of the lesions described. This is not by way of a criticism, but is put forward as a tentative suggestion worthy of consideration in future editions.

R. E. ROBERTS.

Scientific Progress
(Sir Halley Stewart Lectures, 1935.) By Sir James Jeans, Sir William Bragg, Prof. E. V. Appleton, Prof. E. Mellanby, Prof. J. B. S. Haldane, Prof. Julian Huxley. Pp. 210. (London: George Allen and Unwin, Ltd., 1936.) 7*s*. 6*d*. net.

THE Sir Halley Stewart Lectures, 1935, reproduced in this volume were dealt with in NATURE at the time of their delivery. The collected volume offers the opportunity of intercomparison in relation to the aims of the Sir Halley Stewart Trust, with their concern for the prevention and removal of human misery, the social relationships of man, the development of body, mind and spirit in the individual, of just environment in the community, and of "peace on earth" through international goodwill. The placing of the six lecturers in this series on "Scientific Progress" is an excellent, if highly individual and invidious, exercise. One reader would unhesitatingly put J. B. S. Haldane first, would hesitate between Mellanby and Huxley for second place, and with renewed firmness put Sir James Jeans last. So much for a physicist's view. What would the biologist say?

Social Hygiene To-day

By H. E. Garle. Pp. 387. (London: George Allen and Unwin, Ltd., 1936.) 12*s*. 6*d*.net.

With some remarkable exceptions, such as Abraham Flexner, the authors of works on prostitution and venereal disease have been medical men. The present work is remarkable as emanating from a barrister-at-law, who possesses no medical qualification.

The book is divided into two parts. The first consists of ten chapters dealing with various aspects of prostitution and venereal disease, while the second part contains a digest of laws relating to prostitution and venereal disease in different countries. There are numerous appendixes dealing with international agreements made at Paris and Geneva for the suppression of the traffic in women and children and the facilities given to merchant seamen for the treatment of venereal disease, followed by a bibliography classified according to anthropology, biology and physiology, psychology, social applications and venereal diseases.

Albrecht van Borgunnien's Treatise on Medicine

(Sloane MS. 3002, British Museum). By W. L. Wardale. (St. Andrews University Publication, No. 38.) Pp. xlvii+80. (London: Oxford University Press, 1936.) 10*s*. 6*d*. net.

This work is a fifteenth century medico-astrological treatise written in Eastern North Low Saxon by a certain Albrecht van Borgunnien, about whom nothing further is known. Almost the whole text, which consists of a prologue and remedies for various diseases, appears to be founded on a methodical leech book which contained charms of a popular character and various medico-astrological treatises.

In addition to numerous external and internal remedies, the subjects dealt with in the work include urinoscopy, phlebotomy and the signs of the Zodiac, the four elements, the four complexions and the signs of life and death. A glossary and short bibliography are appended.

Forthcoming Books of Science

Agriculture and Horticulture

Cassell and Co., Ltd. Roses in Colour—J. Horace McFarland.

"Country Life", Ltd. A Woodland Garden—A. T. Johnson. A Gardener's Testament—Gertrude Jekyll. Greenhouse Culture for Amateurs—Edith G. Wheelwright.

English Universities Press, Ltd. (*Hodder and Stoughton, Ltd.*). The Vegetable Book—W. E. Shewell-Cooper. The Herbaceous Border—R. Sudell.

Faber and Faber, Ltd. The Hill Lands of Great Britain—Prof. R. G. Stapledon.

George G. Harrap and Co., Ltd. The Family Garden—Marguerite James.

McGraw-Hill Publishing Co., Ltd. Conservation of the Soil—A. F. Gustafson. Engineering Properties of Soil—G. A. Hogentogler.

Putnam and Co., Ltd. Plants for the Connoisseur—T. Hay.

Anthropology and Archæology

G. Bell and Sons, Ltd. Little-known India—Henry Newman.

A. and C. Black, Ltd. Peasant Costume of the Black Forest—D. W. Pettigrew.

Thornton Butterworth, Ltd. The Arabs—Dr. Bertram Thomas.

Cambridge University Press. Excavations at the Argive Heraeum—Carl W. Blegen.

Lovat Dickson and Thompson, Ltd. The Savage Hits Back—Prof. Julius Lips.

English Universities Press, Ltd. (*Hodder and Stoughton, Ltd.*). The Aryans—R. T. Clark.

Eyre and Spottiswoode, Ltd. Bible Evidence from Lachish—Sir Charles Marston.

Faber and Faber, Ltd. Soviet Arts and Culture—Kurt London.

Hodder and Stoughton, Ltd. White African—Dr. L. S. B. Leakey.

Longmans, Green and Co., Ltd. Darwin's Theory applied to Mankind—A. Machin.

Macmillan and Co., Ltd. Archæological Reconnaissances in North-Western India and South-Eastern Īrān—Sir Aurel Stein. The Irish Countryman—Dr. C. M. Arensberg. The Rengma Nagas—J. P. Mills.

Methuen and Co., Ltd. Ancient Cyprus—S. Casson.

Oxford University Press. Topographical Bibliography of Ancient Hieroglyphic Texts, Reliefs and Paintings (vol. 5)—B. Porter and R. L. B. Moss. Witchcraft, Oracles, and Magic among the Azande—E. E. Evans-Pritchard. The Mandæans of Iraq and Iran—E. S. Drower.

Kegan Paul and Co., Ltd. The History of Witchcraft—M. Summers.

G. Routledge and Sons, Ltd. What is Culture?—Prof. B. Malinowski. Crime and Racial Conflict in Africa—Dr. H. J. Simons. The Bantu-Speaking Tribes of South Africa—edited by I. Schapera.

Martin Secker and Warburg, Ltd. Half-Caste—Cedric Dover.

Seeley, Service and Co., Ltd. Arctic Eskimo—C. E. Whittaker.

H. F. and G. Witherby, Ltd. Gypsy Hog Hunters—W. M. Kirkpatrick.

Biology

Philip Allan and Co., Ltd. A Bird Lover's Britain—G. K. Yeates. Introducing British Butterflies—H. Bastin. Nightmare of the Insect World—Dr. M. Burr.

George Allen and Unwin, Ltd. Evolution Re-stated—Dr. Julian Huxley. The Principles of Genetics—C. H. Waddington. Human Reproduction—Dr. S. Zuckerman.

D. Appleton-Century Co., Inc. The Little Things in Life—Barnett Sure. Birds around the Year—L. L. Fletcher. Adventures in Bird Protection—T. G. Pearson. General and Economic Botany, E. E. Stanford.

A. and C. Black, Ltd. A Pocket Book of British Trees—E. H. B. Boulton. A Pocket Book of British Wild Flowers—C. A. Hall.

Thornton Butterworth, Ltd. Nutrition and Diet—Dr. W. R. Aykroyd.

Cambridge University Press. British Stem- and Leaf-Fungi (vol. 2)—W. B. Grove. Development Abnormalities of the Eye—Dr. Ida C. Mann.

Cassell and Co., Ltd. South African Eden—Colonel Stevenson-Hamilton. The Science of Life: (7) How Animals Behave; (8) Man's Mind and Behaviour; (9) Biology of the Human Race—H. G. Wells, Julian Huxley and G. P. Wells.

Chapman and Hall, Ltd. Elements of Food and Nutrition—Mary T. Dowd and Prof. Alberta Dent. Ecological Animal Geography—Prof. Richard Hesse, translated by Prof. W. C. Allee and Dr. K. P. Schmidt. The Plant Diseases of Great Britain: a Bibliography—Dr. G. C. Ainsworth.

"Country Life", Ltd. Design in Nature—Prof. J. Ritchie. Ways of Birds—Thora Stowell.

Victor Gollancz, Ltd. The Book of Birds—Mrs. J. B. Priestley.

W. Heffer and Sons, Ltd. Floral Morphology—E. R. Saunders.

J. B. Lippincott Co. Picture Miracles of Plant and Animal Life—A. C. Pillsbury.

McGraw-Hill Publishing Co., Ltd. Economic Botany—A. F. Hill.

Methuen and Co., Ltd. Mainly about Wolves—E. T. Seton. Nutrition and Sex—Judith A. Silburn.

Kegan Paul and Co., Ltd. Pavlov and his School—Prof. Y. P. Frolov.

Putnam and Co., Ltd. Giant Fishes, Whales and Dolphins—J. R. Norman and F. C. Fraser. The Sky's their Highway—K. Williamson.

Charles Scribner's Sons, Ltd. Beaver Pioneers—Wendell and Lucie Chapman.

Ward, Lock and Co., Ltd. The Country Book—E. Golding. British Wild Flowers and their Garden Varieties—W. Willett.

Williams and Norgate, Ltd. General Plant Physiology—E. C. Barton Wright.

Chemistry

Edward Arnold and Co. The Retardation of Chemical Reactions—Prof. K. C. Bailey. Collisions of the Second Kind—Dr. E. J. B. Willey.

Baillière, Tindall and Cox. A Textbook of Applied Biochemistry—F. C. Wokes. Principles of Biochemistry—Dr. A. P. Mathews.

Cambridge University Press. An Introduction to Comparative Biochemistry—Dr. E. Baldwin.

Chapman and Hall, Ltd. The Chemistry of the Lipids—Prof. H. B. Bull. Organic Syntheses (vol. 17)—edited by Prof. L. F. Fieser. Drugs and Galenicals: their Quantitative Analysis—Dr. D. C. Garratt. The Chemistry and Technology of Rubber Latex—G. Genin and C. F. Flint. The Fine Structure of Matter—C. H. Douglas Clark.

Gerald Duckworth and Co., Ltd. A Hundred Years of Chemistry—Prof. Alex. Findlay.

W. Heffer and Sons, Ltd. Sterols and Related Compounds—Dr. E. Friedmann.

H. K. Lewis and Co., Ltd. Milk Products—W. Clunie Harvey and H. Hill.

McGraw-Hill Publishing Co., Ltd. Chemicals in War—A. M. Prentiss. Food Technology—S. C. Prescott and B. E. Proctor.

Macmillan and Co., Ltd. A Short History of Chemistry—Prof. J. R. Partington.

Oxford University Press. The Biochemistry of Cellulose, the Polyuronides, Lignin, etc.—Dr. A. G. Norman.

Technical Press, Ltd. Colloid Chemistry—Dr. A. von Buzagh, translated by O. B. Darbishire and Dr. W. Clayton.

Engineering

Chapman and Hall, Ltd. Aeroplane Design—C. H. Latimer-Needham. Cyclopædia of Television—A. T. Witts. Storage Reservoirs—G. Bransby Williams. Electrolytic Condensers, P. R. Coursey. Engineering Electronics—Prof. W. G. Dow. Refrigeration Engineering—Prof. H. J. Macintire.

Draughtsman Publishing Co., Ltd. Data for Design of Axial Flow Fans—R. Poole.

Gerald Duckworth and Co., Ltd. A Hundred Years of Mechanical Engineering—E. Cressy.

English Universities Press, Ltd. (*Hodder and Stoughton, Ltd.*). Aerodynamics—Dr. N. A. V. Piercy. The Electrification of Agriculture and Rural Districts—E. W. Golding. The Utilisation of Electrical Energy—E. Openshaw Taylor. The Rectification of Alternating Current—H. Rissik. Fundamental Science for Building Students—J. E. Thomas and H. C. Smith. Elementary Calculation in Building Subjects—R. V. Boughton.

H. K. Lewis and Co., Ltd. Modern Principles of Ventilation and Heating—Dr. T. Bedford.

McGraw-Hill Publishing Co., Ltd. Motor and Control Applications—G. H. Hall. Gear Cutting Practice—F. Calvin and F. A. Calvin. Fundamentals of Vacuum Tubes—A. V. Eastman. Measurement of Radiation—W. E. Forsythe. Steam Power Stations—G. A. Gaffert. Applications of the Method of Symmetrical Components—W. V. Lyon. Applied Fluid Mechanics—M. P. O'Brien and G. H. Hickox. The Theory of Continuous Structures and Arches—C. M. Spofford.

Macmillan and Co., Ltd. Engineering Science—H. B. Brown and A. J. Bryant.

Methuen and Co., Ltd. Molecular Beams—Dr. R. G. J. Fraser. Alternating Current Methods—Dr. D. Owen. Television—A. G. D. West.

Sir Isaac Pitman and Sons, Ltd. Definitions and Formulæ for Students (Telegraphy and Telephony)—Dr. E. Mallett. Television Engineering—J. C. Wilson. Hydro- and Aerodynamics—S. L. Green. Aircraft Radio—D. H. Surgeoner. The Complete Air Navigator—D. C. T. Bennett. A Simple Study of Flight—J. D. Haddon.

Technical Press, Ltd. Technical Electricity for Junior Students—J. E. Phillips and Dr. R. W. B. Stephens. The Battery Book—H. H. V. Cross.

H. F. and G. Witherby, Ltd. A Preliminary Practical Course in Gas Supply—Dr. O. E. de C. Ellis and Dr. W. F. Howell.

Geography and Travel

D. Appleton-Century Co., Inc. The Geography of Europe—G. D. Hubbard.

A. and C. Black, Ltd. The Syrian Desert—Christina P. Grant. The Lakeland Landscape—W. H. Thompson and G. Clark.

Blackie and Son, Ltd. Exercises in Cartography—Prof. F. Debenham.

Cambridge University Press. The Ascent of Nanda Devi—H. W. Tilman.

Jonathan Cape, Ltd. Pool and Rapid: The Story of a River—R. L. Haig-Brown.

J. M. Dent and Sons, Ltd. Britain and the Beast—Various Authors. Modern Scotland—Cicely Hamilton.

Hodder and Stoughton, Ltd. Camp Six—F. S. Smythe.

Macmillan and Co., Ltd. The Road to Oxiana—Robert Byron. Town and Country in Southern France—Frances Strang.

Sir Isaac Pitman and Sons, Ltd. New British Industries in the Twentieth Century—Dr. Alfred Plummer. The Coal-Mining Industry—Prof. J. H. Jones.

G. Routledge and Sons. Ltd. South Sea Islands—P. Verger.

Geology

Chapman and Hall, Ltd. Field Tests for Minerals—E. H. Davison.

McGraw-Hill Publishing Co., Ltd. Gold Deposits of the World—W. H. Emmons.

Thomas Murby and Co. Lexicon de Stratigraphie (1) Africa—edited by Dr. S. H. Houghton. The Geology of South Western Equador—Dr. G. Sheppard. Silicate Analysis—Dr. A. W. Groves. Geology of China—Prof. J. S. Lee. The Cycle of Weathering—Prof. B. B. Polynov, translated by Dr. A. Muir.

Mathematics and Astronomy

Victor Gollancz, Ltd. Men of Mathematics—Prof. E. T. Bell.

McGraw-Hill Publishing Co., Ltd. Analytic Geometry and Calculus—M. Morris and E. O. Brown.

Macmillan and Co., Ltd. The Elements of Mathematical Analysis—Prof. J. H. Michell and M. H. Belz. Advanced Algebra—S. Barnard and J. M. Child.

Methuen and Co., Ltd. Intermediate Trigonometry—Prof. T. M. MacRobert and W. A. Arthur.

Oxford University Press. Introduction to the Theory of Fourier Integrals—Prof. E. C. Titchmarsh. Eclipses of the Sun and Moon—Sir Frank Dyson and Dr. R. Woolley.

Technical Press, Ltd. Comets: Nature and Origin—Mary Proctor and Dr. A. C. D. Crommelin.

Metallurgy

Edward Arnold and Co. Bearing Metals and Alloys—H. N. Bassett.

Hutchinson and Co. (Publishers), Ltd. Pocket-Book of Electric Arc Welding—K. Mellar.

McGraw-Hill Publishing Co., Ltd. The Alloys of Iron and Carbon (vol. 2)—F. T. Sisco.

Technical Press, Ltd. Practical Metal-Turning—J. Horner.

Miscellany

George Allen and Unwin, Ltd.—What Science Stands For—Sir John Orr, Prof. A. V. Hill, Prof. J. C. Philip, Sir Richard Gregory, Sir Daniel Hall, Prof. L. Hogben. Science for the Million—Prof. L. Hogben. A Survey of European Civilization—W. K. Ferguson and G. Bruun. The Story of Civilization—Will Durant. What is Ahead of Us?—Various Authors.

Cassell and Co., Ltd. Science Front—Gerald Heard.

English Universities Press, Ltd. (Hodder and Stoughton, Ltd.). Professor Low's Home Experiments—Prof. A. M. Low.

McGraw-Hill Publishing Co., Ltd. Science in the Elementary Programme—W. C. Croxton.

Kegan Paul and Co., Ltd. The Social Function of Science—J. D. Bernal.

Martin Secker and Warburg, Ltd. American Men of Science—J. G. Crowther.

C. A. Watts and Co., Ltd. Dictionary of Scientific Terms for General Readers—Surgeon Rear-Admiral C. M. Beadnell.

Philosophy and Psychology

George Allen and Unwin, Ltd. Value and Ethical Objectivity—G. S. Jury. A Hundred Years of British Philosophy—Dr. Rudolph Metz (translated). That Inferiority Feeling—J. S. Hoyland. Adolescent Psychology—Ada H. Arlitt. Psychology and the Promethan Will—W. H. Sheldon.

D. Appleton-Century Co., Inc. The Principles of Reasoning—D. S. Robinson.

Cambridge University Press. Visual Perception—M. D. Vernon.

Herbert Jenkins, Ltd. Seven Stages of Childhood—Dr. Elizabeth S. Chesser.

P. S. King and Son, Ltd. The Fight for Our National Intelligence—Dr. R. B. Cattell.

Longmans, Green and Co., Ltd. Learning and Teaching—Drs. A. G. Hughes and E. H. Hughes.

McGraw-Hill Publishing Co., Ltd. Social Treatment in Probation and Delinquency—Pauline V. Young. The Nature of Human Nature—Ellsworth Faris.

Macmillan and Co., Ltd. Hume's Theory of Knowledge—C. Maund. Plato's Conception of Philosophy—Dr. H. Gauss.

Methuen and Co., Ltd. The Intelligence of Animals—G. C. Grindley. A History of Psychology—Prof. W. McDougall. Philosophy and the Physicists—Prof. L. Susan Stebbing.

Kegan Paul and Co., Ltd. On the Upbringing of Older Children—edited by E. Miller. Plato's Cosmology—Prof. F. M. Cornford. Technique of Psychoanalysis—Dr. David Forsyth.

Seeley, Service and Co., Ltd. Recent Psychic Experiences—E. A. Reeves.

C. A. Watts and Co., Ltd. The Tongues of Men—J. R. Firth. The Changing Outlook in Psychology—Prof. F. Aveling. First Principles—Herbert Spencer.

Physics

Cambridge University Press. Alchemy—Lord Rutherford. Elasticity, Plasticity, and Structure of Matter—R. Houwink. The Physical Principles of the Quantum Theory—Prof. A. Landé. Low Temperature Physics—Dr. M. Ruhemann. Examples in Numerical Physics—C. W. Hansel.

Chapman and Hall, Ltd. College Physics—Prof. J. A. Eldridge. Textbook of Thermodynamics—Prof. P. S. Epstein.

Longmans, Green and Co., Ltd. An Introduction to Fluid Mechanics—A. H. Jameson.

McGraw-Hill Publishing Co., Ltd. Introduction to Ferromagnetism—F. Bitter.

Macmillan and Co., Ltd. A Text-book of Light—G. R. Noakes.

Oxford University Press. Constitution of Atomic Nuclei and Nuclear Transformations—G. Gamow. Modern Thermodynamical Principles—A. R. Ubbelohde. Atomic Structure of Minerals—Prof. W. L. Bragg.

Seeley, Service and Co., Ltd. Electrical Conceptions of To-day—Dr. C. R. Gibson.

C. A. Watts and Co., Ltd. Noise—Dr. A. H. Davis.

Technology

Chapman and Hall, Ltd. The Applications of the Rare Gases to Industry—J. T. Randall. Gases and Metals—Dr. C. J. Smithells. Canning Practice and Control—O. Jones and T. W. Jones.

Leonard Hill, Ltd. Industrial Microbiology—Galloway and Burgess. Shoe Creams and Waxes—Davidsohn. Zinc as a Pigment—Remington.

McGraw-Hill Publishing Co., Ltd. Grinding Practice—F. Calvin and F. A. Stanley. Oil Burners—K. Steiner. Oil Fuels and Oil Burners—J. F. Moyer. Water Treatment and Purification—W. J. Ryan. Absorption and Extraction—T. K. Sherwood.

Sir Isaac Pitman and Sons, Ltd. Colour Sensitive Materials—R. M. Fanstone. Fabric of Modern Buildings—E. G. Warland. Science for Craftsmen and Technical Students—edited by A. F. Collins.

Printed in Great Britain by FISHER, KNIGHT & Co., LTD., St. Albans.

Letters to the Editor

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

NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 474.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Estimation of Vitamin A

SOON after the Second International Conference on Vitamin Standardisation (1934), it became apparent that the value of 1,600, which the Conference had provisionally allotted to the factor for converting results of spectroscopic tests for vitamin A into international units, might need reconsideration[1].

The Vitamin A Sub-Committee was reluctant to undertake experimental work on this problem which, it was hoped, would be settled before long by published work. When, by the autumn of 1935, this hope had not been realized, the Sub-Committee proceeded to collect unpublished data of biological and spectroscopic tests for vitamin A in various materials. These showed certain anomalies, which in the state of knowledge existing at the time, could not be harmonized. For example, a consistent series of biological tests, particularly of concentrates, showed a conversion factor of about 1,000–1,200, while equally consistent tests with some cod and halibut liver oils seemed to require a value nearer 2,000.

Further experimental work on this subject was therefore initiated by the Vitamin A Sub-Committee. The co-operation of as many laboratories as possible was enlisted, so that the results should command the maximum of confidence, and show whether any part of the discrepancy was due to variations in technique. It was obvious that with biological tests the most trustworthy results would be obtained by confining attention to a small number of materials and using as many experimental animals as possible. It was decided to investigate first whether the act of saponification, presumably effecting hydrolysis of the esterified vitamin, resulted in any change which might influence the conversion factor. Halibut liver oil, as the richest common source of vitamin A, was the material chosen. The Sub-Committee is indebted to Messrs. Parke, Davis and Co. for a quantity of a rich oil which was mixed with an equal quantity of an oil manufactured in Aberdeen.

The preparation of the concentrate and the dilution of the feeding-solutions of oil and concentrate, as well as the spectroscopic examination of all the materials including the carotene standard at the beginning of the experiment, and of the residues of the feeding-solutions from each laboratory at the end, were in the hands of Dr. R. A. Morton and Dr. J. R. Edisbury of the University of Liverpool. A special dilution of the β-carotene standard for use in the biological tests was prepared in the Department of Biological Standards of the National Institute for Medical Research. Special precautions were taken to minimize deterioration of all these materials, and great emphasis was laid on the importance of the tests for stability made on the residues of the actual solutions used for feeding. Sources of variation in technique, apart from the choice of basal diets and general treatment of the animals, were eliminated as far as foresight would permit. All the diluted feeding solutions were derived from one batch and distributed to the participants, ready for use. The relative, though not the absolute, dosage to be used was fixed and each worker used one dropping pipette for all the materials. The bottles of test material were stored continuously in a refrigerator from the time of arrival, only the approximate amount needed for dosage on any day being withdrawn at one time.

The materials were prepared in April 1936, and the last of the tests was completed in the following October. The participants in the biological tests were :

A. L. Bacharach and E. L. Smith, Glaxo Laboratories, Ltd., Greenford.
W. A. Broom, Messrs. Boots Pure Drug Co., Ltd., Nottingham.
H. M. Bruce and K. H. Coward, Pharmaceutical Society, London.
A. D. Emmett and O. D. Bird, Messrs. Parke, Davis and Co.'s Detroit Laboratories (communicated by J. A. Freeman).
E. M. Hume, Lister Institute, London.
S. K. Kon, National Institute for Research in Dairying, Shinfield.
T. Moore, Dunn Nutritional Laboratory, Cambridge.
S. W. F. Underhill, Messrs. The British Drug Houses, Ltd., London.
H. Wilkinson, Messrs. Lever Bros., Ltd., Port Sunlight.

The results showed a surprising degree of harmony. They are now being subjected to a statistical examination. There will necessarily be some delay before this is completed, but it seems unlikely that the general conclusion will be modified. A preliminary announcement of the results is thought to be in the general interest.

After a suitable correction, to weight the means obtained according to the number of rats used by the different participants, the conversion factor for the halibut liver oil was found to be 1,470, the range of the individual values being 1,400 to 1,700. For the concentrate the values were lower, most of them lying between 1,000 and 1,200.

The spectroscopic tests for stability of the solutions administered, however, made it clear that while the halibut liver oil solution had remained relatively stable throughout the period of the tests, deterioration had occurred in the solution of the concentrate. When the individual tests were corrected for the degree of deterioration, the low value for the conversion factor disappeared, and little doubt was entertained that, in the case of this concentrate, its instability was sufficient to account for the lower values obtained. Since this deterioration took place in spite of special precautions, it seems possible that other vitamin A concentrates might behave in the same way.

It is concluded therefore that:

(1) In view of the margin of error inherent in the biological tests, the above results, giving a conversion factor of 1,470 for a halibut liver oil, provide no support for changing the value of 1,600 recommended by the International Conference (1934) for the conversion factor.

(2) Many apparent discrepancies with concentrates are likely to have been due to unsuspected deterioration in the course of biological tests, so that independent control of this source of error is essential.

(3) The ground has now been cleared for further experiments designed to test supposed variability of the conversion factor in materials derived from different species of animals.

Further co-operative experimental work is contemplated on other alleged discrepant materials from different sources, and, for this purpose, information regarding other materials showing well substantiated discrepancies would be welcomed.

E. M. HUME.
(Secretary, Vitamin A Sub-Committee of Accessory Food Factors Committee, appointed by the Lister Institute and Medical Research Council.)
Lister Institute,
London, S.W.1.

[1] Morgan, Edisbury and Morton, *Biochem. J.*, **29**, 1645 (1935).

Chromosome Behaviour and Phylogeny in the Neuroptera

THERE has been disagreement on morphological and palæontological grounds as to the relationship of the groups of true Neuroptera and Megaloptera. In the first place, take the family Sisyridæ of the true Neuroptera (or Planipennia). Its members possess aquatic larvæ, and as they have some morphological features in common with Osmylidæ, the larvæ of which are semi-aquatic, Tillyard[1] in 1916 put forward the suggestion that it had to be regarded as a comparatively late offshoot of the latter. This view was then adopted by Withycombe[2], and recently Killington[3] in his admirable monograph of the British Neuroptera maintains the idea that "these two families are no doubt closely allied, and, indeed, it appears very probable that the Sisyridæ have been derived from an Osmyloid ancestor". On the other hand, Handlirsch[4] was not of the opinion that the families were very nearly related, and pointed out that Sisyridæ show a remarkable similarity with the then oldest known fossil remnants of true Neuroptera, that is, the Triassic Prohemerobidæ, the larvæ of which are supposed to have been aquatic also. Recently, Handlirsch[5] (and Beier), after having considered the discoveries of true Neuroptera in the Permian by Tillyard[6] and Martynov[7], also directs attention to the striking resemblance of some of these very old remnants with the living Sisyridæ, which group he still regards as a primitive and primarily aquatic one. Tillyard[8] seems later to have given up his original view and regarded Sisyridæ as "a specialized side branch" not very close to Osmylidæ. After much dispute, therefore, morphologists have come to no agreement on the relationships of the two groups.

The evidence of chromosome behaviour, on the other hand, proves to be unequivocal. From the work of Naville and Beaumont[9] we know that in Planipennia, including the Osmylidæ, the males possess an X and a Y chromosome, which show what Lorbeer has called "distance conjugation", that is, in the first meiotic metaphase the sex chromosomes always lie near the opposite poles of the spindle, apparently not having been in touch earlier. This property is not found in any other group of Insecta, and is extremely rare elsewhere. Now the Sisyridæ, which so far have been cytologically unknown, differ from all Planipennia, in having a normal behaviour of the sex chromosomes (Fig. 1 *a*, *b*). This is shown by their behaviour in *Sisyra fuscata*, which has $2n = 12 + X + Y$ in the male. X and Y pair like the autosomes in the first metaphase. (The stainless space between X and Y in the figure is a connexion, the existence of which is proved by a case where the XY-complex is bent at this point without any dislocation of their near ends.) This, I think, supports the view of Handlirsch.

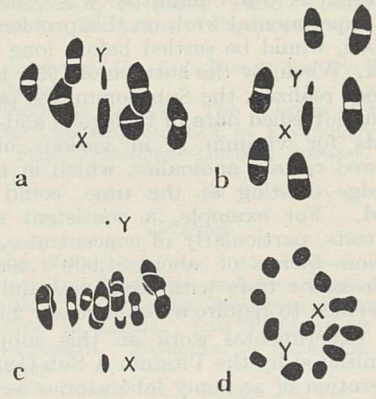


Fig. 1.

FIRST MEIOTIC METAPHASE OF *Sisyra fuscata* (*a*, *b*) AND *Raphidia xanthostigma* (*c*, *d*). PERMANENT ACETO CARMINE SMEARS, SLIGHTLY PRESSED.

Consider now the Megaloptera (Sialoidea and Raphidioidea). They have long been regarded as a single group remotely related to Planipennia. Thus Killington[3] does not include it in his comprehensive work. Tillyard[8], however, after having found fossils of Raphidioidea from so early a time as the lower Permian, and considering also the discoveries of Sialoidea by Martynov and himself from the same period, now considers these two groups to be as different *inter se* as they are from Planipennia. He refuses to give them ordinal rank as Handlirsch did (cf. also Withycombe[2], p. 401).

The chromosomes of a species of Raphidioidea, the whole group previously having been unknown cytologically, are shown in Fig. 1, *c*, *d*. The males have an XY-pair of sex chromosomes, the Y being very small, dotlike. These chromosomes show the "distance conjugation", known otherwise only among insects in Planipennia, and suggest a relationship with this group. The number of chromosomes in the male of the species investigated, *Raphidia xanthostigma*, is $2n = 24 + X + Y$.

The chromosomes of Sialoidea are described only in Japanese by Ito[10]. From his figures, however, I do not find any evidence of the occurrence of "distance conjugation" of the sex chromosomes. The number of chromosomes is $2n = 18 + X + Y$ in *Chauliodes*

japonicus and $2n = 20 + \alpha + \beta_1 + \beta_2$ in *Protohermes grandis*.

The opinion put forward by Tillyard in 1936 on palæontological grounds therefore seems to be supported by the cytological evidence. Raphidioidea may be even closer to Planipennia than to Sialoidea, and the distinction between Megaloptera and true Neuroptera therefore unsound.

Note added in proof. Since writing the present note, I have received an article by Naville and Beaumont *Arch. d'Anat. micr.*, 32, 1936), which shows the same behaviour as I have found in another species of Raphidia.

HOLGER KLINGSTEDT.
John Innes Horticultural Institution,
London, S.W.19.
Jan. 29.

[1] Tillyard, *Proc. Linn. Soc. N.S. Wales*, **41** (1916).
[2] Withycombe, *Trans. Entom. Soc. London* (1924).
[3] Killington, "A Monograph of the British Neuroptera", **1** (1936).
[4] Handlirsch, in Schröder's "Handbuch der Entomologie", **3** (1925).
[5] Handlirsch (& Beier), in Kükenthal's "Handbuch der Zoologie", **4** (1936).
[6] Tillyard, *Proc. Linn. Soc. N.S. Wales*, **51** (1926).
[7] Martynov, *Trav. Mus. geol. Acad. Sci. U.S.S.R.*, **4** (1928).
[8] Tillyard, *Amer. J. Sci.*, (5), **23** (1932).
[9] Naville and Beaumont, *Arch. d'Anat. micr.*, **29** (1933).
[10] Ito, *Dobutsugakuzasshi*, **45** (1933).

Duality of the Reversibly Oxidized Forms of Vitamin C and the Polarization of its Dienol Group

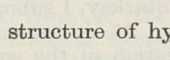
OUR recent work[1] on oxygen absorption of acid vitamin C solutions suggested the existence of the oxidized form: vitamin + ½ O, or vitamin − H. This form corresponds to the first step of the reversible oxidation of the vitamin, deshydroascorbic acid being the second. New evidence corroborates the duality of the reversibly oxidized forms of vitamin C. Phosphomolybdic acid ($P_2O_5(MoO_3)_{24} + 16\ H_2O$) mixed with an acid solution of vitamin C develops a blue or a green colour. The blue colour reaches its maximum intensity when the ratio $\frac{\text{ascorbic acid}}{\text{phosphomolybdic acid}}$ approaches $\frac{176}{3000}$. This colour fades when the quantity of the oxidizer, the phosphomolybdic acid, is diminished, and turns green when it increases.

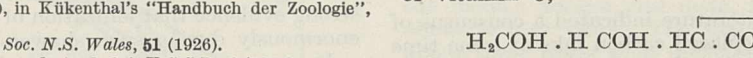
The blue colour may be obtained not only by the consequent increase of the concentration of vitamin, but also by adding to the weak ascorbic acid solution a substance such as cysteine. This last substance is not capable by itself of giving any colour reaction with phosphomolybdic acid, but acts by lowering considerably the potential of the solution. The changes from the blue to the green reaction and vice versa evidently depend upon the potential. Therefore these reactions must be evidence of the existence of two reversibly oxidized forms of the vitamin. To make this clearer, we have produced the maximum blue and green reactions and treated the solutions with hydrogen sulphide. Testing the liquids (after removal of hydrogen sulphide) with the Bezssonoff reagent [$3(MoO_3 17(WO_3)P_2O_5 + 24H_2O)$] and iodine, we find about 94 per cent of the vitamin which was present before the colour reactions.

We also ascertained that after precipitation of the green colour by means of neutral lead acetate, and lead with sulphuric acid, the liquid no longer gives the reactions of ascorbic acid. Later treatment with hydrogen sulphide restores the vitamin reactions.

Phosphomolybdic acid gives similar blue and green reactions with hydroquinol but not with pyrogallol, nor with various other polyphenols. Catechol gives a completely distinct yellow colour reaction; however, it possesses like vitamin C the common group COH : COH. The presence of such a group in the vitamin C molecule[2] is shown by the well-established formula of Hirst and confirmed by means of a titanium sulphate colour reaction (Ettori[3]).

Thus, phosphomolybdic acid gives identical colour reactions with hydroquinol and vitamin C, but not with catechol, in spite of the presence in these last two substances of the same dienol group (COH : COH). It is therefore evident that the dienol groups of vitamin C and hydroquinol are subject to a common influence which does not occur in the case of catechol.

The structure of hydroquinol,  , and of vitamin C,



indicates that in both substances the dienol group is polarized. This peculiarity does not distinguish the enol groups of catechol and of pyrogalol.

N. BEZSSONOFF.
MÉLANIE WOLOSZYN.
Clinique Infantile,
Faculté de Médicine,
Strasbourg.
Feb. 9.

[1] Bezssonoff, N., et Woloszyn, Mme. M., *C.R. Soc. Biol.*, **122**, 941 (1936); *C.R. Acad. Sci.*, **203**, 275 (1936).
[2] Pointed out first by Bezssonoff, *C.R. Acad. Sci.*, **180**, 970 (1925).
[3] Ettori, *C.R. Acad. Sci.*, **202**, 852 (1936).

Tyrosine in Diseased Pedipalps

THE value of X-ray methods in the identification of minute quantities of crystalline substances is well demonstrated in the following example. Dr. E. Warren has been studying part of the collection of Pedipalps (arachnids related to the scorpions) in the British Museum (Natural History), and in two series of *Hypoctonus formosus* Butler, from Further India, he has found evidence of a fungus disease (actinomycosis), which had affected at least 70 per cent of the specimens. Associated with the fungus centres, which are scattered throughout the tissues of the host, there are yellowish-white spherules measuring up to ½ mm. in diameter. These spherules are made up of radiating, birefringent needles which are probably pseudomorphous after the radiating fibres and hyphal tubes of an Actinomyces.

An X-ray photograph (using copper radiation) of one of the spherules yields a well-marked 'powder pattern' identical with a photograph of powdered artificial *l*-tyrosine, thus confirming Dr. Warren's preliminary determination based on solubility tests. Possible alternatives such as uric acid, the two hydrates of calcium oxalate, leucine, etc., are also excluded by their X-ray patterns. Moreover, two samples of *dl*-tyrosine, prepared by different methods, which were kindly sent to me by Prof. H. S. Raper, give patterns similar to, but not identical with, those of *l*-tyrosine. This distinction between *l*- and *dl*-tyrosine is enhanced in powder photographs of the hydrochloride derivatives. Hence tyrosine is present

in diseased Pedipalps either as the *d*- or *l*-form, more probably the latter. It results from the decomposition of proteins in the host, and has been detected in vertebrates as a rare urinary sediment associated with acute yellow atropy of the liver, phosphorus poisoning and yellow fever.

F. A. BANNISTER.

Mineral Department,
British Museum (Natural History).

The Lachish Letters and the Use of Iron Inks in Antiquity

THE documents found early in 1935 on the ancient biblical site of Lachish, and now known as the Lachish Letters, were brought to London on the return of the expedition. During the summer of 1935, at the request of Mr. L. J. Starkey, I submitted them to a chemical examination. At the same time I made a more general investigation of the subject of early inks.

A survey of the literature indicated a consensus of opinion that iron displaced carbon inks at some time during the Middle Ages. I found, however, that the ink used in these letters contained both carbon and iron.

The problem is complicated by the presence of ferric iron in the body and on the surface of the sherds, and it was necessary to develop a special technique for testing the microscopic particles detached from various positions within and outside the lettering. It was observed that the better preserved writing was richer in iron, and the more eroded characters were primarily carbon.

A further search of the literature gave evidence of the early knowledge of iron inks. An examination was therefore made of the material available in the British Museum, and it was found that most of the writing on vellum of the early Christian period was in iron free from carbon. The earliest of these was the second century leaf from a Codex, concerning which Kenyon[1] says : "The earliest extant examples (of vellum) are probably two leaves, one in the British Museum containing part of Demosthenes' De Falsa Legatione (B.M. Additional MS. 34,473 i) . . ." A minute fragment of this taken from a broken edge of a paragraphing line, after subdivision into portions of about 0·02 mm. in size, was tested under the microscope. This gave the reactions for iron, the ink being entirely soluble and leaving no residue of carbon. Of the third and fourth century vellum documents or fragments, three out of twelve were carbon. Among the nine of iron type is the Codex Sinaiticus, which is a good example of this carbon-free brown iron ink.

Iron inks are decomposed with time to brown ferric oxide and hydroxides, which in the case of these early vellum manuscripts, appear as an almost transparent gel, combined perhaps as a complex with the vellum.

It can scarcely be doubted that the writers of antiquity insisted upon an ink of good appearance, comparable when fresh with a carbon ink, and as in these examples carbon is absent, the iron must have been in combination with a gall or tannin extract.

The ancient world was well acquainted with iron inks and with the various combinations which could be made with carbon, copperas, oak galls and gum ; and it was with such an iron and carbon mixture that the Lachish Letters were written.

A complete account of the work will be found in "The Lachish Letters. I. The Wellcome Archæological Research Expedition to the Near East", which is now in the Press.

ALKIN LEWIS.

Chemical Department,
King's College,
London, W.C.2.

[1] "Books and Readers in Greece and Rome", **42**, 92 (1932).

Effect of Meteoric Shower on the Ionization of the Upper Atmosphere

OBSERVATIONS on the ionization of the upper atmosphere during a meteoric shower have as yet been very few in number and have all been confined to the Kennelly-Heaviside or *E* region. So far as we are aware, only two observations, one carried out in the United States[1] and the other in India[2], comprised direct measurements of the ion content of this region during the Leonid showers. Both gave strong evidence that ionization of this region increases enormously during such showers.

It seems natural to inquire if meteoric showers have any effect on other regions besides the *E* region of the ionosphere. Measurements with this object in view were carried out at Calcutta on five consecutive nights during the Leonid shower in November 1936. The dates of observations were centred around the night of maximum shower, November 14–15. The critical penetration frequency method was employed for the purpose ; the range of frequencies used was 1–15 Mc./sec. Observations were made at intervals of one hour between 22.00 and 05.30 hours. The observed results are plotted in Figs. 1 and 2.

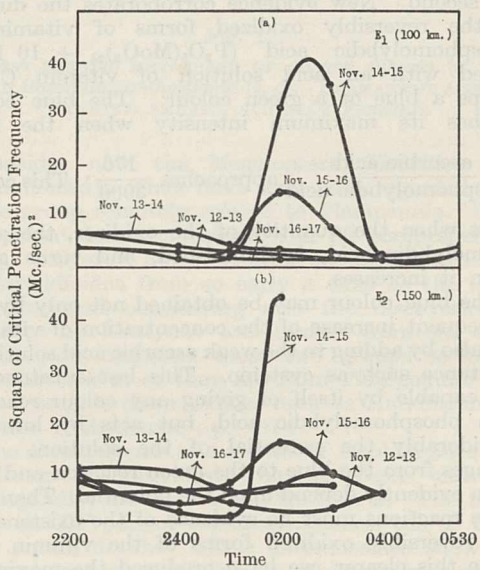


Fig. 1.

Fig. 1 (*a*), E_1 region. There is sharp increase of ionization between 01.00 and 04.00 hours, which is the period of maximum intensity of the shower in the nights of November 14–15 and 15–16.

Fig. 1 (*b*), E_2 region. Similar increase as in the case of E_1. The drop in the curve for November 14–15 could not be observed, presumably because the ionization fell below that of the E_1 region.

Fig. 2 (*a*), F_1 region. The ionization on an average diminishes for all the nights except for that of November 15–16.

Fig. 2 (*b*), F_2 region. The ionization on an average diminishes for all the nights.

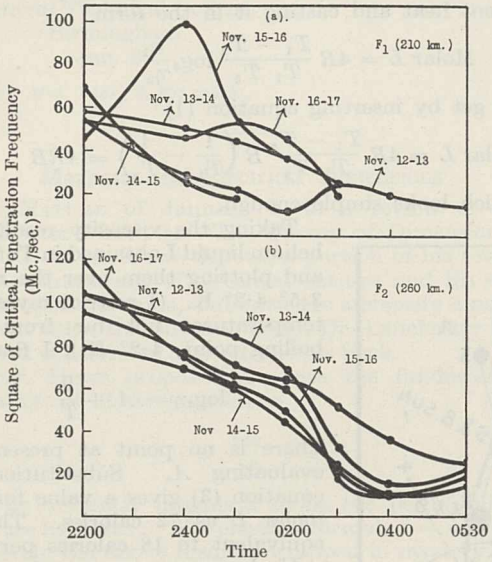


Fig. 2.

The increases in the ionization of the E_1 and E_2 regions (Fig. 1) on the night of November 14–15 are undoubtedly due to the impact of meteors. There was no other disturbing factor in this night. There might be some uncertainty with regard to the increases on the night of November 15–16 in E_1, E_2 and F_1 ionization, as there was a magnetic storm in progress during that night. Since, however, the time of increase in the ionization of E_1 and E_2 on this night corresponds, as on the previous night, to the hour of maximum intensity of the Leonid shower, and also since no significant correlation between a magnetic storm and abnormal increase of the ionization of these regions has, as yet, been found in our latitude, it may safely be inferred that these increases are also due to the meteoric shower. With regard to the increase in the F_1 ionization during the same night, it is very doubtful if meteors were responsible for this, since the time of increase does not correspond with the time of maximum shower. Further, as in the case of the two E regions, there was no increase of a similar nature on the previous night.

Since the heights of most frequent appearance and disappearance of meteors, visible to the naked eye, lie between 160 km. and 70 km., it is to be expected that any increase of ionization caused by the meteors should be confined within these limits. This is what has actually been observed. Though, in the course of our observations, we were able to detect each of the four distinct regions of maximum ionization, it was only the lower ones—E_1 and E_2—which were found to be affected by the meteoric shower. The fact that these regions showed increase separately and were not merged into one continuous region due to meteoric impact—as, at first thought, might have been expected—also receives an easy explanation if we remember that a region which is already ionized should undergo proportionately greater increase of ionization than a region which is not originally ionized.

An account of this work with fuller details will appear shortly in the *Indian Journal of Physics*. The author is indebted to Prof. S. K. Mitra and Dr. H. Rakshit for their kind interest in the work.

J. N. BHAR.

Wireless Laboratory,
University College of Science,
92 Upper Circular Road,
Calcutta.
Jan. 18.

[1] Skellet, A. M., *Proc. Inst. Rad. Eng.*, **23**, 132 (1935).
[2] Mitra, S. K., Syam, P., and Ghose, B. N., NATURE, **133**, 533 (1933).

Figures of the Earth and Moon

A RECENT paper of mine, noticed in NATURE for February 27, p. 381, needs a correction, since the next issue of the *Monthly Notices of the Royal Astronomical Society* (p. 126) contains a correction by Prof. E. W. Brown to the calculated motions of the moon's perigee and node, which had stood for about twenty years. The change for the perigee is about three times what appeared to be the probable error of the previous value. Brown, in a letter to me, has queried the probable errors that I used; but provisionally retaining them until better estimates are available, I have made a new solution, which is: $J = 0{\cdot}0016361 \pm 0{\cdot}0000059$; $1/e = 297{\cdot}19 \pm 0{\cdot}52$; $J' = 0{\cdot}000316 \pm 0{\cdot}000024$; $K' = 0{\cdot}000115 \pm 0{\cdot}000048$; $f = 0{\cdot}69 \pm 0{\cdot}06$.

The ellipticity of the earth is only slightly affected; the chief change is in the ellipticity of the moon's equator, which is proportional to K' and is more than doubled. It is now almost midway between the two inconsistent values of Hayn and Stratton, and affords no ground for preferring either to the other. The coefficient of $g_0\sin^2\phi$ in gravity will be increased to $0{\cdot}0052911 \pm 0{\cdot}0000059$.

The need for a modern series of observations to determine the moon's librations in longitude is clear; in the above determination, K' rests entirely on the motion of the perigee. If it is correct, the period of the free libration in longitude should be close to 50 sidereal months and the amplitude of the annual forced libration 0·84′.

HAROLD JEFFREYS.

St. John's College,
Cambridge.

Planetary Positions at Sunset in 1937

THE hour after sunset is possibly the time most often chosen by many for noticing the bright planets, chiefly because Venus and Mercury scarcely let us notice them at any other time, except by insisting on inconvenient wakefulness before sunrise.

In the accompanying drawing (Fig. 1), and for the English sunset sky, the positions of the sun and the bright planets are indicated for the first day of every month of the year. Number 1 stands for the first day of January, 2 for the first of February, and so on, 13 standing for the first of January 1938. The positions of the setting sun on the first day of two months like January and December are not really the same, but they are sufficiently near to one point to be marked the same for the purposes of this diagram.

The positions of Mercury lie on a peculiarly tangled path, and the middle of April (the fourth month)

seems the best time to look for that planet. It is then at a considerable altitude directly above the setting sun, but the small size of the spot marked 5—the spots are graded for relative brightness—indicates that the planet may not be very bright on those evenings. Venus will evidently be a magnificent object in March, over the south-west horizon and about half-way up to the zenith. The curve for Mars shows a singular loop in the autumn, and during August, September and October the planet is actually farther *east* each successive evening at the time of sunset. This loop, by the way, is not to be thought of as only the ordinary loop made relative to the background of stars, but rather as a loop made relative to the leafless branches of the old tree at the south end of my garden,

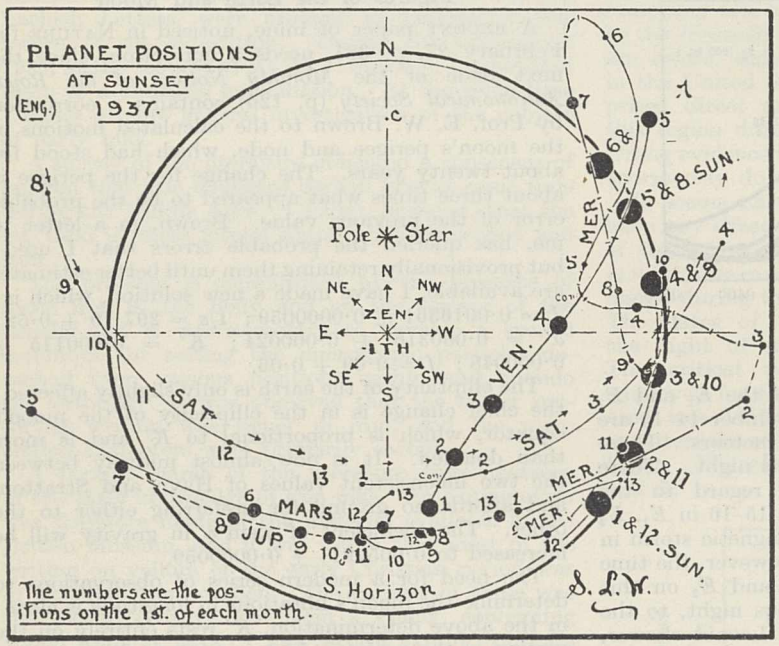


Fig. 1.

as viewed each evening from the same spot, at the time of sunset. The hourly changes of position of any object may be judged from the seventeen little arrows showing the track of an equatorial star at sixteen hourly intervals, and some planetary positions are marked below the eastern horizon. Jupiter and Saturn are nearly as sedate as fixed stars.

About the middle of January the planets Venus and Saturn appeared close together, and the same will be true of Venus and Mercury in April. Mars and Jupiter are to be so close together at the end of October that the one spot numbered 11 is allowed to mark the position of both.

S. L. WALKDEN.

London.
Feb. 2.

Latent Heat of Evaporation of Liquid Helium

THE letter of Dr. J. Newton Friend in NATURE of December 26, 1936, on this subject raises interest in his equation. I have tested it with the following results:

As many know, the variation of the coefficient of viscosity of a liquid with temperature can often be expressed—over a short range at least—by an equation of the type

$$\log_e \eta = A + \frac{B}{T} \quad . \quad . \quad . \quad . \quad (1)$$

Taking therefore Dr. Newton Friend's equation for latent heat and casting it in the form

$$\text{Molar } L = 4R \frac{T_1 - T_2}{T_1\ T_2} \log_e \frac{\eta_1}{\eta_2} \quad . \quad . \quad . \quad . \quad (2)$$

we get by inserting equation (1)

$$\text{Molar } L = 4R \frac{T_1 - T_2}{T_1\ T_2} B \left(\frac{1}{T_1} - \frac{1}{T_2}\right) = 4RB \quad . \quad . \quad (3)$$

which looks simple enough.

Taking the viscosity results on helium liquid I obtained in Toronto and plotting them over the range 3·5°–4·2° K. (I restrict myself to temperatures not far from the boiling point, 4·2° K.), I find:

$$\log_e \eta = A + \frac{9}{T}$$

There is no point at present in evaluating A. Substitution in equation (3) gives a value for the molar L as 72 calories. This is equivalent to 18 calories per gm.

If, however, we use the data obtained at Leyden, the latent heat of vaporization of liquid helium 1 is of the order of 5 calories per gm. (Reference to the Leyden entropy diagram of helium shows an increase of entropy of 1·2 units per gm. when liquid helium 1 evaporates at 4·2° K., and 1·2 × 4·2 = 5 calories very nearly).

Therefore whether we consider Dr. Newton Friend's result or the value I quote above as being more correctly obtained by his equation, we see that the agreement with the correct value is not good. Hence his equation must be in error.

JOHN SATTERLY.

Department of Physics,
University, Toronto.
Jan. 19.

I AM grateful to Prof. Satterly for directing attention to the discrepancy. Accepting 5 × 4 = 20 as the molar latent heat of evaporation of helium, the value 31·3 calculated with the aid of the Clausius-Clapeyron equation is certainly wide of the mark; so is 36·2 which I calculated from my equation using Prof. Burton's data. But as my equation was derived on the assumption that the Clausius-Clapeyron equation holds, clearly if the latter fails the former may be expected to do so also.

Both equations have, however, been found to give very satisfactory results with a large number of substances. Assuming the vapour pressure and viscosity data for liquid helium are correct, instead of suggesting that the equations "must be in error", would it not be better to suggest that helium is abnormal? That such may well be the case is evidenced by the curious fact that liquid helium II is much more fluid than

liquid helium 1, despite its lower temperature, as Prof. Satterly has himself pointed out elsewhere[1]. It would be interesting to ascertain the absolute cause of this discrepancy.

J. NEWTON FRIEND.

Central Technical College,
Birmingham.
Jan. 28.

[1] *Rev. Mod. Phys.*, **8**, 356 (1936).

Magnetic and Electrical Dimensions

IN NATURE of January 9, in a review of Dr. Lanchester's book on "The Theory of Dimensions", Prof. G. W. O. Howe devotes a portion of his review to the dimensions of electrical entities and his own views upon the same, and criticizes adversely a paper of mine upon this subject, which Dr. Lanchester had printed in full in an appendix in his book.

Prof. Howe proposes to write the fundamental equation of electromagnetism

$$f = \mu \cdot \frac{ids}{r^2} \cdot ids,$$

and he evidently intends μ to be the permeability, because he states : "The classical formula $f = mm'/\mu r^2$ is merely the above formula wrapped in mystery".

It will be noticed that in Ampère's classical equation given above, Prof. Howe has substituted μ for $1/A'$. He does this without any explanation or justification, unless, since $c^2 = A'/K$, it is merely to maintain the expression $c^2 = 1/\mu K$, whereas the full expression is $c^2 = A'/K = A^2/\mu K$, A, A',μ and K being the four fundamental constants in the classical theory. Now Maxwell assumed A' to be an undimensional constant numerically equal to unity, and this has been the established practice, hence K has the dimensions $1/V^2$ and even if $c^2 = 1/\mu K$, μ must be undimensional, a conclusion to which Prof. Howe objects.

With regard to Prof. Howe's mystery and his further reference to "such a fictitious complexity as a permanent magnetic point pole of unit strength", is there any more in this than the conventional application of our standard method of dealing with a system of distributed forces in a case where the forces are both attractive and repulsive, by finding the centroid of each system and calling these points the poles of the magnet ? The resultants through the poles give the same magnetic moment as the magnet possesses, and the historical choice of the unit pole was a very natural one. How else would it be possible to deal with the interaction of magnets ? It is a common physical laboratory experiment to determine the equivalent poles of a long bar magnet by means of an exploring coil or vibrating needle. Other "fictitious" complexities are found useful in other branches of science in order to make very abstruse problems easily tractable, such as point sources and sinks in hydrodynamics. Think of Rankine's work on streamlines by this method.

If magnetic forces are due to electric currents, then the two standard equations $f = ids \cdot i'ds'/A'r^2$ and $f = mm'/\mu r^2$ must be co-dimensional, and the simplest solution is $m = iL$ and $A' = \mu$ dimensionally. No objection either physical or mathematical has yet been offered to this solution, which eliminates from electrical science that great bugbear, the dual system of dimensions, and no sacrifice is required in adopting it.

I would remind Prof. Howe that one International Committee has already recommended that μ is to be considered a dimensional entity, also that the final decision is to be made this year.

38 Blackheath Park,
London, S.E.3.
Feb. 11.

JAMES B. HENDERSON.

IN reply to Sir James Henderson, I can only say that I was under the impression that I had given ample explanation and justification for introducing only one magnetic constant of space. If ferromagnetism is due to orbital movement of electrons, that is, to electric currents, then I cannot believe that the forces between magnetic poles involve one property of space and the forces between current-carrying conductors another property. I intended μ to be exactly what I stated in the review, namely, the space constant which makes the formula for the force between electric currents (or magnets) dimensionally and numerically correct, just as $1/K$ is introduced in the formula for the force between charges, and G in the gravitational formula.

I agree that point sources and sinks are excellent mathematical tools and that the unit pole is a very useful conception, but having invented the conception, let us not look to it as an oracle and expect it to answer questions on the ultimate realities of electromagnetism. As I have said elsewhere[1] : "the greatest danger in this subject is that of overlooking the fact that, having put various ingredients into the hopper and turned the handle several times, the result has not dropped from heaven but has come out of the machine and contains all the assumptions that were put in". For this reason I am not impressed by the statement that on certain assumptions "μ must be undimensional" or that the simplest solution of some equations is that $A' = \mu$ dimensionally.

With reference to the equations "$f = ids \cdot i'ds'/A'r^2$" and "$A' = \mu$ dimensionally", to which Sir James Henderson says "No objection either physical or mathematical has yet been offered", seeing that this is equivalent to writing $f = ids \cdot i'ds'/\mu r^2$ with μ in the denominator, I can only express my surprise that such a suggestion is put forward seriously.

I cannot understand why Sir James Henderson should remind me of the well-known fact that one International Committee has already recommended that μ is to be considered a dimensional entity. This is surely what I maintained in the review. I was under the impression that he was trying to maintain the contrary opinion. I am in entire agreement with the recommendation of the Committee and with Rücker, who pointed out the advantage of "not suppressing the secondary fundamental units such as μ and K" by "arbitrarily assuming that some one of the quantities involved is an abstract number".

University,
Glasgow.
Feb. 17.

G. W. O. HOWE.

[1] *Wireless Engineer*, January 1937, editorial.

Supraconductivity of Lanthanum

WE have investigated the magnetic behaviour of lanthanum below 10° K. The metal was kindly lent to us by Prof. F. M. Jaeger of Groningen ; the analysis was given as lanthanum 98 per cent, iron 1 per cent and traces of carbon, silicon, aluminium

and magnesium. Two lumps of irregular shape were tested by methods described previously[1,2]. Strong diamagnetic susceptibility, which could be destroyed by a magnetic field, showed that the specimens became supraconductive. After supraconductivity had been destroyed by a magnetic field, the magnetic flux threading the specimens 'froze in' when the field was lowered again. The formation of such a supraconductive 'sponge' was to be expected in a specimen containing 2 per cent of impurities[3].

The transition point in zero field was determined by the decrease of the 'frozen in' magnetic dipole with increasing temperature[4]. The transition point was found to be 4·71° K. The threshold values, that is, the field strengths at which the last trace of supraconductivity disappeared, were found to be very high (steepness of the threshold curve more than 1,000 gauss per degree). The specimens behaved in all respects similarly to the samples of tantalum investigated by Mendelssohn and Moore[1].

So far, supraconductivity has been observed in all metals in Groups II*b*, III*b*, IV*a*, IV*b* and V*a* of the Periodic Table (except germanium, which is cubic like grey tin, and protoactinium, which has not been tested) but in no other group. The supraconductivity of lanthanum (Group III*a*) makes it probable that some of the other metals of this group also (scandium, yttrium, actinium) will become supraconductive. The question arises also whether the rare earths between lanthanum and hafnium will show supraconductivity. It has to be remembered, however, that the rare earths, owing to their incomplete *N*-shells, have strong magnetic moments which may make supraconductivity impossible. From this point of view, the element 71 (where the *N*-shell is completed) is the one in which supraconductivity is most likely.

K. MENDELSSOHN.
J. G. DAUNT.

Clarendon Laboratory,
Oxford.
Feb. 13.

[1] Mendelssohn, K., and Moore, J. R., *Phil. Mag.* (21), **7**, 532 (1936).
[2] Mendelssohn, K., *Proc. Roy. Soc.*, A, **155**, 558 (1936).
[3] Keeley, T. C., and Mendelssohn, K., *Proc. Roy. Soc.*, A, **154**, 378 (1936).
[4] Mendelssohn, K., and Babbitt, J. D., *Proc. Roy. Soc.*, A, **151**, 316 (1935).

Dr. Seeber in South Africa

IN connexion with the study of South African freshwater fishes, it is of interest to ascertain particulars about Dr. Seeber, after whom two fishes were named by Gilchrist and Thompson. Apparently Dr. Seeber corresponded with these authors about the years 1909–11, but I can obtain no information as to who Dr. Seeber was, where he lived or was stationed, or where he travelled in South Africa. The Medical Register and other local sources have failed, and this request is issued in the hope that one of the many readers of NATURE may have known Dr. Seeber. Any facts bearing on his residence or activities in South Africa will be welcome.

KEPPEL H. BARNARD

South African Museum,
Cape Town.
Jan. 8.

Points from Foregoing Letters

Miss E. W. HUME reports the preliminary results of an investigation on vitamin A standards, undertaken by the Accessory Food Factors Committee with the help of numerous collaborators. It appears that the discrepancies previously reported in the case of 'concentrates' have been due to unsuspected deterioration in the course of biological tests. The factor for converting results of spectroscopic tests into international units is found to be 1,470, with a range of individual values of 1,400–1,700. The previously accepted value of 1,600 recommended by the International Conference of 1934 is, however, retained for the time being.

According to investigations described by Holger Klingstedt, the behaviour of the sex chromosomes at meiosis indicates a closer relationship between sections of the Megaloptera and true Neuroptera than exists within these orders. The old distinction between them may therefore be unsound, as newer morphological and palæontological evidence also indicates.

The reversible behaviour of the blue and green solutions obtained by treating ascorbic acid (vitamin C) with phosphomolybdic acid is described by Prof. N. Bezssonoff and Mélanie Woloszyn. The authors consider this as further proof of the 'duality' of the reversibly-oxidized form of ascorbic acid and, by comparison with the behaviour of other organic compounds, conclude that the dienol group of the vitamin C molecule is polarized.

The identification of tyrosine by means of X-ray spectrograms in diseased pedipalps (arachnids related to the scorpions) is reported by F. A. Bannister. The tyrosine occurs in the form of radiating needles in museum specimens which have been affected by a fungus disease (actinomycosis).

A chemical examination shows that the ink used for the letters found on the biblical site of Lachish was of mixed iron and carbon type. A. Lewis has, in addition, investigated other ancient documents and concludes that iron inks, probably in combination with a gall or tannin extract, were frequently used in antiquity.

Curves based on the critical penetration frequency of radio waves, indicating a sharp increase in the ionization of the E_1 and E_2 regions of the upper atmosphere during the period of maximum intensity of the Leonid meteoric showers in November 1936 are submitted by J. N. Bhar. The ionizing power of the meteors appears to be effective in the region where they are visible to the naked eye (between 160 km. and 70 km.).

A new value for the ellipticity of the earth and that of the moon's equator, based on a corrected value for the moon's perigee and node, calculated by Prof. W. W. Brown, is given by Dr. Harold Jeffreys.

Prof. J. Satterly points out that the value of the molar latent heat of evaporation of helium calculated from data on viscosity and vapour pressure, according to Dr. J. Newton Friend's formula, does not agree with the experimental value, and concludes that the formula is incorrect. Dr. Newton Friend suggests that, since the formula applies to a large number of substances, one may assume that liquid helium behaves abnormally.

Research Items

The Katanga Skull

THIS human skull belonging to a skeleton found in 1918 in some old native workings in the mine of Kambove (Katanga) in the Belgian Congo, has been made the subject of a study by Dr. Matthew Young of University College, London (*Mém. Musée Roy. d'Hist. Nat. de Belgique*, (2), 5). The skull is complete, with the lower jaw. It is undoubtedly of negro type, though showing signs which suggest admixture. Unfortunately, the remainder of the skeleton was not preserved. Although stained green with malachite, it shows no signs of mineralization to any appreciable degree. The specimen is of moderate length, very narrow, with a notable post-orbital constriction, and relatively high with a well-arched vault. The forehead is fairly rounded and shows the median eminence characteristic of the negroid type, though there are distinct indications of frontal eminences. The supracilliary ridges are fairly prominent. The temporal ridges are strongly developed, which is said to be a negroid feature. They appear to be more convergent than usual. The face is long, the nasal bridge excessively flat. The nasal aperture is relatively wide. Prognathism is moderate, and the lower jaw robust. The lower central incisors had been extracted at an early age. The skull is adult and probably male. It most closely resembles the Teita series from East Africa collected by Dr. Leakey, except in regard to the length of the face and especially of the alveolar portion. In this respect, it resembles two Nuba females from South Kordofan. A similar type of unusually long face and development of the alveolar region, accompanying an exceptionally high palate, is seen in Leakey's Nakuru and Elmenteita types, which have been compared with the Oldoway skull. These are usually considered to be Hamites, while Keith regards Oldoway as proto-Hamite. The Katanga skull then is a negro of recent date, probably not later than twelfth century, and is more nearly allied to the East than the West African type. It may be the remains of a slave captured at some distance from the Katanga.

Mule Deer of the Pacific Region of America

As a result of the examination of 602 specimens of *Odocoileus*, supplemented by the studies of former investigators, Ian M'Taggart Cowan finds that two species only inhabit the Pacific coastal region of North America—the white-tailed deer (*O. virginianus*) with two geographical races, and the black-tailed deer (*O. hemionus*) with nine. Complete intergradation was found between the latter and *O. columbianus*, formerly regarded as a distinct species (*California Fish and Game*, 22, 155; 1936). The monograph is a thorough one, but we can refer here only to two points of general interest. The pigmentation, particularly of the tail, shows great variation, and each colour grade is generally associated with a more or less uniform set of environmental conditions, but over the whole area the intensity of the coat colour seems to be related to the humidity of the environment. The races living in the humid coastal region have the darkest pigmentation, the desert forms the lightest; and in these respects the coloration agrees with what has been found in several other mammals and birds. The second point is that the races of the mule deer conform to the general truth known as Bergmann's law, that individuals of races inhabiting colder localities are larger than those of races inhabiting the warmer regions. Not only is this so, but also the northern races, as well as being larger than the southern, display greater sexual dimorphism in size of body.

Pinus radiata in New Zealand

A LEAFLET (No. 28. N.Z. State Forest Service, December 1936) has been recently issued dealing with the terminal hypertrophy in *Pinus radiata* in relation to frost damage. It is based on researches by Mr. T. T. C. Birch. Hypertrophied terminals are distinguishable from a normal leading shoot by the following characteristics: (1) length of terminal, from last whorl to apex, exceeds 4 ft. and occasionally reaches 12 ft. or more; (2) epicormic shoots and five-needle fascicles are often associated with the condition; (3) the larger hypertrophied terminals do not necessarily represent one year's growth, two layers of wood frequently occurring in the basal portions, without lateral branches; (4) abnormal turgidity and brittleness, primarily due to the large proportion of medulla in the shoots. As might be expected, hypertrophied terminals rarely escape some form of climatic injury, and owing to their brittle nature, many of those projecting above the normal crown-level of a stand, are broken or damaged by wind. Frost also is responsible, both directly and indirectly, for a considerable amount of damage to hypertrophied terminals. Mr. A. D. McGavock, director of forestry, says in a note that "Mr. Birch is conservative when he describes this leader as 'occasionally reaching 12 ft. or more'. This is correctly stated if he refers to a single year's growth only; but similar growth in subsequent years is frequently superimposed on this, and lengths of up to 22 ft. without a single lateral branch have been measured. Such a condition in itself is undoubtedly a sign of ill-health in a tree; but seemingly because it is not due to any pathogen nor to any apparent mechanical injury, it has not, so far as I am aware, received any attention from forest pathologists".

Respiration in Tropical Fruits

THE extensive studies of changes during ripening in fruits in storage under English conditions carried on at the Low Temperature Research Station, Cambridge, are now being very usefully extended to the tropical fruits, at the equivalent research station in Trinidad. Drs. C. W. Wardlaw and E. R. Leonard have two papers dealing particularly with respiration in tropical fruits in the *Annals of Botany*, 50, 1936, which are also issued separately by the Imperial College of Tropical Agriculture (July 1936). Two points of general importance in these communications are the further support given to the importance of the oxygen concentration in the internal gas concentration in relation to the initiation of that period of maturation frequently described as the climacteric,

and the new suggestion that the subsequent onset of senescence may be associated with the difficulty in the movement of oxygen into the interior of the fruit as a result of the changes in texture, etc., associated with maturity, which hinder the ready access of oxygen from the outside air. Considerable attention has been paid to the internal atmosphere in these studies, such hollow fleshy fruits as the papaw readily lending themselves to the necessary technique for sampling the internal gases.

A Halo-Spot of Tomatoes

THE prevalence of tomatoes covered with a number of silvery spots has been noticed on many occasions. Insects were thought to be the cause, but Dr. C. L. Walton has shown (*Gard. Chron.*, Jan. 2, 1937) that this is not so. The trouble appears when 'top-watering' to simulate rain is practised. Drops of water fall upon the fruit, and if a burst of sunshine occurs, they evaporate very rapidly, and the skin of the fruit is scorched. This kind of trouble is probably more widespread than is often realized, and the lens-shape of the drops may even cause necrotic spots or other puzzling symptoms.

Cordierite in Pegmatites from Japan

THE results of an important study of cordierite and its graphic intergrowth with quartz in Japanese pegmatites has been published by H. Shibata (*Jap. J. Geol. Geog.*, 205 ; 1936). The pegmatites are regarded, not as of purely igneous origin, but as syntectic products involving reaction with the invaded rocks. One from Sasago injects sandstone and slate ; in the central zone of graphic microcline-granite, rosettes of andalusite and intergrowths of cordierite and quartz occur. Another intrudes amphibolite of the Misaka Series (Higashidani). Soda diffused into the amphibolite, while reaction between magnesium silicate (from hornblende) and the pegmatitic liquid led to the crystallization of cordierite. In another example (Mujinazawa) cordierite also formed by reaction of magmatic material with hornblende. A zonal arrangement of minerals developed, with graphic intergrowths of cordierite and quartz in the intermediate zone. The analysed cordierites show large amounts of iron, manganese and soda. The author has systematized the physical and chemical properties of cordierites from all parts of the world. The various relationships between optical properties and chemical composition are summarized in a series of tables and diagrams.

Geographical Distribution of Deep-Focus Earthquakes

A RECENT paper by Messrs. B. Gutenberg and C. F. Richter (*Bull. Seis. Soc. America*, **26**, 341 ; 1936) contains some interesting notes on the distribution of deep-focus earthquakes. Those with focal depths of about 100 km. occasionally occur in nearly all the seismic regions of the globe. Others with depths of about 200 km. are frequently found in regions, such as the eastern Mediterranean and the Hindu Kush, where there is at present no evidence of very deep foci. So far as is at present known, earthquakes originating at the greater depths (400–800 km.) are confined to a few regions adjoining the Pacific Ocean, such as Kamchatka and the Kurile Islands, Japan, the East Indies and western South America. In Japan and South America, the deeper the foci, the farther removed as a rule are the epicentres from the ocean basin. With regard to the origin of such earthquakes, the most probable conclusion at present is that normal and deep-focus earthquakes are caused by the same forces, which may act near the surface or at great depths.

Measurement of Upper Winds

THE measurement of upper winds by means of pilot balloons is the subject of a recent publication (M.O. 396) of the Meteorological Office, Air Ministry (H.M. Stationery Office, 1936. 1*s*.) This method of measuring upper winds has been in use for many years, and has developed greatly as the demands of aviation for information about upper winds have increased. It depends upon observations of the elevation and azimuth of a small balloon that ascends at a nearly constant speed and is carried horizontally by the wind at its level. These angles may be measured by a single theodolite, and the wind is then calculated on the supposition that the rate of ascent is strictly constant. Alternatively, two theodolites may be used at a known distance apart, or a tail of known length may be attached beneath the balloon and the angle subtended by the tail be measured by a graticule at the focus of a single theodolite. Each of these alternatives does away with the need for assuming a constant rate of ascent, and in expert hands provides reasonably accurate information about the upper winds. In M.O. 396 the practical details are set out, including the method of filling the balloon and giving the necessary free lift, the setting up of the special theodolite and the working out of the speed and direction of the wind from the observed angles. A full-sized drawing of the special slide rule used for these computations is included.

Air Conditioning in Modern Buildings

IN a paper read on February 19 by Mr. E. R. Dolby to the Institution of Mechanical Engineers the whole question of ventilation and air conditioning in modern buildings is discussed. It has been stated that the ideal condition of the air is that of a hillside on a bright spring morning. This is taken to mean that the air is free from dust, odours, etc., that the temperature should be moderate, say, 60° F., the humidity about 50 and that there should be a bright atmosphere with slight, but not excessive, movement. In the ideal suggested, the carbon dioxide in the air should be restricted to not more than 6–7 parts in 10,000, as compared with 4 parts in 10,000 in the external air. Mere ventilation as, for example, the system used in coal mines, where a large volume of external air is passed into the mine and the contaminated air in the mine extracted, differs from 'conditioned air' ventilation as now used in houses, shops, factories, theatres and ballrooms. In the latter case the vitiated air is evacuated and replaced by air so treated that dust, fog, deleterious gases and odours are eliminated. The temperature of the incoming air is raised or lowered and its humidity is suitably modified. At the same time the conditioned air must cause no unpleasant draughts. The maximum air velocity of the delivered air, for comfort, in sedentary occupations is assumed to be about 2 ft. per sec. In large works, hotels, exhibition buildings in which a kitchen or canteen forms part of the establishment, the installation of a separate ventilating and air conditioning plant is well worth considering.

The Beta-Ray Disintegration

A DISCUSSION on the β-type of nuclear transformation was held by the Royal Society on March 4. Papers were read by Prof. C. D. Ellis, Dr. J. D. Cockcroft, Dr. R. Peierls and Dr. H. O. W. Richardson; a number of other experimental and theoretical workers took part in the discussion. The main centre of interest seemed to be in the correctness or otherwise of the neutrino theory.

Prof. C. D. Ellis, in his opening address, gave a brief account of the development of our knowledge of the β-ray transformation in recent years. As is generally known, the fundamental difficulty is that the electrons (or positrons) are emitted with a continuous energy distribution although there must be a constant difference between the proper energies of the initial and final nuclei. This anomaly could be explained either by abandoning the conservation laws, or as suggested by Pauli, assuming that another uncharged particle, the neutrino, is emitted in the transformation and shares the available energy with the electron. This latter alternative is now generally favoured.

The neutrino has been given a spin equal to that of the electron, to enable angular momentum to be conserved in the transmutation; and a mass, which if not zero, is only of the same order as that of the electron. A particle with these properties would be very difficult to observe directly, and in fact the many attempts which have been made to detect the neutrino by any ionization it produces have all failed. The hypothesis can at present only be tested by its success in accounting for the features of the β-ray decay.

One consequence of the neutrino hypothesis can be seen without any detailed theory. The β-ray spectrum should have a definite upper limit at which the neutrino is emitted with zero kinetic energy, and this end point should be given by the difference between the masses of the particles before and after the transmutation. If these predictions were not fulfilled, the neutrino theory would have to be abandoned.

The evidence on this point was discussed by Dr. Cockcroft. In about six cases of β-transformation among the light elements, the end point of the spectrum is known with fair accuracy, and the difference between the initial and final masses can be obtained from other transmutations in which energy is certainly conserved. The results are sufficiently definite to show that the mass difference cannot be equated to the *mean* energy of the β-ray spectrum, but its identity with the experimentally determined end point is still rather uncertain. However, even this is very useful evidence. It is known that the total energy emission as measured in a calorimeter corresponds to the mean energy of the spectrum. As the change in mass in the transmutation is certainly greater than this, there is a definite surplus of energy which must either have disappeared or have been carried out of the calorimeter in the form of neutrinos.

Further data on the identity of the end point of the spectrum and the mass difference of the initial and final nuclei would be very important, as this is one of the few points on which the neutrino hypothesis is capable of being disproved. However, the determination of the end point of the spectrum is a matter of some difficulty, because the intensity approaches zero very slowly with increasing energy. The actual end point must be found by extrapolation. Here a theory of the form of the β-ray spectrum would be very useful. Unfortunately, the most successful theory, that of Uhlenbeck and Konopinski, disagrees with the observed spectrum just in this region, and extrapolations based on it give values for the end points which appear to be too high. In these circumstances, all that can be said is that the experiments do not disagree with the value for the end point given by the mass change in the disintegration.

The detailed mathematical development of the theory enables it to be compared with other experimental data. We may expect the theory to predict the form of the β-ray spectrum and how it depends on such parameters as the total energy released and the change of nuclear spin in the transmutation. Also the theory should give the value of the total probability of disintegration, or the decay constant. The general case of β-decay is one in which the final nucleus may be formed in one of a number of excited states. The β-ray spectrum is then built up of a number of partial spectra, each with a different end point and intensity. In examining such a spectrum, the experimenter depends on theoretical guidance on these points.

The theoretical aspects of the problem were dealt with by Dr. Peierls. The theory is based on the analogy between the transition of an atom between two stationary states with the emission of a light quantum, and the transmutation of a neutron into a proton with the emission of an electron and a neutrino. A remarkable consequence of this point of view is that it should be possible for a nucleus to be transformed by capturing one of its K electrons and emitting a neutrino—a new type of transmutation which has not yet been observed.

To proceed further, the theoretical worker has to assume some form of interaction between the neutrino and the heavy particles which give it birth. Here he has little to guide him but the demands of relativistic invariance and his æsthetic sense. The most simple and natural assumption was made by Fermi, but this led to a form of the β-ray spectrum which was definitely too symmetrical about the mean energy. Konopinski and Uhlenbeck remedied this by using a form of interaction which depended on the velocity of the neutrino as well as on its position. At first they appeared to have been very successful. Experiments with the large sources of light radioactive elements now available in the United States gave very satisfactory agreement with the new theory. A more detailed study has since shown that though the main part of the spectrum was given correctly, the high- and low-energy regions required modification. The evidence on this point was discussed by Dr. Richardson, who showed that whereas fair agreement with experiment was obtained for the low-energy part of the spectrum when account was taken of the Coulomb forces on the electrons, the Konopinski-Uhlenbeck theory gave too high an intensity for the high-energy electrons, in some cases by a factor of fifty.

Attention has therefore been turned to other possible modifications of the theory. A very wide choice seems to be possible, so that the theory could be made to fit almost any form of the experimental spectrum in several different ways. This elasticity is perhaps an advantage, in that there is no immediate danger of our being forced to abandon the neutrino theory and therefore the conservation laws, but it destroys much of the heuristic value of the theory. For example, although the β-transmutations can be classified into two groups, corresponding to the two Sargent curves connecting the decay constant with the energy of the end point, it is not known how this classification is connected with the change of nuclear spin in the transmutation.

In conclusion, the general impression given by this discussion was that although the neutrino theory is probably capable of explaining most of the features of the β-ray transmutation, it scarcely does so in the natural and unforced way which alone would reconcile the physicist to an unobservable particle. However, it remains a working hypothesis useful in directing attention to the points which still require experimental work, and in collating the data already obtained.

A. NUNN MAY.

Lightning

AN instructive paper on lightning was read on January 7 by B. L. Goodlet, of the Metropolitan-Vickers Electric Co., Ltd., to the Institution of Electrical Engineers. He discussed lightning first as a physical phenomenon and then gave the elementary theory of direct strokes to transmission circuits. He began by saying that although "Lightning" was the title of the Kelvin Lecture given seven years ago, yet the progress made during the last seven years is at least as great as that made during the previous seventy. He awarded due credit to the early pioneers, but modern research on the subject has been so intensive in high-tension laboratories, in the upper atmosphere and in connexion with the tens of thousands of miles of high-tension overhead wires now in continuous operation, that the modern research workers have large sources of experimental data from which they can test theories widely accepted in recent years.

The cumulo-nimbus cloud, or thundercloud, differs from the ordinary rain cloud in having greater vertical dimensions and in the existence of powerful upward air currents. Its formation is associated with convectional instability of the atmosphere, the separation of the electric charge being effected by the resulting upward currents of air. Lightning strokes usually discharge negative electricity into the ground, and consist of a preliminary 'leader' stroke from cloud to earth followed by a powerful return stroke from earth to cloud. Schonland found by means of a Boys camera that each flash is initiated by a streamer which shoots rapidly downwards from the cloud towards the ground, but becomes extinguished before it has travelled more than a fraction of the total distance. About 50 microseconds later, a second streamer follows closely on the track of the first and elongates the channel a little farther. This goes on until an ionized channel is blazed all the way from cloud to earth. The rate of growth of the channel is of the order of 100 kilometres per second.

The maximum current at the ground end of a lightning flash is deduced from the intensity of the magnetic field produced in the vicinity of transmission towers and lightning conductors struck by lightning. About 24,000 magnetic detectors were distributed over the lines of various German electric power companies in 1934. The results showed that the most frequent value of the maximum stroke current lay between 30,000 and 40,000 amperes. Currents greater than 100,000 amperes occur very rarely. In 97 per cent of the cases recorded, the cloud discharged negative electricity to the earth. Presumably therefore the base of the cloud must have been negative. Similar results have been obtained in the United States.

The question has often been discussed as to whether certain localities receive an abnormal proportion of lightning strokes. The evidence in favour of localization of lightning flashes comes mainly from the records of electricity undertakings. It has been found, for example, that a certain 80 km. line received 43 strokes, of which 26 fell on one section 6·3 km. in length. Investigation showed that this section of the line was traversed by underground springs. A study of available data has convinced the author that the existence of 'danger spots' struck more frequently for a given storm exposure is a fact.

Some interesting lightning problems occur in connexion with aircraft. Ten cases are known of British aeroplanes having been struck by lightning. In nine out of the ten cases, the wireless aerial was hanging down and was damaged. Moored kite balloons are particularly troubled by phenomena of this nature. When an aeroplane or an airship is flown through a thundercloud, the metal parts of the machine, unless bonded together, acquire very different potentials. Shocks are experienced by persons inside the aircraft when they touch and when they leave go of metal objects.

The earth currents caused by lightning can be a source of great danger. If a current of 50,000 amperes enters the soil at a point and spreads out uniformly in all directions, the voltage drop on the surface as we go away from the point may be very large even at some distance away from the point. The voltage between two points on the earth separated by the length of an animal's stride may be quite sufficient to pass a lethal current up one leg and down another.

The second part of the paper was more technical, being concerned mainly with direct strokes to transmission circuits. In this case rather more than half the direct strokes to a line fall on the conductors in the span between the towers. The final potential of an insulated conductor so struck is probably never less than 2 million volts, and may be sixteen times as great. The insulator impulse spark-over voltage of the most heavily insulated overhead line yet

constructed is of the order of 2½ million volts. Wooden poles give additional insulation to earth, but cannot be relied on to withstand more than 100–150 kV. per foot. It seems highly probable, therefore, that practically every direct stroke to a live wire will produce some kind of flash-over.

Hence it is necessary to prevent direct strokes or to render flash-overs innocuous. The first can be done by an overhead earthed wire, which proves to be a reasonably effective interceptor; but in places where special protection is required, two earthed overhead wires should be used. In order to secure easy entrance for the current in dry soil, many modern lines are equipped with a 'counterpoise'. This consists of a length of bare cable buried in the ground and attached to the foot of the tower. Each circuit of the new Boulder Dam line in America is equipped with two parallel counterpoises, continuous from tower to tower.

The alternative to lightning-proof construction of the line is to ensure that lightning flash-overs on the line do not interrupt the supply. The best known method of doing this is to use a Petersen coil, which is in general use on the Continent but is less popular in Great Britain and the United States. Alternative methods were also mentioned. In the author's opinion, these methods will prove more popular than the overhead earthed wire, as they are much cheaper. Arc rupturing devices and lightning arrestors can be installed easily on existing unsatisfactory lines.

University Events

BIRMINGHAM.—Dr. Henry Pratt Newsholme, Medical Officer of Health for Birmingham since 1927, has been appointed to the chair of hygiene and public health in succession to the late Sir John Robertson.

CAMBRIDGE.—Prof. E. D. Adrian, Fellow of Trinity College, Foulerton professor of the Royal Society, has been elected as from October 1 to the professorship of physiology which will become vacant by the retirement of Sir Joseph Barcroft.

The subject for the Sedgwick Prize for the year 1940 is: "The Influence of the Idea of Evolution on some Branch of Geological Studies". The essays must be sent to the Registrary on or before October 1, 1939.

The examiners consider that the following essays submitted by candidates for the Smith's Prizes and Rayleigh Prizes are of distinction: H. M. Cundy (Trinity College), "Motion in a Tetrahedral Field"; E. R. Love (Trinity College), "Riemann-Stieltjes Integrals"; H. R. Pitt (Peterhouse), "Tauberian Theorems". The Smith's Prizes have been awarded to E. R. Love and H. R. Pitt and a Rayleigh Prize to H. M. Cundy.

GLASGOW.—Prof. G. G. Henderson, regius professor of chemistry, has sent in his resignation, to take effect from October 1.

Dr. J. Bassil Rennie has been appointed whole-time lecturer in the practice of medicine.

SOUTHAMPTON.—Dr. N. K. Adam, research chemist in Imperial Chemical Industries, Ltd., has been appointed professor of chemistry in University College.

Science News a Century Ago

Birds of Paradise of the Arru Islands

AT a meeting of the Royal Geographical Society held on March 13, 1837, a communication by W. S. Earl was read entitled "On the Key and Arru Islands". The Arru Islands, the author said, were about forty miles south-west of Papua, or New Guinea, and about a hundred miles to the north-east of Timor Laut. The Keys were a smaller group about thirty miles to the westward of the Arrus. The islands were small but closely grouped. Much commercial intercourse prevailed between the islands and the neighbouring coasts, the chief exports being tortoise-shell, bees-wax, ambergris, edible birds' nests and birds of paradise. The last were found in great numbers on the Arrus and the coasts of New Guinea. They were especially valuable, and from the numbers sent to Singapore appeared to be inexhaustible.

Valentyn, a Dutchman who wrote on the East in 1702, described seven varieties of these beautiful birds, while Le Vaillant, and later Guimard, gave descriptions of them. They were exported in great numbers to Arabia and Persia. Francois Valentyn or Valentijn, who was born in 1666 and died about 1725, was a protestant minister at Amboina, Banda and other places.

The Zoological Society

VARIOUS papers were read at the meeting of the Zoological Society held on March 14, 1837, one of them being by Darwin on the *Rhea Americana* and the newly discovered species, in which he described its mode of swimming, a fact unnoticed by earlier writers, but which he had witnessed in two instances. Their progress through the water was slow, very little of the body appearing above the surface, the necks being extended slightly forward. According to the Guachos, the males carried out incubation and not only hatched the eggs, but also attended the young until they were able to provide for themselves. Several females laid in one nest and the number of eggs deposited by each female during the season was from forty to fifty, or according to Azara, from sixty to seventy.

Physical Science in the University of Edinburgh

No one did more to further the study of physics in Scotland a century ago than J. D. Forbes, who instituted a complete working system of examining for degrees in arts in the University of Edinburgh by means of printed papers. His letters frequently contained references to his efforts to stimulate an interest in natural philosophy, and writing on March 15, 1837, to Airy, he said:

"I have been exceedingly busy, and not very well, which have been the causes of my silence. Among other occupations I have had to read five essays, which I have received in competition for a medal I proposed on the Undulatory Theory of Light, a new subject in Scotland, which I am delighted to find has stirred up our youth, and I have got some really respectable compositions. This is a proof to me that things are mending, and that exertion, private and personal, is not thrown away, even where public sympathy or support is not to be looked for.

"I have not abandoned my polarized heat, but have been much driven about this winter. I have got twelve thermometers sunk in different soils from three to twenty-six feet deep, to measure conduction."

Anniversary Meeting of the Statistical Society

AT the anniversary meeting of the Statistical Society held on March 15, 1837, the third annual report of the Council was read. In the report, suggestions were put forth for furthering the object of the Society, which was instituted "for the purpose of procuring, arranging and publishing facts calculated to illustrate the conditions and prospects of society". Reference was also made to the advancement of statistical studies. A Statistical Society had been established at Bristol, and the Statistical Society of Glasgow had commenced to publish its proceedings. In foreign countries the collections of statistics had advanced rapidly. The French Government, following the example of that in Great Britain, had published a volume of statistical tables; the Belgian Government had published a similar volume and a statistical journal had been founded in Sicily. The total membership of the Statistical Society at this time was 392.

Societies and Academies

Dublin

Royal Dublin Society, January 25.

PAUL A. MURPHY: A ten-year experiment on the spread of leaf-roll in the field. The extent of spread was determined in relation to weather conditions in a uniform experiment. Most infection took place in June. Wet Junes were always marked by least spread, due to direct repression of aphids. The reverse did not always hold, the effect of dry Junes being more complex, affecting differently aphids, parasites and plants. Most spread generally took place when the rainfall of the month was nearly normal.

K. C. DIXON: Some aspects of carbohydrate metabolism.

Paris

Academy of Sciences, February 8 (*C.R.*, 204, 385–456)

ALEXANDRE GUILLIERMOND, FERNAND OBATON and ROGER GAUTHERET: Presentation of a film on the mitochondria in plant cells. This film, which is believed to be first taken of plant cells, proves definitely a certain number of essential properties of mitochondria concerning which many cytologists have held different views.

ANTONIN GOSSET and IVAN BERTRAND: The treatment in man of peripheral nerve sections by medullary heteroplastic grafting. Details of three successful applications of the method.

MARC KRASNER and MLLE. BRITT RANULAC: A property of polynomials of the division of the circle.

JACQUES HADAMARD: Remarks on the preceding communication. A. Lienard and Khintchine have given independent solutions of the same problem.

SZOLEM MANDELBROJT: The principle of regularization of functions.

GEORGES VALIRON: The curves of constant modulus of integral functions.

CHI-TAI CHUANG: Some theorems of the directions of Julia and of Borel of meromorph functions.

PIERRE DIVE: A heterogeneous fluid mass in rotation with a given kinetic moment.

L. CAGNIARD: The propagation of movement in viscous media.

RENÉ SWYNGEDAUW: A new theoretical expression concerning a pulley with a thick belt.

DAVID BELORIZKY: Resolution of the nebular lines in the spectrum of Nova Herculis 1934.

THÉODORE KAHAN: The theory of the deuton: proton-neutron interaction of exponential tendency.

ERNEST BAUMGARDT: The absorption of ultra-sound waves by benzene.

RENÉ LUCAS: New properties of the thermal elastic waves of liquids.

DOUCHAN AVSEC and MICHEL LUNTZ: Electro-convective vortices in a liquid sheet.

MLLE. MARGUERITE QUINTIN: The potential of copper in solutions of copper benzenesulphonate.

LÉON and EUGÈNE BLOCH: Structure of the spectra Sb VI and Te VII.

LÉON GRILLET: The enlargement of the green line (5461 A. Hg) in mercury vapour arcs under high pressure. The green mercury line has been taken as the most useful basis for many measurements. The radiation of two mercury lamps has been studied with a prism spectrograph and with a grating. It is shown that the definition of the wave-length of this line requires special precautions.

MLLE. HOANG THI NGA: The colouring matters of the anthracene group and their photo-sensible capacity.

RENÉ AUDUBERT and HENRI MURAOUR: The emission of ultra-violet radiation in the course of the slow decomposition of nitrides (hydrozoates). The slow decomposition of nitrides when heated is accompanied by an emission of ultra-violet radiation. It is relatively intense with the nitrides of sodium, potassium, lead and silver, but very slight with the calcium and barium salts.

PIERRE BONNEMAN: Contribution to the study of the condensed phosphoric acids.

VICTOR AUGER and MLLE. NINA IVANOFF: The study of some phosphates of the type $M_{II}(NH_4)PO_4$.

HENRI MOUREU and GEORGES WÉTROFF: The phospham of Rose. It is concluded that phospham is not produced in the reaction between ammonia and phosphorus trichloride.

LOUIS ROYER: The relations which exist between the gneiss, granitic and rhyolitic rocks of Djebel Arous to the north of Ménerville (Algeria).

ANDRÉ RIVIÈRE: The rational interpretation of the sifting 'spectra' of sandy sediments and the geological signification of the diagrams.

JACQUES BARDET, ARAKEL TCHAKIRIAN and MLLE. RAYMONDE LAGRANGE: The determination of lithium in sea-water. Description of the methods employed for concentrating the lithium from 200 litres of sea-water: the purity of the lithium chloride separated was verified spectroscopically. The quantity found was 0·17 mgm. of lithium per litre.

PAUL DE GRAEVE: The evolution of puric nitrogen in the course of germination.

ROBERT BRUNET and ANTOINE JULLIEN: The principal elements of myocardiac architecture in the Lamellibranchs.

RAOUL LECOQ and ROGER DUFFAU: The influence of acute lack of food balance of glucidic origin on the composition of the muscle of the pigeon.

P. G. CHARPENTIER, MAURICE DOLADILHE and CHARLES MOREL: The antibody property of the viscous protein of hæmolytic sera.

W. KOPACZEWSKI: Gel formation of the blood constituents.

Brussels

Royal Academy (*Bull. Classe Sci.*, 22, No. 10 ; 1936).

L. GODEAUX : Construction of an algebraic surface of divisor three.

T. DE DONDER and Y. DUPONT : New theory of the dynamics of continuous systems (2).

J. E. VERSCHAFFELT : The application of thermomechanics to electrochemistry.

E. DE WILDEMAN : Variations of generic characters which are specific, or belong to varieties, in plants, and some of their consequences.

P. FOURMARIER : Preliminary observations on slaty cleavage between Boscastle and Newquay, Cornwall.

T. H. J. LEPAGE : Geodesic fields of the calculus of variations (2).

D. S. MITRINOVITCH : Asymptotic lines of a class of surfaces and linear differential equations of the second order belonging thereto.

L. PASQUALINI : Conditions of convexity of a plane curve or of a surface.

M. LINSMAN : Remark on the singular points of real surfaces.

MLLE. G. SCHOULS : Application of affinity and quantum statistics to catalysis.

Z. M. BACQ : Poisons of the nemerteans.

W. ROBYNS : Phenomena of pleiomery and synanthy in *Salpiglossis sinuata* Ruiz and Pav.

J. DE LA VALLÉE POUSSIN : Stratigraphy of the old formations in the region of the Great African Lakes.

J. THOREAU, R. BRECKPOT and J. F. VAES : The monazite of Shinkolobwe (Katanga).

(*Bull. Classe Sci.*, 22, No. 11 ; 1936).

P. BRUYLANTS and J. JENNEN : Maleic and citraconic nitriles.

R. GODEAU : (1) A class of surfaces the asymptotic lines of which have a given differential equation. (2) Remark on the paper "Asymptotic Lines of a Class of Surfaces" by Mitrinovitch.

MLLE. G. SCHOULS : Deduction and generalization of Arrhenius's formula with the aid of affinity and quantum mechanics.

E. RUPPOL : Ultra-violet absorption spectrum of maleic nitrile.

J. JENNEN : Maleic and fumaric nitriles. Preparative details, chemical and physical properties.

M. FLORKIN : True plasmatic glycæmia of a selachian (*Scyllium canicula* L.).

L. LISON : Vital coloration of the nucleoles in the Malpighian tube in *Forficula auricularia* Linn.

Geneva

Society of Physics and Natural History, December 17.

F. CHODAT and R. LEVY : Edaphism of moraine soils.

E. GUYENOT and K. PONSE : The action of the urine of the ovariotomized woman on immature and adult female guinea pigs.

E. GUYENOT : The action of the urine of the ovariotomized woman on hypophysectomized female guinea pigs.

Moscow

Academy of Sciences (*C.R.*, vol. IV, No. 7 ; 1936).

P. ALEXANDROFF : Affine transformations of enumerably infinite multiplicity.

N. GÜNTHER : An integral analogous to the integral of Fourier.

P. P. LAZAREFF, Z. V. BOULANOVA and M. R. SEMENOVYCH : Influence of the latitude of the observation point on the adaptation in peripheral vision at different ages.

P. P. LAZAREFF and T. N. ČIŽEVSKAJA : Change in the adaptation in peripheral vision with altitude above sea-level.

A. V. LUGOVOJ : Effect of short radio waves upon the life activities of cockchafer larvæ.

S. A. NEUFACH : Fate of glutathione introduced into the blood *in vitro*. Reduced glutathione can scarcely be detected in blood after 30 minutes.

V. KARASIK and M. LICHAČEV : (1) Comparative biological activity of aromatic and heterocyclic arsonium bases. (2) The influence of the anion of dimethylphenazarsonium hydroxide salts on their biological activity.

A. P. VERNER and A. A. KOVALEV : The problem of the nitrogen-fixing power of *Bacterium radicicola*. The presence of bios is necessary for the reproduction of *B. radicicola* and for the accumulation of nitrogen by it.

N. A. ILJIN : Homologous series in the phenogenesis of pigmentation.

B. S. ILJIN : A new goby from the Caspian Sea, *Gobius nonultimus*, sp.n. (Pisces, Gobiidæ).

A. A. STUDITSKAJA : Formation of osteoclasts in cultures of skeletogenous tissue.

L. S. BERG : *Teleopterina*, n.g., a highly organized Acanthopterygian from the Carboniferous of North America.

Washington, D.C.

National Academy of Sciences (*Proc.*, 22, 673–713, December 15).

G. S. AVERY, JUN., P. R. BURKHOLDER and HARRIET B. CREIGHTON : Plant hormones and mineral nutrition. Experiments with shoot tips of sunflower and tobacco plants grown in sand culture suggest that growth hormone production is unaffected by relative deficiencies of the common elements, or by variation of osmotic pressure of nutrient solution, but is most abundant in plants provided with a high concentration of nitrogen and scarcely detectable in absence of this element.

W. E. CASTLE : A simplified explanation of Bellamy's experiments concerning sex determination in tropical fishes.

M. J. BUERGER : (1) The kinetic basis of crystal polymorphism. For a given temperature, there is a preferred vibration mode for the aggregate (or cluster) forming the unit of the crystal. This preferred mode requires a certain dynamic symmetry, and stable crystals are formed by the building up of a structure providing this symmetry. (2) The general role of composition in polymorphism. A theoretical discussion of the temperature-composition diagram with particular reference to solid solution.

E. R. DUNN : Notes on North American Leptodeira (Colubrine snakes of moderate to small dimensions).

ACHILLE BASSI : New invariants of a manifold.

G. A. MILLER : (1) Enumeration of the Abelian groups whose orders do not exceed a given number. (2) Groups whose prime powers generate a cyclic subgroup.

JOHN VON NEUMANN : Regular rings.

Forthcoming Events

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

Monday, March 15

ROYAL GEOGRAPHICAL SOCIETY, at 5.—Prof. C. Daryll Forde: "A Study of Settlement in the Cross River Area, Southern Nigeria".

Tuesday, March 16

EUGENICS SOCIETY, at 5.15—(at the Linnean Society, Burlington House, W.1).—Miss H. Holland, Dr. J. R. Baker and Dr. S. Zuckerman: "Birth Control: The Last Year's Work".*

Wednesday, March 17

CHEMICAL SOCIETY, at 5.30—(at the Royal Institution, Albemarle Street, W.1).—Prof. V. M. Goldschmidt: "Principles of Distribution of Chemical Elements in Minerals and Rocks" (Seventh Hugo Müller Lecture).

UNIVERSITY COLLEGE, LONDON, at 5.30.—Dr. V. Friedenreich: "Blood Groups and Genetics".*

ROYAL METEOROLOGICAL SOCIETY, at 7.30.—Prof. D. Brunt: "Clouds, Natural and Artificial" (Symons Memorial Lecture).

ROYAL SOCIETY OF ARTS, at 8.—H. D. Henderson: "Problems of the Displacement of Labour by Mechanization".

Thursday, March 18

CHEMICAL SOCIETY, at 4—(at Grosvenor House, Park Lane, W.1).—Annual General Meeting and Anniversary Dinner (at 7).

ROYAL ASIATIC SOCIETY, at 4.30.—Dr. Li Chi: "The Culture of the Shang Dynasty".

BRITISH INSTITUTE OF RADIOLOGY, at 8.—Prof. S. Russ and Miss G. M. Scott: "Some Biological Effects of Continuous Gamma Irradiation. With Notes on Protection".

Friday, March 19

GEOGRAPHICAL DISCUSSION at 4.30—(at the Royal Astronomical Society).—Discussion on "Instrumental Seismology" to be opened by J. J. Shaw.

ROYAL INSTITUTION, at 9.—Lord Rutherford, F.R.S.: "The Transmutation of Heavy Elements".

INSTITUTE OF PHYSICS, March 18–20.—Second Conference on Industrial Physics to be held at the University of Birmingham. Subject: "Optical Devices in Research and Industry".

March 18, at 4.30.—Prof. A. Fowler, F.R.S.: "Spectroscopy in Industry" (Presidential Address).

Appointments Vacant

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

SCIENTIFIC OFFICER (air armament—ref. 308/*C*) and ASSISTANT (grade II. Experimental and design work—ref. 309/*C*) in the Directorate of Scientific Research, Air Ministry—The Chief Superintendent, Royal Aircraft Establishment, South Farnborough (March 19).

JUNIOR SCIENTIFIC OFFICERS and ASSISTANTS (grade III) in the Building Research Station, Garston and the Road Research Laboratory, Harmondsworth—The Establishment Officer, Department of Scientific and Industrial Research, 16 Old Queen Street, Westminster, S.W.1 (March 19).

ASSISTANTS (grade III) for library work in the Department of Scientific and Industrial Research—The Establishment Officer, D.S.I.R., 16 Old Queen Street, Westminster, S.W.1 (March 19).

EXAMINER IN THE NON-METALLIC SECTION, A.I.D. Test House, Kidbrooke—The Secretary (S.2.d.), Air Ministry, Kingsway, F.C.2 (March 20).

TUTOR AND LECTURER IN BIOLOGY in the Maria Grey Training College, Salusbury Road, London, N.W.6—The Secretary to the Principal (March 20).

CHIEF TECHNICAL INSTRUCTOR in the Government Trade School, Haifa—The Secretary (*SIR/CA*), Board of Education, Whitehall, S.W.1 (March 21).

SUB-ASSISTANT BOTANIST in the Royal Botanic Gardens, Kew—The Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W.1 (March 22).

THREE SCIENTIFIC OFFICERS in the Explosives Directorate, Research Department, Woolwich, S.E.18—The Chief Superintendent (March 27).

ASSISTANT (grade II—engineering) in the Admiralty Technical Pool—The Secretary of the Admiralty (C.E. Branch) (March 27).

RESEARCH PALÆONTOLOGIST in the University of Western Australia—The Agent General for Western Australia, Savoy House, 115/116 Strand, W.C.2 (March 31).

TECHNICAL ASSISTANT IN THE INFORMATION DEPARTMENT AND LIBRARY of the British Non-Ferrous Metals Research Association—The Secretary, B.N.F.M.R.A., Regnart Buildings, Euston Street, N.W.1 (March 31).

SENIOR LECTURER IN SOCIAL ANTHROPOLOGY in the University of the Witwatersrand—The Secretary, Office of the High Commissioner for the Union of South Africa, South Africa House, Trafalgar Square, W.C.2 (March 31).

LECTURER IN PURE AND APPLIED MATHEMATICS in the Battersea Polytechnic, London, S.W.11—The Clerk to the Governing Body (April 17).

LECTURER IN GEOGRAPHY and DEMONSTRATOR IN PHYSIOLOGY in Bedford College for Women, Regent's Park, N.W.1—The Secretary (April 20).

PROFESSOR OF ANATOMY in Middlesex Hospital Medical School—The Academic Registrar, University of London, W.C.1 (April 23).

ASSISTANT DIRECTOR OF PATHOLOGY (with title of Nuffield Reader in Pathology) in the University of Oxford—The Secretary of Faculties, University Registry, Oxford (April 26).

SENIOR LECTURER IN PHYSIOLOGY in the University of Liverpool—The Registrar (May 1).

PROFESSOR OF CHEMISTRY in the University of Western Australia—The Agent General for Western Australia, Savoy House, 115/116 Strand, W.C.2 (May 17).

Official Publications Received

Great Britain and Ireland

Air Ministry: Aeronautical Research Committee: Reports and Memoranda. No. 1706 (1416): Tests of Six Aerofoil Sections at various Reynolds Numbers in the Compressed Air Tunnel. By E. F. Relf, Dr. R. Jones and A. H. Bell. Pp. 33. 4*s*. 6*d*. net. No. 1708 (2264): Effect of Surface Roughness on Characteristics of Aerofoils N.A.C.A. 0012 and R.A.F. 34. By Dr. R. Jones and Dr. D. H. Williams. Pp. 56. 8*s*. net. No. 1709 (2263): Experiments on a Heinkel He. 70 Aeroplane in the Compressed Air Tunnel. By Dr. R. Jones and E. Smyth. Pp. 5. 1*s*. net. No. 1714 (2189): Interim Report on Systematic Model Research in Free Spins; Low Wing Monoplanes. By R. H. Francis. Pp. 15. 2*s*. 6*d*. net. No. 1716 (2198): Oscillations of Elastic Blades and Wings in an Airstream. By Dr. W. J. Duncan, A. R. Collar and H. M. Lyon. Pp. 38. 6*s*. 6*d*. net. No. 1717 (2433): Tests of Aerofoils R.A.F. 69 and R.A.F. 89, with and without Split Flaps, in the Compressed Air Tunnel. By D. H. Williams, A. F. Brown and E. Smyth. Pp. 24. 3*s*. 6*d*. net. (London: H.M. Stationery Office.) [52

Proceedings of the Royal Irish Academy. Vol. 43, Section A, No. 5: Contact Conditions for Surfaces. By J. G. Semple. Pp. 49–71. 1*s*. Vol. 43, Section B, No. 8; A Record of New Analyses of Tertiary Igneous Rocks (Antrim and Staffa). By Arthur Holmes. Pp. 89–94. 6*d*. Vol. 43, Section B, No. 7: The Synthesis of Diflavonals. By Dr. Joseph Algar and Dorothy E. Hurley. Pp. 83–87. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.) [52

Brompton Hospital Reports: a Collection of Papers recently published from the Hospital. Vol. 5, 1936. Pp. iv+143. (London: Hospital for Consumption.) 3*s*. [62

Other Countries

Meddelande från Lunds Astronomiska Observatorium. Ser. 1, Nr. 145: A Graphical Method of determining the Absolute Luminosity Distribution of the Stars. By W. Gyllenberg. Pp. 11+1 plate. Ser. 1, Nr. 146: Eine Bemerkung zu den Spektralvergleichungen in der Bergedorfer Spektral-Durchmusterung. Von Erik Holmberg. Pp. 7. Ser. 2, Nr. 77 (Historical Notes and Papers No. 3): Two Early Conceptions concerning the Earth's Hanging Free in Space. By Knut Lundmark. Pp. 8. 50 öre. Ser. 2, Nr. 81: On the Masses of the Stars. By Folke Berglund. Pp. 25. 2.00 kr. (Lund: Astronomiska Observatorium.) [112

U.S. Department of the Interior: Geological Survey. Bulletin 868–C: Upper Copper and Tanara Rivers, Alaska. By Fred. H. Moffit. (Mineral Resources of Alaska, 1934.) Pp. ii+135–143+plate 8. (Washington, D.C.: Government Printing Office.) 10 cents. [122

U.S. Department of the Interior: Office of Education. Bulletin, 1936, No. 10: Scholarships and Fellowships available at Institutions of Higher Education. By Ella B. Ratcliffe. Pp. v+117. (Washington, D.C.: Government Printing Office.) 15 cents. [122

Smithsonian Institution: United States National Museum. Report on the Progress and Condition of the United States National Museum for the Year ended June 30, 1936. Pp. iii+115. (Washington, D.C.: Government Printing Office.) 15 cents. [122

Report of the Secretary of the Smithsonian Institution and Financial Report of the Executive Committee of the Board of Regents for the Year ended June 30, 1936. (Publication 3404.) Pp. iii+107+2 plates. (Washington, D.C.: Government Printing Office.) [122