

Editorial & Publishing Offices :

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



Telegraphic Address :
PHUSIS, LESQUARE, LONDON

Telephone Number :
WHITEHALL 8831

No. 3477

SATURDAY, JUNE 20, 1936

Vol. 137

Training of Industrial Physicists

A SHORT time ago, a conference, arranged by the Institute of Physics, was held on the training of industrial physicists. An account of the meeting, by Prof. J. A. Crowther, honorary secretary of the Institute, appears in the May issue of the *Journal of Scientific Instruments*.

That such a conference should be thought necessary is a striking indication of the increased number of physicists now going into industry. That there should have been, on the industrial side, nearly as many different views as speakers, is, perhaps, evidence of the diversity of subjects with which industrial physicists are now dealing. An employer interested in the crystalline structure of metals quite naturally thinks that his physical staff should have had a different training from those who are going to undertake research in, say, the musical industries. There are, however, a certain number of features in the training, knowledge and the personal qualities of candidates for such industrial posts that most employers of experience will want.

In the first place, the young physicist should have a good honours degree in his subject, with adequate mathematics. It is risky to take a man for a research post immediately after graduation, as a good examinee is not necessarily good at research. About a year's experience in research at a university should give a better idea of his capabilities in this respect than any ordinary examination. He may even find research less attractive than he thought it would be, and seek to earn his living in other ways. Further, since personal qualities are very important in an industrial position, this research will afford the director of the laboratory a better opportunity to give suitable advice on the choice of a career.

A number of university teachers appear to be strongly in favour of graduates attending the university until the Ph.D. degree is obtained, the argument being that they are being trained in research. In the opinion of scientific industrialists, the time required for this is, *from the candidate's point of view*, rather wasteful. The earlier he goes into industry the sooner will he become acquainted with the properties of the materials with which he has to work; and if he is fortunate enough to be placed under the supervision of an experienced physicist, there is no reason why his training in research should not take place in the industrial laboratory. If he is going to a laboratory where he will have to rely on his own resources, more post-graduate research will be a great advantage.

An unsatisfactory consequence of spending three years in post-graduate research is that, instead of becoming broader in knowledge, a man is apt to become more and more of a specialist. It is very desirable that the post-graduate training should be designed to widen his range of interests. For example, he might be encouraged to learn some chemistry, and to write essays on some physical problems which would require reference to the original sources in foreign languages. Candidates fresh from the university appear to have had little practice in getting up a new subject without considerable help, and, in general, physicists are not so familiar with foreign languages as are chemists. Some day, it may be hoped, there will be at least one man on the physics staff of universities who will have had experience in commercial research, and may be able to encourage students to look for commercial applications of the knowledge they acquire.

Little of the very modern theoretical physics finds immediate application in industry, but it is essential that the young physicist should have a good knowledge of the older physics dealing with properties of matter; this is usually a weakness. Again, he may know quite well the properties of thick lens systems, but he often knows little about the actual use of a microscope with high magnification, and he has probably not heard of the conditions for critical illumination; in fact, his knowledge of microscopy usually ends with the use of a measuring microscope. He is often unacquainted with refractometers, and so neglects a test which is frequently useful. Lack of knowledge of this type is perhaps pardonable when it is remembered that experimental work in a graduate course is designed to elucidate physical principles rather than to obtain a quick result.

A thing that will surprise a scientifically trained man when he enters a works in one of the older industries or one not closely in touch with science, is the number of operations that are carried out without scientific control at each stage. To get this control is one of the present problems of commercial research. Further, it is found in commercial laboratories that a large number of tests are required for which there is no standard testing machine. For both these purposes new testing instruments will have to be devised. The average post-graduate is not very successful at this class of work, probably because his post-graduate reading has been too much concerned with theory. More time should be given to reading the *Journal of Scientific Instruments* and similar journals, which give many hints on the design of testing

apparatus, and the most suitable materials to use in its construction. Coupled with this should go instruction in machine drawing. It is perhaps too much to ask that the student should also attend classes in machine construction and design, but he should certainly do so after taking a post. There is considerable evidence that in the early stages of development of a process, a physicist with a little knowledge of engineering is better than an engineer with little knowledge of physics.

It was rightly remarked at the Conference that the personality of the industrial research worker is as important as his university training; and because of this there are many good physicists who will never reach high administrative positions. The ability to communicate ideas and plans to employers (probably unscientific men) in non-technical language, and, having gained their assent to these schemes, to overcome the inertia and gain the goodwill of the works managers and the workmen, is essential.

The research worker is among the most intelligent of the employees, and he should be able and willing to go outside physics altogether on occasion. For example, he should be able to suggest selling points to the sales organisation, and even to the advertising staff. Last, but not least, an industrial physicist must be able to apply results of research to commercial use. To be able to visualise practical developments of scientific research is a gift which does not seem to be created by training, but it is one to be cultivated by every physicist who hopes to occupy a leading position in an industrial works.

The Pattern of Culture

The Fear of the Dead in Primitive Religion
By Sir James George Frazer. Vol. 3. Pp. x+323.
(London: Macmillan and Co., Ltd., 1936.) 10s. 6d. net.

NO linguist would think of picking words from a variety of languages none of which he had studied as a whole, and on these pickings base a theory of language. Every linguist knows that structure and function are essential to an understanding of speech. What is impossible in language is still possible in the study of customs and beliefs.

To take an example. It is a widespread custom to avoid noise, or even to observe complete silence, after a death. Does the anthropologist study thoroughly a few cultures of which this custom is an element in order to determine its relations to other elements? No, he is quite content to collect instances from all over the world, and then to suggest whatever motive his imagination may prompt. In Indonesia his imagination is assisted by the opinion of one whom Sir James Frazer considers "the highest living authority" on that archipelago. That authority thinks complete silence is observed after a death in order "that no

sound should meet the ear of the soul to indicate the way to its home". It is a case of that deception which Sir James believes "primitives" generally are fond of practising on their dead.

Unfortunately, we are not told on what evidence this opinion is based. The magic word 'authority' is supposed to silence all doubts. Well, we shall not question the authority, in order to give Sir James's method every chance. We shall even assume that the opinion is based on the best possible evidence, the clear unequivocal statements of the Indonesians themselves. That is giving the method a very fair start, since in the end the explanations of the natives concerning their own customs must be the foundation on which our theories are built.

That does not mean that we are to accept the first explanation a native gives as the origin of the custom; for another native will give a different one, and as we go round the world we shall hear a dozen explanations or more given of the same custom. They cannot all represent the original reason. In this particular case we, for example, explain our 'two minute silence' as an expression of respect for the dead and an occasion for remembering them; and what is more, we do use the silence for that purpose. Why should the Indonesian explanation represent the original rather than ours, which Sir James does not even mention?

That reason must be the original one which fits all the facts. All the varieties of the custom and all the various reasons alleged must derive from it naturally so that at last we understand. Sir James's method unfortunately leaves out the most important and decisive fact of all, the place which custom occupies in the general scheme of culture.

To ask for the whole of Indonesian *culture* is to ask for a lot; but we should not be unreasonable if we asked to know something of Indonesian *ritual* as a whole. As we are not vouchsafed that much, we cannot test Sir James's method on his own material; we must fall back on a people whose culture we do know in detail. The Fijians forbid all noise after a death. They give no reason, but they suggest a theory in their technical term for this quiescence: they call it "abiding as *iloloku*". Now *iloloku* is used of suttee, of self-mutilation at a death, of fine mats put in the grave, common boys circumcised with a noble boy, etc. They evidently look upon this quiescence as a fictitious dying to accompany the dead, or as an offering to the dead. The two interpretations are not mutually exclusive, for the truth is probably that they offer themselves up as companions who die with their lord. However, we are not here to explain the custom, but on a point of method,

to show that a study of structure leads to conclusions quite inconsistent with Sir James's, and so we must go on to examine the ritual structure as a whole.

It very soon forces itself on our attention that all Fijian rituals have the same general structure, and that quiescence is just one member of that structure. Thus funerals and the king's installation follow much the same lines; quiescence is part of both, and the still watch in the house of the dead or of the new king is in both cases called *tonitoni*. The same quiescence turns up again in circumcision as part of the same pattern, and again in the priest's installation which the natives recognise as identical with that of a manslayer. Do the Fijians want by their silence to deceive the king, the priest, the manslayer, the neophyte? Any theory that would explain the quiescence in one case must explain it in all.

We cannot rule out the Fijians as abnormal; we are realising more and more how normal they are, as we find everywhere the same pattern running through all the varieties of ritual. Dr. H. G. Quaritch Wales has demonstrated it most clearly in the case of the royal ceremonies of Siam, first tonsure, coronation, funeral. We need not go outside our own sacraments.

Even the fragments offered us by Sir James have sometimes adhesions which point to a uniform and widespread pattern. Thus the quiescence lasts four days among the Bella-Coola, and we know that that mystic number four which extends all over North America, the Pacific, ancient India, and much of Africa, is connected with the four quarters. The four days' quiescence of the Bella-Coola and the Fijians, and of many others, thus links up with a cosmic doctrine in which the four quarters figure very largely, and it cannot be detached from that doctrine and treated as an isolated fact.

The idea of structure or pattern in culture began to germinate when field-workers undertook comprehensive surveys of particular cultures. Recently it has made great strides, as witness such works as "Myth and Ritual", "The Labyrinth", "Siamese State Ceremonies", "The Hero" and others. Prof. B. Malinowski has crusaded persistently against the fact isolated from its context, and its days are numbered. When Tylor first relied on the isolated fact there was little else to rely on. His method of instances has done good work. It gave us "Primitive Culture" and "The Golden Bough". It sometimes put us on the right scent, oftener on the wrong one, but it served a valuable purpose in that it made us learn by our failures what we lacked. We must be grateful for the valuable studies with which it has provided us, through the pen of the veteran anthropologist and philosopher, Sir James Frazer.

A. M. HOCART.

Physiology of Plants

Plant Physiology

By Meirion Thomas. Pp. xii+494. (London: J. and A. Churchill, Ltd., 1935.) 15s.

A COMPREHENSIVE text-book on plant physiology has been lacking for too great a length of time, in view of the ever-increasing demand for well-trained botanists at home and especially in the Empire overseas. This demand for botanists and other biologists has gone unsatisfied for several years now, especially during the post-War years; but it is regrettable that, apart from a very few outstanding university and other departments, little attempt has been made to meet the situation. Sir Arthur Hill, in the report of the Third Imperial Botanical Conference held in London on August 28-30, 1935, shows that the authorities at the Royal Botanic Gardens, Kew, and also certain of the British Empire Governments, recognise this need for betterment in the training facilities offered to budding botanists. But naturally the changes that they suggest can only affect those young botanists who have already been through their preliminary academic training (see NATURE, Feb. 15, p. 268). Increased facilities for such preliminary training, and profound improvements in those already established, are sorely needed, especially in the universities, if the right type of man and woman is to be attracted to botany as a profession. The prospects for any ambitious candidate are good: but the opportunities for training, as compared with other branches of science, are gravely inadequate. The reasons are not far to seek, and one of them is the lack of text-books of the right type.

For this reason we welcomed Dr. Thomas's "Plant Physiology", and for the same reason we cannot suppress a slight feeling of disappointment. We grant the author's contention that "there is still room for several more [text-books] in which the subject is treated from different stand-points and with different objects in view", especially so far as plant physiology is concerned, but it is difficult to see where the different treatment and points of view lie in the work under notice. Our criticism is directed almost solely against the author's choice of subject matter. Naturally the exigencies of space preclude the treatment of the whole of the subject in any one text-book, and thus the author disarms criticism by pleading force of choice. But, unfortunately for the student, Dr. Thomas has selected those very aspects of plant physiology which have been chosen by other

authors, and also has admittedly left out those branches of the subject which are scarcely dealt with in other English works and are very important from the point of view of those who wish eventually to make botany their profession. We refer chiefly to the physiology of development and other aspects of the nutrition and reproduction of the plant.

The biochemistry of the subject is excellent, but we would have wished to see it developed further in order to cater for those who desire to continue their studies and researches on foodstuffs and other plant products of economic value. Agricultural and horticultural botanists, too, are passed over. This is all the more disappointing since, in view of the way in which Dr. Thomas has dealt with the subject matter, we feel that an important gap would have been adequately filled in the most praiseworthy fashion had the final choice of material been determined more by the primary needs of the professional botanist, economic and otherwise, so much in request to-day both at home and abroad.

Having now aired our grievance with the author over the choice of material, a brief review of what has been chosen is necessary. The book is divided into four parts, namely: (1) protoplasm; (2) absorption, translocation, and elimination of water, solutes and gases (osmosis, soils, transpiration, translocation, gaseous exchange); (3) nutrition and metabolism (photosynthesis and respiration); (4) growth and movement. There are two appendices, one on biochemistry and the other on physical chemistry. These are excellent surveys, as one would expect from an authority on chemical problems of plant physiology.

For university students, the discussion on protoplasm leaves nothing to be desired. Few books seem to give a clear but condensed account of our present-day knowledge of this important attribute of life, but Dr. Thomas has been successful in writing an intelligible account without wasting time and causing confusion with masses of irrelevant detail. This discussion leads up to an excellent survey of enzymes and enzymic action.

The chapter on permeability is of outstanding merit, since, in the reviewer's experience, this subject is one of the most difficult for students to grasp, yet Dr. Thomas has made it quite as lucid as any other topic in the book. The chapters on the various aspects of metabolism have obviously been written with meticulous care. No outstanding results of researches in this field have

been overlooked: this applies to the literature of the subject right up to the time of this book having gone to press. The discussion on growth and movement is undoubtedly one of the best, of this standard, we have read.

Following the text is a bibliography of 163 citations, including papers, etc., up to, and including, 1935. The reviewer can think of scarcely any outstanding works omitted from this list, which will prove a boon not only to students of botany but also to more advanced botanists. There are author and subject indexes.

Having read the book, the reviewer's original disappointment after glancing at the contents, becomes even more acute. Had this been a mediocre review of those branches of plant physiology chosen for discussion, then one would have felt relieved that the author had gone no

further. But what has been written is first-rate. In fact, the reviewer cannot think of another textbook of this standard (at any rate, British or American) which is so well written and up to date. To the academic botanist, it may be said of this book that it genuinely satisfies a long-felt want. But the author offers little food for thought or encouragement to the economic botanist, agriculturist, horticulturist or chemist. One consolation, however, is that in Dr. Thomas has been found what is sorely needed—a trustworthy author for students of plant physiology. Our appetite has been whetted, and now we can only ask that Dr. Thomas will set to work and give us at any rate one more volume, dealing with the more economic aspects of plant physiology, and those other aspects of the subject having a more direct bearing on plants and their cultivation in relation to man.

Progress in Acoustics

(1) Anecdotal History of the Science of Sound to the Beginning of the 20th Century

By Prof. Dayton Clarence Miller. Pp. xii + 114 + 16 plates. (New York: The Macmillan Co., 1935.) 10s. 6d. net.

(2) Klänge und Geräusche:

Methoden und Ergebnisse der Klangforschung, Schallwahrnehmung, Grundlegende Fragen der Klangübertragung. Von Prof. Dr. Ferdinand Trendelenburg. Pp. viii + 235. (Berlin: Julius Springer, 1935.) 25.80 gold marks.

THE study of the history of physics is not popular among physicists, and fewer textbooks now use the historical method of presentation. But is lack of time or space the only factor? Admittedly the undergraduate must labour under the increasing bulk of physics, and the mature worker must in addition grapple with the tangle of inference, extrapolation and philosophy encountered in atomic physics. If theory be placed before fact and science be regarded as the pursuit of truth (in any philosophical sense), then the history of any branch of physics presents one long succession of human 'error'. In such circumstances the psychologist would not be surprised to find that the history of physics was an unpopular subject amongst practising physicists.

(1) Prof. Miller's book is an amplified version of an address given to the Acoustical Society of America and, unlike most histories, is short enough to be read in an evening. It succeeds well in its purpose of recording what seem to be the principal

events in the progress of acoustics up to the beginning of the twentieth century. If the early workers lacked facilities, they certainly lacked nothing that ingenuity could provide. For example, one might have thought that the device of moving objects in a vacuum by using a magnet outside was quite modern. Yet in the earliest version of the bell *in vacuo* experiment which Prof. Miller could find, Kircher records in 1650, with diagram, how he struck the bell with an iron clapper by manipulating a "vigorous lodestone" outside the glass bulb. The lecturer who has tried to give an effective demonstration, with simple apparatus, of this experiment, can sympathise with the early workers. Kircher, the Italian Academy and Boyle, in his first attempt, all failed.

The book is so well filled that almost any page records some interesting fact, whether it be details of the most gigantic sound known, that of the Krakatoa volcanic explosion in 1883, which was heard nearly three thousand miles away and affected all barometers, or of unsolved problems of mathematical acoustics. "Strange as it may seem, there is not now any theoretical formula by which one can derive, without the aid of empirical information, the dimensions of an organ pipe which will give a specified tone". In the simplest of wind instruments, the flute, the difference between the 'theoretical' and the actual length of the tube is more than two inches!

(2) The profound influence of developments of technique in several branches of physics upon recent experimental studies in acoustics is strikingly

shown by the contents of the second book. By his work in the Berlin laboratories of Siemens, Dr. Trendelenburg is in close touch with practical problems. He has presented an excellent summary of all physical and some physiological aspects of sound. Methods of generation, detection, measurement, recording, transmission and propagation in and out of doors and the main results are given, together with some of the relevant mathematical formulæ. Quantitative data appear in about one half of the 150 illustrations.

There is no book in English giving so varied and so recent results, with so little repetition of material readily accessible in the excellent text-books now current. Noteworthy in the section on musical instruments is the reproduction of about seventy quantitative sound spectra from the work of Meyer and Buchmann. Some of the results show the well-known variation of tone quality with pitch and intensity of the note played. A nine-page section on electrical musical instruments includes details of the Nernst-Bechstein electrical piano as well as of the less musical electrical synthesisers of sounds.

Both books can be strongly recommended as supplementing the text-books with but little overlapping. Although both are short, they contain numerous references to more detailed and original sources, and the Trendelenburg volume is more up to date than any handbook.

Progress in acoustics has already helped physics by making severe demands upon mathematical and experimental technique. There are signs that in the future still greater help may be given. Already the idea that the pitch of a musical note is that of the lowest harmonic has had to be abandoned. Pitch is found to be a property of the complex whole (depending even on such a factor as intensity) and not necessarily inherent in any of the parts into which a complex note may be analysed. That all those properties of a whole, of interest to the physicist, may yet not be explicable in terms of properties of parts, is apt to savour too much of biology to find general favour in physics. But does it not fit some of the facts discovered in recent research in acoustics, and may not the same idea be of service also in other branches of physics?

W. H. GEORGE.

A Tribute to Dr. R. R. Marett

Custom is King :

Essays presented to R. R. Marett on his Seventieth Birthday, June 13, 1936. Edited by L. H. Dudley Buxton. Pp. xiii+325+4 plates. (London: Hutchinson's Scientific and Technical Publications, 1936.) 12s. 6d. net.

IN this volume, in which Dr. Marett's friends and former pupils have united to express their affectionate esteem on the occasion of his seventieth birthday (see page 1023), there are nineteen contributions. There are not more only because anthropologists are notorious wanderers, and Dr. Marett's friends are scattered over the four quarters of the globe. Enough have been accessible, however, for a representative selection from those who have accompanied, or followed in, Dr. Marett's footsteps.

The volume opens with a graceful dedication in Latin verse, which, like the contribution from Prof. Henry Balfour, following immediately after, commemorates a friendship and association of long standing. Prof. Balfour, in tracing a cultural link between the Nagas of Assam and the peoples of Melanesia, makes use of a method of technological analysis in demonstrating the movements of cultural elements, which he has made peculiarly his own. A somewhat similar problem, though in a different context, and with greater emphasis on the ethnological side, is considered by Mr. Diamond

Jeness of Ottawa, in his essay on the prehistory of the Canadian Indians. In the course of a closely reasoned argument, he puts forward an interesting suggestion as to the chronological position of Eskimo culture and as to the standing of the Caribou Eskimo, which has recently been under discussion. He is of the opinion that this eastern group is neither original nor degenerate, but is the product of a fusion of Eskimo and Indian elements.

Dr. Marett's ever-lively interest in living 'savages', as he loves to call them, is perhaps best reflected in Dr. R. S. Rattray's "Totemism and Blood-Groups", which, notwithstanding its title, is not concerned with physiology, but discusses the place and influence of the totem in West African society, and Dr. E. E. Evans-Pritchard's "Daily Life of the Nuer in Dry Season Camp". In both of these, though indirectly, may be discerned the effects of Dr. Marett's guidance in directing attention to the practical interest of anthropological studies for the administrator. Mr. A. M. Hocart's witty discussion of the influence of "Snobbery" suggests a new line of research.

Among the archaeological papers, mention can be made of no more than two—Prof. R. M. Dawkins's study of the activities and character of the Norsemen in the service of Byzantium, and the results of Mr. O. G. S. Crawford's detective zeal in tracing early routes to and from Ireland.

Factor Table giving the Complete Decomposition of all Numbers less than 100,000

Prepared independently by J. Peters, A. Lodge and E. J. Ternouth, E. Gifford, and collated by the British Association Committee for the Calculation of Mathematical Tables. Pp. xv+292. (British Association for the Advancement of Science Mathematical Tables, Vol. 5.) (London: British Association, 1935.) 20s. net.

THE theory of numbers, going back at least as far as the time of Pythagoras, differs in many respects from other branches of mathematics, a fact that may explain the attraction of the subject, not only for the majority of mathematicians (though a minority dislike it intensely), but also for enthusiastic amateurs such as the late Lieut.-Col. A. J. C. Cunningham, whose generous bequest has made possible the production of this and two preceding volumes of British Association tables.

No other mathematical subject comes so near to being a science of observation and description, and the data to be observed are largely connected with factorisation of numbers. The study of congruences, quadratic and power residues, continued fractions, quadratic forms, and other more recent theories have arisen as by-products in the process of factorisation. The systematic treatment of the problem may be said to have started with Eratosthenes in the third century B.C., but the first extensive factor table was published by Brancker in 1668. Others were published by Chernac (1811), Barlow (1814), Inghirami (1832), Vega (1849), Hinkley (1853), Jones (4th ed., 1893), and Gifford (1931), while there also exist some of much greater range, notably Lehmer's "Factor Table for the First Ten Millions" (1909).

The great defect of factor tables is their liability to contain errors, which are not only more difficult to detect than is the case with tables of the ordinary continuous mathematical functions, but also more serious in their consequences. The present table rests on the comparison of three tables prepared independently by Prof. J. Peters, Prof. A. Lodge and Miss E. J. Ternouth, and Mrs. E. Gifford, assisted by no less than eighteen volunteer proof-readers. It may not be in mortals to command accuracy, but in any event the authors deserve it. The whole of the work of computers and readers has been voluntary, and the cost of production consists entirely of that of organisation and printing.

H. T. H. P.

The Beginnings of Systematic Bibliography

By Theodore Besterman. Pp. xi+81+12 plates. (London: Oxford University Press, 1935.) 21s. net.

THIS beautifully printed and illustrated work forms the third of a series known as the Oxford Books on Bibliography. In Part 1, Mr. Besterman traces the development of systematic bibliography from its earliest beginnings to the end of the seventeenth century. Bibliographies of very limited scope are shown to have existed before the invention of printing. In the second century, for example, Galen composed a classified list of his own very numerous writings, which was afterwards printed (1525). The

greatest of early bibliographers was Conrad Gesner, but Mr. Besterman deprives him of the title of 'father of bibliography'. This honour, previously accorded to him by some authors, he awards to Johann Trithem, who published at Basle in 1494 a bibliography listing some 7,000 works, mainly ecclesiastical. To Gesner still belongs the credit of being the first universal bibliographer, and a chapter is devoted to a description of this author's bibliographical works. It is interesting to note that in his "Pandectarum sive partitionum universalium" (Zurich, 1548), in which the books listed are classified by subjects, works of scientific interest have been separated under headings such as geometry and optics, astronomy, natural philosophy, etc. Gesner's bibliographies were restricted to works in the learned languages, Greek, Latin and Hebrew.

In subsequent chapters Mr. Besterman discusses particularly the evolution of national and subject bibliographies. One of the earliest known subject bibliographies is Symphorien Champier's "De medicina claris scriptoribus" (Lyons, 1506). This is the first medical bibliography, and lists works in European, as well as classical, languages. Pierre Borel's "Bibliotheca Chimica" (Paris, 1654), the first chemical bibliography, perhaps deserves to have received a mention.

Part 2 consists of a list of all important bibliographies published up to the end of the sixteenth century.

Mr. Besterman's scholarly work will appeal to all bibliophiles, and may not be without practical value to those whose researches lead them into the bypaths of sixteenth and seventeenth century literature.

In the Heart of Europe:

Life in Czechoslovakia. By Dr. Gerald Druce. Pp. 228+30 plates. (London: George Allen and Unwin, Ltd., 1936.) 6s. net.

THIS recent addition to the already numerous works on Czechoslovakia attempts to combine a general account of the country with guide-book details intended to help the tourist. Too much space is wasted by such statements as "life in provincial towns is naturally quieter than in the capital . . . it need not, however, be dull". A chapter is devoted to education, science, religion and art, fourteen pages being given to science. The influence of the exiled Komensky (Comenius) on the formation of the Royal Society in England and on contemporary American thought is recalled; the Czech origin of Purkyně and Mendel is naturally recorded, and many of the leading names of the present day and the last century are mentioned. But the information concerning their contributions to knowledge is too casually expressed to have much value. Thus one man of science has "added greatly to our knowledge of the useful and harmful bacteria"; another's special study "will eventually prove of value both to industry and to science itself", whilst a third "made many contributions to technological methods". Apart from the Frenchman Barrande, the only geologist selected for mention is Slavík. The volume has an excellent map prepared by the military cartographical institute of Prague.

L. D. S.

Modern Sociologists

(1) Tylor. By Dr. R. R. Marett. Pp. 220. (2) Pareto. By Franz Borckenau. Pp. 219. (London: Chapman and Hall, Ltd., 1936.) 6s. net each.

THESE two little books inaugurate a series under the editorship of Prof. M. Ginsberg and Mr. Alexander Farquharson, in which the contributions to sociology of the more important of modern thinkers will be set out for the use of students and the benefit of a wider public. The first two volumes should be read together, not only for the contrast in the character and careers of the two men with whom they deal, but also for the insight they afford into the diverse ways in which modern sociological theories have come into being.

(1) Dr. Marett writes of Tylor and his work with the close and intimate sympathy of personal friendship and an association in anthropological studies lasting over many years. Without losing sight of the special purpose of the series of which his book forms part, he has produced the best account of Tylor's achievement that has yet appeared. It will serve to correct numerous misapprehensions that have arisen from the strictures of less thoroughly informed critics.

(2) Pareto stands in a different category from Tylor, though he too ended his life as the occupant of a professorial chair. His early and formative years, however, were passed as a man of action. He was an engineer in the service of the Italian Government until his political views and activities made it necessary for him to relinquish his official position. He seems to have been most strongly influenced by his antagonism to the views of Mazzini, of whom his father had been a supporter in the revolutionary movement. Hence, whereas Tylor's contribution to sociological thought is an integral part of a theory of the development of culture as a whole, Pareto's sociological theory seems to emerge from an opposition to humanitarian liberalism and the trend of Italian politics rather than from a general philosophical position which determined his outlook. His doctrine of the place of force in the State finds its embodiment in Mussolini; but his death took place before this had become fully apparent.

Exotic Aquarium Fishes:

a Work of General Reference. By William T. Innes. Pp. 464. (Philadelphia: Innes Publishing Co., 1935.) 5 dollars.

It will certainly surprise most readers to learn that there are about sixty flourishing aquarium societies in North America, and that there is a well-organised trade in about three hundred species of fresh-water fish. These are brought mainly from the tropics, where the fish are more brilliant in colour and often of bizarre shape. Here these fish are nearly all represented by photographs, many of them coloured. The fish are properly classified and named, and under each there is a description of the fish with an account of its spawning and its food and a note as to the temperature required. There are often practical hints as to keeping it in health and in some cases as

to line breeding. This systematic part is preceded by a discussion of the primary principles, namely, sufficient oxygen, enough light, right temperature and correct feeding. There are directions as to prepared food and the collecting of such live foods as *Daphnia*, mosquito larvæ, *Tubifex* and various other forms, together with the culturing of enchytraëids and infusorians. Then follow the enemies of fish—water beetles, dragon-fly larvæ, *Hydra*, various other insects and *Argulus*.

Of diseases and parasites there are far fewer in aquaria than in Nature. The chief troubles are a parasitic protozoon (*Ichthyophthirius*), which burrows into the skin and later gives entrance to fungus, and a fluke (*Gyrodactylus*), for both of which remedies are suggested. Various molluscs and crustaceans are valuable scavengers in aquaria, but the success of these largely depends on the proper growth of plants, of which there is a valuable account. The book is not intended for the professional zoologist; but it will be found of great value in his reference library.

Organic Syntheses:

an Annual Publication of Satisfactory Methods for the Preparation of Organic Chemicals. John R. Johnson, Editor-in-Chief. Vol. 16. Pp. v+104. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1936.) 8s. 6d. net.

THE latest addition to this series maintains a high standard of efficiency and utility. It contains details of twenty-eight preparations, together with three pages of later references to matter appearing in earlier volumes. The index covers vols. 10–16.

1,4-Diphenylbutadiene is prepared by the condensation of phenylacetic acid and cinnamic aldehyde, in presence of acetic anhydride and litharge. A somewhat similar condensation of phenylacetic acid and glacial acetic acid in presence of a thorium oxide catalyst, yielding methyl benzyl ketone, is accomplished at 430°–450° in a neat electrically heated furnace, figured in the text. Methylhydrazine sulphate is made by the action of dimethyl sulphate on benzalazine (prepared from benzaldehyde, hydrazine sulphate and aqueous ammonia), the other products being the recovered benzaldehyde and methyl alcohol. In recrystallising that useful reagent, *p*-nitrobenzyl bromide, from ligroin, the inverted filtration method of Bost and Constable (figured in the text) is recommended, since it reduces the fire hazard and facilitates the manipulation of the lachrymatory solution.

Quinone is prepared in a yield of 92–96 per cent by oxidising hydroquinone at 40° with sodium chlorate in presence of dilute sulphuric acid and a little vanadium pentoxide. Furan is hydrogenated almost quantitatively to tetrahydrofuran (tetramethylene oxide) in presence of a palladium oxide catalyst, of which the preparation is described. Among other interesting preparations included are β -alanine, epichloro- and epibromo-hydrin, *n*-hexaldehyde, the two dimethylhydrazines (as hydrochloride), and *sym*-trithiane.

J. R.

Transportation of the 200-inch Mirror

THE manufacture of the Pyrex disk for the 200-inch reflecting telescope of the California Institute of Technology is one of the most notable technical feats of this decade. A detailed description of the manufacture and annealing has already appeared as a Supplement to NATURE (February 8, 1936), and we have now received from Dr. G. E. Hale the following description of the transportation of the giant disk from Corning, N.Y., to Pasadena, California, where the mirror will be ground, polished and figured.

"The 200-inch disk was packed with great care at Corning and mounted within a heavy steel case in a special low car, built for the long trip across the continent by the New York Central Railroad. The operation of packing and transportation was a delicate one,

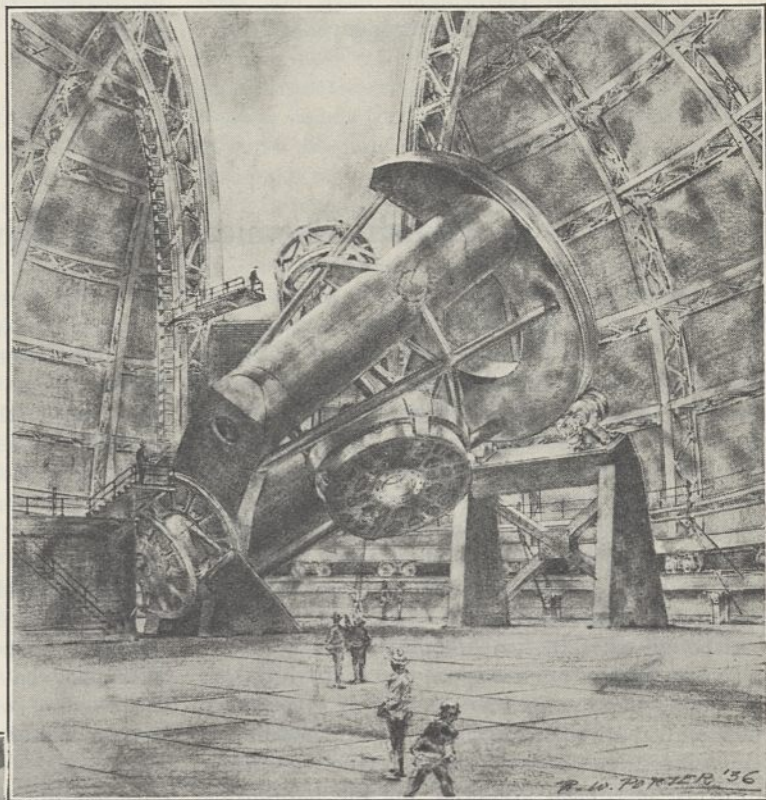


FIG. 1. Tentative sketch of the 200-inch reflecting telescope. This design may be altered in several respects before construction.

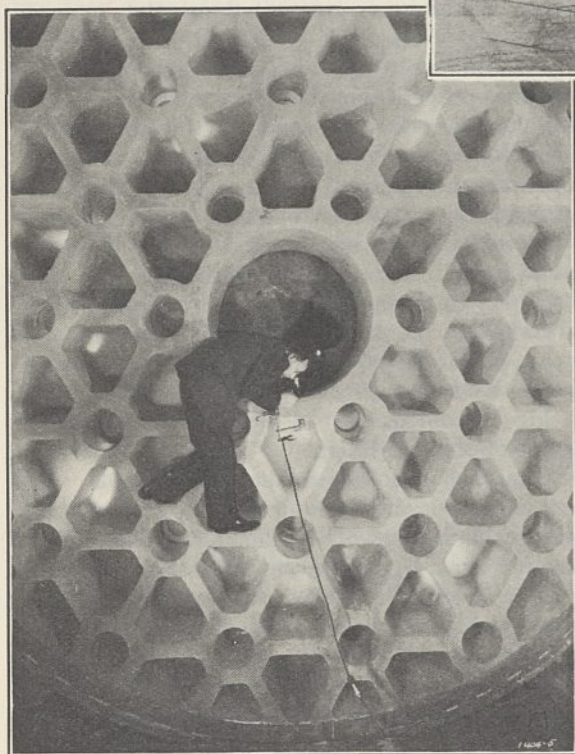


FIG. 2. Dr. McCauley testing the 200-inch disk with polarised light at the Corning Glass Works.

as the base of the steel covering cleared the roadbed by only a few inches, while its upper extremity came within three or four inches of various tunnels and bridges on the route. A special train of three cars and a locomotive was provided, and this proceeded at the rate of 25 miles per hour over the New York Central, the Chicago, Burlington and Quincy, and the Atcheson, Topeka and Santa Fé systems from the glass works at Corning, N.Y., to Pasadena. The train moved only by day, with an advance scout, and all vibrations were automatically recorded. The paper record is remarkably smooth, and it was no surprise to find the large disk in perfect condition when opened in the optical shop of the California Institute. Ordinary visual tests, supplemented by observations through various parts of the disk and its rib system in polarised light, indicate the perfection of the annealing process conducted at Corning.

"To an old-timer like myself it is difficult to realise, when looking at the new disk, that the central hole has an aperture equal to that of the

40-inch Yerkes refractor. No other scale gauge could be more striking to me, as I recall so vividly the arrival of the 40-inch objective at the Yerkes Observatory in 1897. Contrasted with our previous refractors, it greatly excited our anticipations, and our hopes of good performance have not been disappointed during the intervening years."

The accompanying illustrations show (Fig. 1) a tentative sketch of the complete 200-inch reflecting telescope, and (Fig. 2) Dr. McCauley testing the great disk with polarised light at the Corning glass works. The design shown in Fig. 1 may be altered in several respects before construction takes place.

British Chemical Plant Exhibition

ON Monday next, June 22, the Right Hon. J. Ramsay Macdonald is to open an exhibition of British Chemical Plant at the Central Hall, Westminster, S.W.1. This exhibition, which has been organised by the British Chemical Plant Manufacturers' Association, will occupy the ground floor and basement of the Central Hall, and will run concurrently with the Chemical Engineering Congress of the World Power Conference, which is meeting in the same building from 9.30 a.m. until 6.30 p.m. on June 22-27 and until 8 p.m. on June 23 and 26.

Although the British Chemical Plant Manufacturers' Association has sponsored this exhibition, the management committee has wisely given firms not members of the Association an opportunity of displaying their manufactures. One condition, however, has been imposed on all exhibitors, namely, that all plant exhibited shall be of British manufacture, the criterion laid down being that at least 75 per cent of the cost of the plant shall represent labour or material within Great Britain or the Empire.

The last exhibition organised by this Association was held in 1931, so that those who are attending this, the first international conference on chemical engineering, may be able to observe the rapid progress made within five years. To others who are not intimately acquainted with chemical engineering, the exhibition should provide an admirable illustration of the scope of the subject and the complexity of the plants which may have to be used when a laboratory experiment or research has to be developed into an industrial process.

Of the forty-eight firms which are exhibiting, thirty have declared that a number of exhibits which they are showing, amounting to a hundred in all, have not been shown by them at any previous British chemical plant exhibition.

Materials of construction being of outstanding importance to the chemical engineer, it is not surprising to find that this aspect of the subject

has received considerable attention, both from the research associations working in close alliance with the Department of Scientific and Industrial Research, as well as commercial enterprises. Numerous exhibits are therefore to be found throughout the stands of the exhibition which deal with the improvements in the cast irons now available, developments which have taken place in steels designed to resist corrosion or withstand high temperatures, the protection of steel by glass, enamels, or other metals.

Owing, for example, to the tendency to intergranular corrosions in austenitic stainless steels, after they have been heated to a dull red heat, the welding of such steels into chemical plant having dimensions greater than the internal dimensions of the heat treatment furnace could only be done at the expense of the corrosive resistance properties of the welds. Research in this field, however, has shown that the addition of silicon to such a chromium nickel steel not only eliminates the necessity for the heat treatment of the welded joints, thus removing the limitations to the size of vessel which could be manufactured and still retain its resistant qualities, but also that this type of steel increases the resistance to attack by various acids, and oxidation at high temperatures. Examples of vessels made from this type of steel as well as various types of welding and cutting equipment are on view in the industrial section of the exhibition.

Research has not been idle in connexion with the non-ferrous metals and their alloys, whilst a considerable amount of development has also taken place in refractory and ceramic materials, possibly accelerated by the extended use of metals or alloys possessing high corrosive resisting properties. Here again is ample illustration of the progress which has been effected by the typical pieces of chemical plant to be seen on the various stands in the exhibition.

The National Physical Laboratory and kindred associations have been interested in the problem

of heat transmission, the properties of steels when at a high temperature and the behaviour of steels in the presence of superheated steam, some or all of which have a direct bearing on the design of high-pressure autoclaves, forced circulation evaporators, rotary economisers, heat exchangers, high vacuum distillation plants, band and drum dryers. Many pieces of apparatus of this character are to be found on various stands.

Still taking the exhibit organised by the Department of Scientific and Industrial Research, which will be found in a separate room in the north-east corner of the ground floor, as the key to the exhibition, it will be found that there is a number of exhibits which illustrate the work being carried on at the Fuel Research Station in connexion with the coal survey, carbonisation of coal, pulverisation of fuel and hydrogenation-cracking of tar, and on passing into the industrial section, models can be seen of a carburetted water-gas plant and a waterless gas holder, as well as a small coal water-gas plant and appliances for using gas such as burners, gas-fired boiler and oil heaters. The pulverisation of coal naturally directs attention to the size-reduction machinery on view on several of the stands, but as crushing and grinding machines in industry usually have large outputs and therefore are of large size, models in some instances have been installed to illustrate the type and action of the firm's make of machine. After size-reduction has been completed, the broken pieces are usually separated either according to size or composition, and again the visitor will note on several stands screening devices of the latest types.

Where the problem facing the chemical engineer is to obtain hydrogen in a pure state suitable for hydrogenation processes, a visit to the exhibition will show him some of the latest developments in the cells used in the electrolytic production of hydrogen and oxygen from water. The juxtaposition of this stand and the welding stand serves to remind the visitor that the oxygen produced by the electrolysis need not as formerly constitute an industrial waste, but may be readily used as one of his raw materials by the welder.

Since the problem of separation arises in mixtures where the components forming the mixture can exist in the same or different states of matter, the types of plant designed for separation problems are very varied. In the exhibition are numerous examples of equipment intended for the separation of mixtures of solids and liquids, such as filters and filter parts ranging from the sterilising type where the solid content is extremely small to the various types designed to separate thick slurries, centrifugal machines, classifiers, flocculators and thickeners. Industrially, many of these machines are of considerable size and would therefore be

too large for exhibition purposes, but the firms desirous of making a representative display have in such cases provided small-scale equipment, models, spare parts or other means of illustrating the types of plants they supply and their operation.

The converse problem, namely, mixing solid with solid, or solid with liquid, or liquid with liquid, is of equal importance in the chemical industry, and on various stands throughout the exhibition a variety of types of plant which have been developed for this purpose can be studied.

An important problem in chemical works is often the movement of large quantities of material, for the chemical engineer has not only to consider the physical and chemical properties of the substance to be moved but also, as in all other operations, the efficiency with which it is carried out, so that the cost of the final product may not be unduly raised. It is, therefore, not surprising that on many stands in this exhibition will be found examples of pumps, valves, pipe-lines and so on, many of which have been specially designed and constructed for use in factories where corrosive liquids or liquids containing large percentages of solid matter have to be transported. On the other hand, the aim of the designer has sometimes been to produce a reliable machine suitable for the food industry, where no form of contamination by lubricants or other means can be tolerated.

Efficiency being the watch-word in modern industry, it is pleasing to observe that in the present exhibition this factor has not been overlooked, but that there is on view apparatus for measuring temperature, pressure, humidity, controllers and recorders, various types of meters for the measurement of air and gas, steam and liquids as well as recorders for pH values and such checks as can be made by colour comparisons.

Moving about in the industrial section, one sees how closely the work of the various research associations is being studied and followed by the plant manufacturer.

The Chemical Works Regulations of 1922 contain rules relating to the equipment to be provided and used by anyone entering a chamber containing poisonous material and so on, and even this section of the equipment of a chemical factory is well represented at the exhibition. Another group of stands of interest to those concerned with chemistry, chemical engineering or chemical industry contains the literature available, both books and periodicals.

There is much of interest in the exhibition to everyone associated with chemical industry, so that it seems a pity that members attending the Congress will only be able to visit the exhibition during intervals between the meetings upstairs.

Fuel Research in Great Britain

NEARLY five hundred guests visited the Fuel Research Station at East Greenwich on June 9. They were received by the Director of Fuel Research (Dr. F. S. Sinnatt). The plant and laboratories were open to inspection and the work in progress was explained by members of the staff.

The Lancashire boiler was seen in operation using a pulverised fuel burner and distributor designed at the Station. The boiler (25 ft. \times 7 ft. 6 in.) is rated at 5,000 lb. of steam per hour, but was working smoothly and without difficulty at an overload of 100 per cent. Commercial users of these appliances have found that they enable greatly increased loads to be maintained steadily for long periods. The distributor, which enables a heterogeneous stream of material to be divided into two equal parts, was first shown last year, and has since been successfully applied in a number of industrial plants. A Scotch marine boiler has just been installed for examining bunker coals under conditions comparable with those prevailing at sea, and also for trying out alternative methods of firing.

The cleaning and grading of coal at the colliery before it is placed in the market is a practice that has extended greatly in recent years. A detailed study is being made at the Station of the effects of moisture in fine coal on treatments such as dedusting, screening and dry cleaning. The use of flocculating agents for promoting rapid settlement of suspended solids in washery circulating systems is now an accepted practice, but work is proceeding to try to elucidate the actual mechanics of the processes involved and to determine the best way of applying these flocculating agents. Special attention is being given to coal breaking. The coal industry is beginning to experience certain difficulties owing to the diminished demand for large coal and the increased demand for graded sizes. Tests carried out under the direction of Survey officers are proceeding in certain coal fields with the view of providing data regarding the breaking properties of seams and the relative value of various types of breakers. The Fuel Research Station is co-operating particularly in assessing the stability of breaker products when subjected to transport and handling.

The carbonising plant at the Station includes a setting of horizontal gas retorts of the type that are in use for carbonising between seven and eight million tons of coal a year in the gas works of Great Britain. In retorts of this type, steaming of the charges of coal has not normally been

practised. Investigations carried out in the horizontal retorts at the Fuel Research Station have shown that by a special method of steaming during the later hours of the carbonisation period, the output of gas can be increased by about 10 therms per ton of coal or about 14 per cent above normal. During this investigation, one retort of the setting of eight has been isolated to allow of accurate determinations of the extent of steam decomposition when different rates of steam supply have been used. The fundamental aspects of the steaming process have received special attention during the work, which is now almost completed.

The greatest interest is being taken in the low temperature carbonisation plant which has been developed at the Fuel Research Station. The hydrogenation programme is of importance in relation to the economical utilisation of the tar. The work done in the plant on British coal seams has shown that a very wide range of coals can be successfully treated. This is of the greatest use in considering the developments that are taking place in low temperature carbonisation. At least one setting of this type of retort developed at the Station is being operated commercially.

The intermittent vertical chamber ovens at the Station are being used in an investigation of the effects, on the coke produced, of blending weakly caking coal with strongly caking coal. One of the main objects of this work is to explore the possibility of extending the life of the supply of strongly caking coals in Great Britain. Series of blends are being carbonised at high temperatures and the conditions of carbonisation with each blend are adjusted so that the final rate of gas evolution at the end of the carbonisation period is as nearly constant as possible with each blend.

A process for the manufacture of active or absorbent carbon from sized coal has been worked out. It has been observed that the nature of the coal is a critical factor in the process and, up to the present, three coals have been found suitable for the purpose. The information for the identification of these coals has been provided by the Fuel Research Coal Survey, reinforced by special experiments on a small scale. Large amounts of the coals suitable for the process are available in the country. When the conditions required for converting coal into active carbon had been established on a small scale, the work was transferred to the large-scale plant at the Station. The sized coal was carbonised continuously in the narrow brick retorts developed at the Fuel Research Station, at

a temperature of 480° C. The low-temperature product obtained was activated by treatment with superheated steam at a temperature of 950° C. This second stage of the treatment was carried out in the same type of retort. The yield of active carbon was 20–25 per cent of the coal originally carbonised. Some of the active carbon sized to a grade from $\frac{1}{4}$ – $\frac{1}{8}$ in. is being used at the Station for the recovery of spirit and benzole from coal gas.

The low-temperature carbonisation of coal produces large amounts of tar for which new industrial outlets are continually being sought. Similarly, the whole of the high-temperature tar produced in Great Britain does not always find a ready market. Processes such as hydrogenation-cracking which employ tars and tar distillates as raw materials for the production of fuel oils are therefore worthy of examination.

Experimental work has been in progress to determine the conditions and plant necessary for the conversion of tars and tar oils into materials, such as motor spirit, for which the market is relatively large. The process is one of hydrogenation-cracking and is operated under high pressures of hydrogen (normally about 200 atmospheres) and at elevated temperatures (350°–550° C.). The most satisfactory conditions and catalysts are being determined by experiment, and continuously operated plants are in use in which the variables of the process are being studied. The catalyst favoured at present for the treatment of crude low-temperature tars is a sulphide of molybdenum supported on a porous gel, but for selected oil distillates more active catalysts are available.

It has been found that low-temperature tar with no pre-treatment, other than filtration to

remove dust, can be hydrogenated satisfactorily. In one passage through the supported molybdenum catalyst there is obtained a product which is free from pitch and which contains motor spirit amounting to 45 per cent of the tar treated. By re-processing the high-boiling oils the total yield of spirit becomes 76 per cent by weight of the tar and 100 per cent by volume. Tar fractions can be treated with greater ease than crude tar. Creosote, for example, is much more readily treated than high-temperature tar. The crude spirit requires very little refining to make it a stable water-clear motor spirit having satisfactory properties. It has a good anti-knock value (octane number 70–75).

The scale of operation of the process has been increased in stages, the latest development being the design and construction of a plant capable of dealing with 1–2 tons of raw material per day. In erecting this plant, two main tasks were undertaken. The first of these consisted in working out a technique or method of operation which should be applicable to a large-scale plant; the second entailed the examination of the effect of variables (temperature, pressure, through-put, etc.) with the view of determining the best working conditions for the treatment of various raw materials. The first task has been accomplished, and work on the second is in progress.

The Fuel Research Station is also the headquarters of the Physical and Chemical Survey of the National Coal Resources, which is examining the coal seams of Great Britain. Much interest was taken in samples which were exhibited to show the great diversity in the appearance and properties of different types of coal, and in the methods and apparatus used in their examination.

The Kiss Precise

FOR pairs of lips to kiss maybe
 Involves no trigonometry.
 'Tis not so when four circles kiss
 Each one the other three.
 To bring this off the four must be
 As three in one or one in three.
 If one in three, beyond a doubt
 Each gets three kisses from without.
 If three in one, then is that one
 Thrice kissed internally.

Four circles to the kissing come.
 The smaller are the benter.
 The bend is just the inverse of
 The distance from the centre.
 Though their intrigue left Euclid dumb
 There's now no need for rule of thumb.

Since zero bend's a dead straight line
 And concave bends have minus sign,
 The sum of the squares of all four bends
 Is half the square of their sum.

To spy out spherical affairs
 An oscular surveyor
 Might find the task laborious,
 The sphere is much the gayer,
 And now besides the pair of pairs
 A fifth sphere in the kissing shares.
 Yet, signs and zero as before,
 For each to kiss the other four
 The square of the sum of all five bends
 Is thrice the sum of their squares.

F. SODDY.

Obituary

Prof. Frank Cavers

PROF. FRANK CAVERS, whose premature death occurred on May 26, was educated as a botanist at the University of Leeds, under the stimulating influence of the late Prof. Miall, whose heuristic methods attracted much attention in the early years of the century. After leaving the University, Cavers held teaching posts in botany at Hartley College, Southampton, and later at the Goldsmiths' College in London. He was not, however, in all respects well fitted for such work, though he was an excellent botanist and a most lucid expositor of his subject, as was shown by a number of elementary text-books—models of their kind—written for the University Correspondence College. He made a special study of the Bryophyta, publishing the results of his admirable researches in the *Annals of Botany*, the *New Phytologist*, and elsewhere, and obtaining the D.Sc. degree of the University of London.

On leaving the teaching profession, Cavers decided to qualify as a medical man, and after a hard struggle and several set-backs, eventually obtained his qualification. This part of his career furnished striking evidence of Cavers' grit and persistence, for to pursue the medical curriculum is not the easiest of tasks many years after normal student days have been left behind, and the mind has long been running in other channels. Once qualified, he made a thorough success of his job, taking a panel and private practice in the north of London, working extremely hard, and in less than ten years saving enough money to enable him to retire.

Besides his research, Cavers rendered other services to science. For a short time he was assistant editor of the *New Phytologist*, and on the formation of the British Ecological Society in 1913—in which he played an important part—he became its first secretary, and edited the *Journal of Ecology* from 1913 until 1916. In this work he showed his conspicuous powers of masterly condensation and clear exposition. His abstracts of voluminous papers dealing with complicated material were about as good as they could be. The same gifts were later afforded ample scope during his editorship of the *Journal of Cancer Research*, which he undertook on his retirement from medical practice.

Cavers was an extremely hard, untiring worker and the most modest and unselfish of colleagues, always ready and willing to do his share, and more than his share, of the work in hand. He was also a pleasant companion with wide cultural interests—altogether a very lovable man.

A. G. T.

WE regret to announce the following deaths:

Prof. A. A. Bowman, professor of moral philosophy in the University of Glasgow, on June 12, aged fifty-three years.

Sir George Haddock, K.B.E., F.R.S., director of Vickers-Armstrongs, Ltd., and of Armstrong Whitworth, on June 4, aged seventy-five years.

Prof. Charles A. King, principal of the Engineering College, and Jodhpur Hardinge professor of technology in the Benares Hindu University since 1919, on May 19.

News and Views

Total Solar Eclipse of June 19

By the time this note appears in print, the parties stationed at various points on the long belt of totality will know whether atmospheric conditions have enabled them to carry out their eclipse programmes, or whether the many months of organisation and preparation have been in vain. Certain preliminary reports will, we hope, be available for publication in our next issue. An outline of the plans of the various expeditions was given in an article in *NATURE* of April 25, p. 685. Starting from Greece in south-eastern Europe, expeditions are stationed in Asia Minor, the Caucasus, at various places in Siberia, in Manchukuo and in Japan. One party sent by the Joint Permanent Eclipse Committee of the Royal Society and the Royal Astronomical Society, under the leadership of Prof. F. J. M. Stratton, has set up its apparatus at Hamishari in Hokkaido; the other British expedition, under Prof. J. A. Carroll, is at Omsk. We understand from Dr. T. Banachiewicz, of

the Cracow Observatory, that four Polish expeditions are observing the eclipse, paying particular attention to Baily's beads; one is in Japan, at Tsubetsu, one in the region of Omsk, and two in Greece (one on the island of Chios and one in the vicinity of Athens). All four expeditions are using similar chrono-cinematographical instruments with neon tubes constructed at the Cracow Observatory. Prof. B. Gerasimovič, writing from the Eclipse Camp at Ak Boulak, near Orenburg, informs us that there are no less than twelve foreign parties and twenty-eight Soviet expeditions observing the eclipse from the U.S.S.R. The observing parties are stationed at Beloretchenskaya (North Caucasus), Ak Boulak (near Orenburg), Sara (near Orenburg), Kustanay, Omsk, Krasnojarsk and Botchkarevo (Far East). Prof. Gerasimovič has kindly undertaken to cable to *NATURE* a brief statement of results obtained from these stations, and we are also expecting to have a similar communication from Prof. Stratton.

Presentation to Dr. R. R. Marett

A VOLUME of anthropological essays by friends and former pupils, entitled "Custom is King", a notice of which appears on p. 1014, was presented to Dr. R. R. Marett, Rector of Exeter College, Oxford, and reader in social anthropology in that University, on June 13, to mark the occasion of his seventieth birthday. The presentation was made in the College Hall by an undergraduate, and was attended by the Vice-Chancellor, a number of heads of houses and professors. The chair was taken by Sir Charles Harper, a former pupil. In acknowledging the presentation, Dr. Marett reminded his hearers that, as the University had claimed three quarters of his time in his main business of philosophy, only one quarter had been available for the claims of anthropology, while his books had been written in vacation. In speaking of anthropology in the University of Oxford, he referred to the late Arthur Thomson and to Henry Balfour. With himself they had been 'three men in a boat', of whom it was possible to say that no one was captain; and to them had been added Dr. L. H. Dudley Buxton, and later Mr. T. K. Penniman, as cabin boys. In conclusion, he spoke of the termination of his long tenure of the readership in social anthropology, and rejoiced that Oxford at last was to have a full professorship in anthropology.

It is scarcely necessary to recall how great is the debt of anthropology in Oxford to Dr. Marett. With the exception of Sir Edward Tylor, who of course stands apart from and above all, this branch of academic studies, perhaps, owes more to him than to any single individual—even though the great services of the late Arthur Thomson and Henry Balfour be not forgotten. Long before the contemplation of the manners and customs of 'savages' had been raised to the dignity of forming part of an official course, his lectures on ethics and psychology had directed many of his pupils to this pleasing intellectual adventure; and not only did he take a foremost part in the movement which led to the institution of a diploma in anthropology, but also, as secretary for twenty years of the committee responsible in the University for this subject, he imposed his broad and philosophic outlook on the Oxford school of anthropological thought.

Plants and Medicine

THE lecture which commemorates annually Sir Edwin Chadwick, "the father of English sanitation", was this year given at the Chelsea Physic Garden by Sir William Willcox on June 11. In choosing "Plant Pharmacology and Medical Practice" for his subject, Sir William might well have been excused from dealing with synthetic chemical medicaments; he nevertheless claimed as plant products "coal and coal tar with its myriads of derivatives", a claim which suggests a perilous affinity between rhubarb and the barbiturates. It seems a strong thing to hold, as Sir William Willcox is prepared to do, that "plant products rarely act as tissue poisons because of their purity . . . (while) in the chemical laboratory the

conditions are so different from those obtaining in Nature that by-products injurious to health always occur during any chemical synthesis", and that "it is for this reason that so many of the modern artificially synthesised drugs are liver and tissue poisons: examples are cinchophen and similar derivatives". Nevertheless, it is certain that if in recent years orthodox medicine has preferred the synthetic product of the laboratory, the public have turned in increasing measure to herbal remedies, and there has been a large increase in the numbers of herbal stores and in the trade in herbal medicines. The benefit derived from drinking several pints of hot water daily in the form of a *tisane* or decoction may be substantial, and certainly the danger of positive harm is minute compared with the results of uncontrolled resort to the tonics, sleeping-draughts, digestive pills and headache tablets which are a by-product of modern civilisation. The representative exhibition of medicinal plants shown at the lecture served to link the Physic Garden of to-day with its beginnings in the seventeenth century, when it supplied the apothecaries of London with those herbs which they failed to collect on their 'herbarizing' expeditions in the fields of Greenwich and Battersea.

English Death Rates

THE retiring president of the Royal Statistical Society, Prof. Major Greenwood, took for the subject of his valedictory address, read on June 16, "English Death Rates, Past, Present and Future". Prof. Greenwood pointed out that down to the beginning of the twentieth century, there was no improvement in mortality at the beginning of life and little improvement in old age, but that since the turn of the century there had been great improvement in the mortality of little children and some improvement in old age. From the beginning of registration, rates of mortality at ages between early childhood and old age improved, but the improvement began in time with the earlier ages and seemed to pass like a wave down the ages. In the opinion of some students, this wave-like movement was determined by the course of social reform, first directed to the protection of the young and only later to that of adults; Farr attributed the slow improvement of the rates of mortality in his time to the growth of towns; in his view, the general social and hygienic reforms of his time were offset by the disadvantages of density of population. Modern students, notably Kermack, McKendrick and McKinlay, have objected that the wave of improvement is too regular to be explained in these ways and suggested that the prime factor regulating mortality rates is the environment of childhood. Prof. Greenwood concludes that, even if this hypothesis does not completely explain the whole movement, it furnishes an important element of truth, so that contemporary emphasis upon the paramount importance of caring for the young is properly placed. This does not, of course, lead to the pessimistic conclusion that measures directed to the improvement of the conditions of life of adults are useless; there is much evidence that they are of value. Thus, the

problem of cancer is not one which the general statistician can view with much pleasure, "but a perusal of clinical records and of the last report of the Director of the Imperial Cancer Research Fund gives some grounds for optimism".

The Imperial Institute and Vegetable Fibres

WE are indebted to Dr. E. Goulding for an account of forty years of investigation of vegetable fibres at the Imperial Institute, which was the subject of the Mather Lecture delivered by him during the annual Conference of the Textile Institute on June 3-5 in London. A record such as this emphasises the importance and value of the Imperial Institute to the Empire as a whole. Individual technical reports go to all parts of the Empire, but usually each country is concerned only with those which emanate from itself. A comprehensive account of this work is therefore more than welcome, in that it gives an idea of the immense scope of inquiries which have been investigated and of which records and technical reports are available. In recent years, since the creation of the Advisory Councils of the Imperial Institute in 1926, the Scientific and Technical Department has had considerably more scope; for these Councils, of which there is one for vegetable fibres, may propose and consider schemes of work for prosecution by the Institute and may advise on the best means of carrying them out. As a result of this, one of the main lines of investigation in the case of vegetable fibres has been the effect of sea-water on the life of ropes and twines. This work was commenced primarily in the interests of the sisal industry, but has since been enlarged to include New Zealand flax, *Mauritius* hemp and sannhemp. The results of this work have proved to be of the greatest value both to the producer and to the consumer, and have done much to advertise the extremely useful services which the Imperial Institute performs.

The Colorado Potato Beetle

THIS insect is a recent immigrant into Europe from North America, and has now become established over a large area of France. Its further spread into north-eastern France and into Belgium is a matter of importance to potato growers in England. The Ministry of Agriculture and Fisheries directs attention to the probability that examples of this beetle will reach southern England from time to time by direct flight. In such circumstances small outbreaks might readily occur, and the Ministry is accordingly anxious to obtain as early a notification as possible of the discovery of the pest in this country. Potato growers, especially those in Essex, Kent and Sussex, are asked to keep close watch on their crops, and to inform the Ministry immediately the presence of the beetle is suspected or discovered. A full description of the insect is given in the Ministry's Advisory Leaflet, No. 71. Any yellowish beetle with black stripes, or any red or reddish-yellow grub, that is found feeding upon potato leaves should be regarded with suspicion. When such beetles or grubs are discovered, specimens should be placed in a tin box (in which no holes should

be punched) with a piece of potato leaf, and the box should be sent to the Ministry of Agriculture, 10 Whitehall Place, London, S.W.1, with a letter stating the exact place where the insects were caught and the name and address of the finder. No other steps should be taken until instructions are received from the Ministry; it is especially important that the crop should not be sprayed or interfered with, as this is likely to cause the beetles to spread, and an outbreak possibly affecting only a few square yards may be distributed throughout a field. Apart from the specimens sent to the Ministry, no beetles or grubs should be removed. The object of these measures is to keep the insect confined to as small an area as possible, so that it may be eradicated without loss of time.

Discovery : an African Number

Discovery of June, in an opportune moment, is concerned almost exclusively with Africa. It opens, immediately after editorial notes and comments, with an article by Prof. C. G. Seligman on human types in tropical Africa. Prof. Seligman explains how it has come about that the usual classification of the native peoples of the continent is based on linguistics rather than on physical characters, and then sets out the distribution and characteristics of the major racial divisions in the tropical area. Dr. H. E. Hurst, in a study of the Upper Nile, discusses questions relating to water supply at the source, and indicates where there is necessity for further research. Of the remaining articles, two in particular require mention. Capt. William Hichens's account of demoniac possession is a valuable report by an eye-witness of a recent outbreak of *Kupagawa na pepo* ("ridden by demons"), which amounted almost to an epidemic in Mombasa and other towns of East Africa. He describes the various forms of demon dances by which the spirits were exorcised. In another article, G. A. Gardner, field director of the Archæological Committee of the University of Pretoria, describes the results of further excavations at Mapungubwe on the south side of the Limpopo River. The partial excavation of a mound, which was found to consist of village refuse, confirms the results of previous excavation on an adjacent area which has been described by Prof. C. van Riet Lowe. He ascribed the earlier of the two occupations then discovered to the Sotho. This is regarded as the earliest trace of Bantu culture known in the Union. The mound excavated by Capt. Gardner was entirely Sotho. It had a depth of 20 ft. and consisted of about 40,000 tons of material. It was found to be centrally situated in a village from which had come the refuse of which it was composed. There was no iron, but copper ornaments, bangles and bracelets were plentiful. The burials were disarticulated with the skull on top of the bones. In several instances cow bones were associated with the human remains.

World Power Conference

THE death last May of Mr. D. N. Dunlop, chairman of the International Executive Council of the World Power Conference and of the British National

Committee, left a vacancy which was hard to fill. It has been filled, however, by the unanimous election of Sir Harold Hartley, chairman of the British National Committee. By invitation of the American Government, the third World Power Conference will be held in Washington, U.S.A., on September 7-12. The subject matter will be National Power Economy. This will be the third plenary meeting of the World Power Conference, previous plenary meetings having been held at Wembley (1924) and Berlin (1930). There have also been a number of sectional meetings with more limited programmes. The Chemical Engineering Congress meeting in London next week, to which reference is made on p. 1018, is such a sectional meeting. The International Commission on Large Dams of the World Power Conference will be held at Washington concurrently with the third World Power Conference. Work has been continued during 1935 on investigating special cement for use in the construction of dams, and in connexion with the establishment of the international statistical register of large dams.

Seventh International Congress of Refrigeration

UNDER the auspices of the International Institute of Refrigeration, which has its headquarters in Paris, a congress reflecting all sides of the practice and theory of refrigeration, to which the Governments of more than fifty countries are sending official delegates, is being held at The Hague on June 16-27. The British party visiting Holland, numbering about eighty persons, and headed by Dr. Ezer Griffiths, president of the British Association of Refrigeration, is the largest overseas delegation to the Congress. By the co-operation of Lord Rutherford and Prof. F. A. Lindemann, several well-known scientific workers from Cambridge and Oxford are reading papers on very-low temperature research, in which subject the president of the congress, Dr. W. H. Keesom, of Leyden, is a leading authority. The Food Investigation Board has also sent representatives who are contributing reports on food research. Refrigeration is such an important factor in everyday life nowadays, not only in relation to food supply but also as an auxiliary process in many industries, that the two hundred papers presented to the Congress barely exhaust the many phases of this modern branch of engineering development. The International Institute promoting this series of congresses is established under Government convention.

War and Populations

IN a discussion of war and over-population (*Current History*, March 1936), Prof. Raymond Pearl states that the aggressor in every major war in recent times has given the need for more room for his people as the primary motive. The land surface of the earth is some 52,000,000 square miles, about one fourth of which is arid or semi-arid, while lakes and mountains still further reduce the cultivable land on which more than 2,000 million people have to dwell. An equal distribution would give each individual about sixteen acres, but probably little more than

half would be available for production. The United States census for 1930 showed a population density of 40.6 per square mile—very close to the world average. Europe has 92 per square mile, Asia 76, North America 19-20, South America and Africa about 12, Australia and Oceania only 3. Among countries of the world, China stands seventh and India fifteenth in density of population. The province of Kiangsu alone, having 897 persons per square mile, has a greater population density than Belgium, while Bermuda has 1,462 per square mile. India has 195, about the same as France, but large areas of jungle and desert increase the population density of the rest. Urbanisation, however, leads to greater local densities in the West than the East. Nevertheless, highly industrialised countries can induce few of their people to emigrate to colonies. Up to 1914, Italy had placed only 8,000 Italians in her African colonies, and Germany only 24,000 Germans in her colonial empire. Pearl estimates that the British, Russian, French and American "Empires" control 57 per cent of the earth's land surface; but concludes that the conquest of these lands by other nations would not benefit the human race, while war would impoverish all the nations involved.

Industrial Prospecting

THE U.S. National Research Council (Washington, D.C.) has reprinted a lecture entitled "Industrial Prospecting" which was delivered before the Founder Societies of Engineers by Mr. C. F. Kettering, chairman of the Division of Engineering and Industrial Research of the National Research Council. Mr. Kettering argues that scientific advancement has not outpaced social and economic advancement, but that, on the contrary, scientific development is 15-20 years behind social and economic development. More research is needed, since research is a way of finding out what is to be done when it is impossible to keep on doing what is being done now. New industries need to be developed in order to provide more jobs. Research is industrial prospecting, and one reason why it has not been more used is that the wrong kind of book-keeping has been followed. In manufacturing, detailed costs must be determined and each individual part must be charged with the appropriate overheads, material, processing, distribution and advertising costs; but research is not manufacturing since there is nothing to sell but ideas. In industrial prospecting each individual project cannot be expected to show a profit at the end of a set time; but taking a large number of projects over a long period of time, if the results show progress it is worth carrying on; if they do not, it ought to be cut out. Industry has been criticised for having too large a capacity, but there cannot be too large a capacity until everyone has the things he needs and wants. What should really be said is that there are too few products for the factories to make. To-day new things are needed, and we have not exhausted even a small percentage of our ability to make improvements or further developments, or to increase the utility of a product.

Work of the Falmouth Observatory

THE Report of the Falmouth Observatory Committee to the Royal Cornwall Polytechnic Society and the Falmouth Town Council for 1935 is a small booklet which includes meteorological notes and tables for that year. The Observatory possesses records for various meteorological elements that extend back so far as 1871, from which sixty-five year averages have been computed. These are included in the publication, and are used as a basis for comparison of each of the past five years with the sixty-five years in question. It may be noted that 1935 completes one of the lustra recommended as a basis for such comparisons by the International Meteorological Congress of 1887. The rainfall figures show that only one of these five years (1931) was wetter than the average, and by only a small margin, and those for atmospheric pressure show that 1935 was the only one that had not a substantial excess of pressure. Temperature was above the average in each year; the mean for the lustrum was 51.9° , which is identical with the mean for the previous lustrum, this figure being 1.2° above the average. It is interesting to note that temperature at Falmouth has been above the normal for thirteen successive years. The outstanding event of the year 1935 was the snowstorm of May 17. The cold was very much less severe on that day at Falmouth than over most of the country, for temperature there did not fall below 35° in the screen; but on May 14 there was an unusually late ground frost, and this caused very severe damage to crops in some parts of Cornwall. In the section dealing with sunshine, reference is made to the fact that, according to an Air Ministry Pamphlet (No. 69), in two respects Falmouth is the most favoured place in the British Isles in that it has the smallest number of sunless days and the highest number of days with sunshine of more than three, six, and nine hours' duration. Cornwall, in addition to considerable immunity from frost, escapes extremes of heat; at Falmouth the temperature has reached 80° in only eight years out of the last sixty-five.

Loan Collections for Museums

IT cannot be too widely known that there are available for local museums and art galleries small collections of objects of art and of scientific interest on loan from the British Museum and the Victoria and Albert Museum. The objects are accurately labelled, and each set is contained in "one museum case of the ordinary type". The collections cover a wide field of interest. For example, to mention a few, the Victoria and Albert Museum has forty-three sets illustrating Far Eastern pottery and porcelain, thirty-four sets of English pottery, porcelain and tiles, fifteen sets of English silver and Sheffield plate, twenty-seven sets of English and twenty-nine of European embroideries and woven fabrics, and six sets of musical instruments. On three months' loan from the same museum may be obtained collections of water-colours of the British school, Charles Keene's *Punch* drawings, Japanese colour prints with the tools and materials used in the process. Somewhat similar

collections are lent by the British Museum, including water colours by J. M. W. Turner, and additional sets illustrating typical Egyptian gods, and the hand-work of the Bronze and Stone Ages. Information about the conditions on which the loan collections are issued may be obtained from the directors of the museums mentioned.

Corrosion of Iron and Steel

THE Joint Corrosion Committee of the Iron and Steel Institute and the British Iron and Steel Federation has so far presented three reports which contain a large amount of information. Although the work is at the present time in a very preliminary stage, particularly perhaps with regard to the effect of the protection provided by paint coatings, there is, in view of the extreme importance of the subject, every justification for presenting a short abstract of the results so far obtained. This has been done by Dr. W. H. Hatfield in "The Work of the Corrosion Committee", Special Report, No. 11. This summary, which is extremely well done, contains some provisional conclusions of considerable practical importance, and may be recommended most strongly to all who are concerned with the corrosion, or the protection from corrosion, of ordinary steel structures.

Canada's Datum Level

THE use of different datum planes in Canadian surveys has in the past led to some confusion. The first precise levels run in 1883 were linked to the United States Coast and Geodetic Survey datum level, but since then others have been used. All precise levelling is now under control of the Geodetic Survey of the Department of the Interior, and an order in council dated March 11, 1935, is quoted in the *Canadian Surveyor* of January. This order decrees that mean sea-level as determined at coastal points by the Canadian Hydrographic Service shall be the official datum line for elevation in Canada, and shall be known as the Canadian Geodetic Datum.

John Innes Horticultural Institution

AN informative record of the work of the John Innes Horticultural Institution, Merton, London, S.W.19, from 1910 (the time of its foundation) until 1935, has recently been published. The record opens with a brief survey of the history of the Institution, which was founded by John Innes, a merchant of the City of London. At the beginning, the scope of the work there consisted mainly of genetics, but was later extended to include cytology, biochemistry, mycology, X-ray work and further special investigations. The first director was Dr. W. Bateson, who was succeeded by the present director, Sir Daniel Hall. A very useful list of staff and other workers, who have been at the Institution during the past twenty-five years, is included. Their past and present professional appointments are given. This list is followed by lists of present and past members of the garden staff, and these are followed by a valuable bibliography of publications by the staff, past and present.

Simplified Mandelic Acid Treatment of Urinary Infections

THE use of mandelic acid, a new urinary antiseptic, was the subject of a note in a former issue of *NATURE* (136, 482; 1935). In order that the antiseptic action may be exerted, it is necessary for the urine to be acid (*pH* below 5.5), and this was at first effected by the simultaneous administration of ammonium chloride in an amount of 4-8 gm. daily. Treatment with this agent has now been simplified in various ways, which also tend to reduce the disadvantages of the original method, such as the risk of nausea and vomiting, excessive acidity, and albuminuria with casts. Boots Pure Drug Co., Ltd., Station Road, Nottingham, compound the mandelic acid with acid sodium phosphate as the acidifying agent, with sodium bicarbonate in sufficient quantity to neutralise the acid, and suitably sweetened with saccharin. This preparation is put up under the name of 'Neoket', compound mandelic acid granules, the dose of which is two teaspoonfuls in a little water four times a day. The British Drug Houses, Ltd., Graham Street, London, N.1, make use of ammonium mandelate, which is put in the form of an elixir under the name of 'Mandelix', of which 2 fluid drachms constitutes the normal adult dose. This usually suffices to maintain the requisite acidity; exceptionally, it may be necessary to administer ammonium chloride in addition, for which purpose capsules containing gram-doses are supplied. A 'Mandelix Outfit' contains these agents, together with a testing outfit to ensure the proper urinary acidity. Descriptive booklets may be obtained on application from the two firms named.

Mining in South Australia

WE have received from the Department of Mines, South Australia, the "Mining Review", No. 62, for the half year ending June 30, 1935. After some preliminary notes on recent mining legislation, including where and how to get more details for those who require them, there follows a series of reports on Government drilling and Government gold and silver recovery, reports of the Commonwealth Council of Scientific and Industrial Research, reports by the Government assistant geologist and various inspectors of mines, etc. The total value of the mineral production of the State of South Australia from 1841 until 1934 is given as 53½ million sterling, of which copper ranks for something more than 33 millions, ironstone for 12,200,000 and gold only for 1½ millions, the production of the other minerals being unimportant.

Czechoslovak Microchemical Society

A CZECHOSLOVAK Microchemical Society was founded on April 25 in Prague at a gathering of about two hundred chemists, from both Czech and German scientific and industrial circles. Prof. J. Heyrovský, professor of physical chemistry at the Charles University, known for his microchemical polarographic studies, has been elected president. The Society's activities were inaugurated by a lecture by Dr. C. J. van Nieuwenburg, professor of analytical chemistry in the Delft Technical High School, on

"Why and Where Microchemistry?" Austrian microchemists were represented by Prof. Fritz Feigl, professor of chemistry in the University of Vienna. The Society intends to co-operate with microchemical societies and clubs of England, America, Holland and Austria with the view of establishing an International Microchemical Society. The official title of the Society is "Societas microchemica Č.S.R." and its address Prague II, Albertov 2030.

Eugenics Research

LAST year, a Darwin Research Studentship, tenable for two years, was established by the Eugenics Society in honour of Major Leonard Darwin, the award being made to Dr. R. B. Cattell, director of the School Psychological Clinic of Leicester. Dr. Cattell has been investigating the application of intelligence tests to (a) a typical urban, (b) a typical rural population of school children, to determine the average size of family at each level of intelligence. He is also applying intelligence tests to adults and children in the same families, to determine the correlation rates between parents and offspring. A second Darwin Research Studentship has now been established by the Eugenics Society on the same terms, for the investigation of racial crossing. The holder of this Studentship, which is of the value of £250 a year, will begin work in October. The particular aspects of racial crossing to be investigated will be determined after applications have been received.

The 200-in. Telescope Disk

THE successful casting of the 200-in. telescope disk at the Corning Glass Works, America, has aroused world-wide interest during the past eighteen months. An opportunity is being given to English scientific workers to learn some of the details of this achievement since Dr. J. C. Hostetter, director of development research at the Corning Glass Works, who has been intimately associated with the casting of the disk, is to give an address on the subject on Friday afternoon, July 3, at 4.30 p.m. in the lecture theatre of the Institution of Electrical Engineers, Savoy Place, London. The lecture has been arranged under the auspices of the International Congress on Glass which opens in London on July 2, and Sir William Bragg has kindly consented to take the chair at the lecture. Admission is free and no tickets are required. Further information, however, may be obtained from Prof. W. E. S. Turner, General Organising Secretary, International Congress on Glass, University, Darnall Road, Sheffield, 9.

Royal Geographical Society: Medals and Grants

HIS MAJESTY THE KING has approved the following awards of the Royal Medals of the Royal Geographical Society: *Founder's Medal* to Mr. G. W. Murray, director of desert surveys, Egypt, for his long-continued explorations and surveys in the deserts of Sinai and eastern Egypt; for his studies of Badawin tribes, and his unstinted help to desert expeditions; *Patron's Medal* to Major R. E. Cheesman, for valuable

service to geography during nine years residence in north-west Ethiopia, including reconnaissance and surveys of the course of the Blue Nile and exploration of Lake Tana and its islands. The Council of the Society has made the following awards: *Victoria Medal* to Dr. Stanley Kemp, for his work in surveys of the Southern Ocean; *Murchison Grant* to Mr. Michael Leahy, for his explorations of Central New Guinea; *Back Grant* to Muhammad Ayub Khan, for his surveys on three expeditions under the leadership of Sir Aurel Stein in East Persia, 1931-34; *Cuthbert Peek Grant* to Mr. T. H. Harrison, to assist him in his proposed expedition to New Guinea; *Gill Memorial* to Lieut. A. L. Nelson, for his charts of the South Sandwich Group, South Orkneys, and South Shetlands.

Announcements

THE Secretary of State for the Home Department, the Minister of Health and the Secretary of State for Scotland have appointed Mr. J. F. E. Prideaux, as assistant director of medical services, Ministry of Pensions, to be a member of the Inter-Departmental Committee appointed in April, 1936, to inquire into the arrangements made in Great Britain for the restoration of the working capacity of persons injured by accidents.

THE fifteenth international medical congress known as *Les Journées Médicales de Bruxelles* will be held at Brussels under the presidency of Prof. Robert Danis on June 20-24. Further information can be obtained from the Secretariat, 141 rue Belliard, Brussels.

THE tenth general meeting of the DEHEMA (Deutsche Gesellschaft für chemisches Apparatewesen E.V.) will take place in Munich on July 10, on the occasion of the general meeting of the Society of German Chemists.

THE Senate of Buenos Ayres has passed a Bill whereby 150,000 Argentine pesos (about £8,400) will be allowed yearly for the upkeep of a national institute of physics in its application to human pathology. Dr. Mariano R. Castex has been appointed director.

AN International Congress of Anatomy, organised by the Italian Society of Anatomy, in which the corresponding societies of Great Britain, Italy, France, Germany, North America, Poland, Holland, Portugal and Latin America will take part will be held at Milan on September 3-8. Further information can be obtained from the general secretary, 31 Via Mangiagalli, Milan.

THE twenty-fifth anniversary of the Sociedad Astronómica de España y América will be celebrated in Barcelona in October 1936 in connexion with an International Astronomical Exhibition which is being sponsored by the Spanish authorities. Particulars of the meeting can be obtained from the president of the society, Dr. J. Comas Solà, Paso de la Enseñanza, 6, Barcelona.

THE following appointments have recently been made by the Secretary of State for the Colonies: D. W. Bishopp to be economic geologist, British Guiana; F. G. Walton-Smith to be biological assistant, Sponge Fishery Investigation, Bahamas; L. V. Waumsley to be engineer, Posts and Telegraphs Department, Malaya; F. W. Winckley to be tobacco specialist, Jamaica; Dr. G. Bryce (senior agricultural officer) to be assistant director of agriculture, Nigeria; C. J. Tyndale-Briscoe (superintendent of education, Tanganyika) to be director of native education, Northern Rhodesia; R. H. Tyrwhitt-Drake (district surveyor, Kenya) to be director of surveys and land settlement, Zanzibar.

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

A teacher of mathematics and a teacher of technical drawing in the Wandsworth Technical Institute, London, S.W.18—The Secretary (June 22).

A lecturer (Grade IIc.) in organic chemistry and an assistant lecturer (Grade III) in chemistry in the University of Birmingham—The Secretary (June 25).

A lecturer in metallurgy in the Chelsea Polytechnic, Manresa Road, London, S.W.3—The Principal (June 25).

A lecturer in metallurgy in the British Foundry School—The Secretary, British Foundry School, Central Technical College, Suffolk Street, Birmingham (June 26).

A male junior assistant chemist in the Royal Gunpowder Factory, Waltham Abbey—The Principal Clerk, Royal Gunpowder and Small Arms Factories, Enfield Lock, Middlesex (June 27).

A teacher of mechanical engineering in the Smethwick Municipal College—The Director of Education, Education Offices, 215 High Street, Smethwick (June 27).

An assistant lecturer (Grade III) in physics in the University of Liverpool—The Lyon Jones Professor of Physics (June 30).

A principal of the National Training College of Domestic Subjects, 72 Buckingham Palace Road, London, S.W.1—The Chairman of the Governing Body (June 30).

An assistant physicist (X-ray and radium work) at the Hammersmith and Lambeth Hospitals—The Medical Officer of Health (Staff Division 2), County Hall, Westminster Bridge, S.E.1 (July 1).

An organiser of School Museum Service in Derbyshire—The Director of Education, County Education Office, St. Mary's Gate, Derby (July 7).

A professor of botany in University College, Nottingham—The Registrar (July 11).

A University lecturer in geography in the University of Cambridge—Dr. F. C. Phillips, Department of Mineralogy and Petrology (July 15).

An assistant to the chief engineer of the Port of London Authority, London, E.C.3—The General Manager (July 17).

A professor of geology in the University of Aberdeen—The Secretary (August 31).

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. 1036.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Theory of the Stern-Gerlach Effect

IN continuing the development of the theory of the masses of protons and electrons, according to which m_p , m_e are the two roots of the equation

$$10 m^2 - 136 m m_0 + m_0 = 0,$$

I have obtained a confirmation which seems of interest. Considering a hydrogen atom, and introducing a magnetic field by a gauge transformation, the theory is found to give values of the magnetic energy which agree with the results of the Stern-Gerlach experiment—results commonly (but, as it would seem, wrongly) supposed to show that the proton has $5/2$ units of spin. It is difficult to describe this application apart from the rather comprehensive theory—contained in a book now in the press—to which it belongs; but the following will perhaps indicate the line of treatment.

As in celestial mechanics, we analyse the motion of the two particles forming the hydrogen atom into an external motion, represented by a mass $M = m_p + m_e$ moving with the centre of mass, and an internal motion, represented by a mass $\mu = m_p m_e / (m_p + m_e)$ associated with the relative co-ordinates. Correspondingly, we have external wave functions ψ_e, φ_e similar to those of a free electron or proton, and internal wave functions ψ_i, φ_i which are the well-known functions determining the internal quantum states of the atom. Each wave function is a superposition of elementary wave functions distinguished by parameters which we denote collectively by α ; denoting the co-ordinates (x, y, z, t) collectively by x , we denote the elementary functions by $\psi(x, \alpha)$. An essential difference between the external and internal wave functions is that $\psi_e(x, \alpha)$ is a continuous function of α , but $\psi_i(x, \alpha)$ exists only for discrete values of α .

In current practice, the difference between continuous and discrete wave functions is inadequately considered (more especially in formulating the relation between double and simple wave functions); and my determination of the masses m_p, m_e was obtained by showing that, in order to validate the current practice, it is necessary that the masses should satisfy the equation above-mentioned, or equivalently that M/μ should be $136^2/10$. More precisely, it is the general dynamical equations which are validated by assigning these masses to the elementary particles. But, if we apply a gauge transformation, continuous and discrete wave functions must still be distinguished; for $\psi_i \varphi_i$ represents a density in a 4-dimensional volume element dx , and $\psi_e \varphi_e$ represents a density in a 10-dimensional volume-element $dx dx_\alpha$. (The number of dimensions of $dx dx_\alpha$ is found in the investigation of the masses, and supplies the denominator 10 in the above value of M/μ .)

We employ an imaginary gauge transformation to create a fictitious electromagnetic field in the same way that an acceleration of the co-ordinate frame is employed in Einstein's theory to create a fictitious gravitational field. If the 4-dimensional volume-element is multiplied by $e^{-2i\kappa_\mu x_\mu}$, the 10-dimensional element is multiplied by $e^{-5i\kappa_\mu x_\mu}$. The corresponding densities $\psi_i \varphi_i, \psi_e \varphi_e$ are changed in the inverse ratio; so that ψ_i, φ_i become multiplied by $e^{i\kappa_\mu x_\mu}$, and ψ_e, φ_e become multiplied by $e^{5i\kappa_\mu x_\mu/2}$. (It is necessary to mention that the wave functions ψ, φ used in the present theory undergo the same gauge transformation, φ being defined differently from the corresponding function in Dirac's theory, which would undergo the inverse transformation to ψ .) It follows that for the same transformation of gauge, and therefore for the same macroscopic electromagnetic field, the momentum operators are:

For discrete wave functions, $-i\partial/\partial x_\mu + \kappa_\mu$;

For continuous wave functions, $-i\partial/\partial x_\mu + (5/2)\kappa_\mu$.

The factor $5/2$ is carried through into the mutual energy of the particle and field; so that the particle of mass M with continuous wave functions has a magnetic moment proportionately $5/2$ times as great as the particle of mass μ with discrete wave functions. The common interpretation of the experiment confuses the fictitious particle corresponding to the external wave function with the proton, and that corresponding to the internal function with the electron, M and μ being very nearly equal to m_p and m_e , respectively.

The foregoing result applies to strong magnetic fields. A magnetic field determines a definite time-direction, namely, that with respect to which it is purely magnetic, the electrical components vanishing. When the field is strong, the internal states of the atom are coupled to this time-direction. When the field is weak this coupling ceases, and the 'time' in the internal state is a co-ordinate of a different character. Although usually denoted by t , it is a (linearised) interchange co-ordinate. The effect of a gauge transformation on this co-ordinate is rather difficult to investigate; but, so far as I can make out, it is gauge-invariant. This would make the volume-element for internal wave functions effectively 3-dimensional, and thus change the Stern-Gerlach factor from $10/4$ to $10/3$. There appears to be some experimental evidence which supports this expected modification in weak fields.

A. S. EDDINGTON.

Observatory,
Cambridge.
June 6.

Hyperfine Structure of the Resonance Lines of Silver

THE structure of the resonance lines of silver has been investigated by the method of absorption in an atomic beam, the high resolving power instrument being a Fabry Perot étalon with plate separations between 2 cm. and 10 cm. Each line was found to possess four components; for the line $5S_{1/2} - 5^2P_{3/2}$, 3281 Å., the positions were 0.000, -0.013, -0.052 and -0.077 cm^{-1} , and for $5S_{1/2} - 5^2P_{1/2}$, 3383 Å., they were 0.000, -0.013, -0.058 and -0.084 cm^{-1} . In both lines the two components of shorter wave-length were nearly equal in intensity and very much stronger than the two of longer wave-length, which were also of nearly equal intensity; photometer curves of the absorption showed that the intensity ratio of the strong lines to the weak lines was approximately 3:1.

As the structure is nearly the same in both resonance lines, it must be due mainly to the common level $5S_{1/2}$. Silver consists of two isotopes, 107 and 109, their abundance ratio being about 1.3:1. Each isotope must therefore give rise to one of the strong components and one of the weak components, the intensity ratio being 3:1; from this it follows that the nuclear spin of both isotopes is $\frac{1}{2}$.

The difference in abundance of the two isotopes is small, and the two strong lines (and also the two weak lines) are nearly equal in intensity; however, the photometer curves showed that the component at -0.013 cm^{-1} was rather stronger than that at 0.000 cm^{-1} and that at -0.052 cm^{-1} was stronger than that at -0.077 cm^{-1} . It therefore appears probable that -0.013 cm^{-1} and -0.052 cm^{-1} are due to ^{107}Ag and 0.000 cm^{-1} and -0.077 cm^{-1} are due to ^{109}Ag . On this assumption the nuclear magnetic moments, calculated from Goudsmid's formula¹ for the splitting of an $S_{1/2}$ term, are -0.10 nuclear magneton for ^{107}Ag and -0.19 nuclear magneton for ^{109}Ag . There is also a small isotope shift, the centre of gravity of the lines of ^{107}Ag being displaced by about +0.004 cm^{-1} .

The difficulty of measuring the small difference in intensity of the very close lines 0.000 and 0.013 cm^{-1} is very great, so that the possibility that 0.000 and -0.052 cm^{-1} belong to one isotope and -0.013 and -0.077 cm^{-1} to the other, is not quite excluded; in this case the nuclear spins would still be $\frac{1}{2}$, but the magnetic moments would be -0.13 and -0.16 nuclear magneton, and the isotope shift 0.014 cm^{-1} .

A doublet structure observed by Hill² is in agreement with the above result, the small separations being unresolved on account of the very much greater Doppler width of the lines given by the hollow cathode tube which he used; in order to resolve the smallest separation, the temperature of the tube would have needed to be about 15° Abs. The intensity ratio which he observed was falsified by incomplete resolution, the Doppler wing of the strong component overlapping the weak component; if this is allowed for, the intensity ratio is in agreement with the value 3:1.

D. A. JACKSON.
H. KUHN.

Clarendon Laboratory,
Oxford.
May 8.

¹ S. Goudsmid, *Phys. Rev.*, **43**, 636 (1933).

² H. Hill, *Phys. Rev.*, **48**, 233 (1935).

Anomalies in the Fine Structure of the First Spark Spectrum of Iodine

THREE years ago, the multiplet and hyperfine structures of the 4S -system of the first spark spectrum of iodine were analysed by me¹, and I deduced the nuclear spin of iodine to be $5/2$. Recently, Lacroute² has published an extensive multiplet classification of the 2D -system, and established numerous terms. It has now become possible to construct the hyperfine structure scheme of this system. I wish to report here remarkable anomalies in the fine structure of certain terms of the 2D -system.

The structure of the line $\lambda 5678.1$ classified by Lacroute as $(^2D)6s^3D_2 - (^2D)6p^3F_2$ is given in Fig. 1. The fine structure intervals in the term $(^2D)6s^3D_2$ are

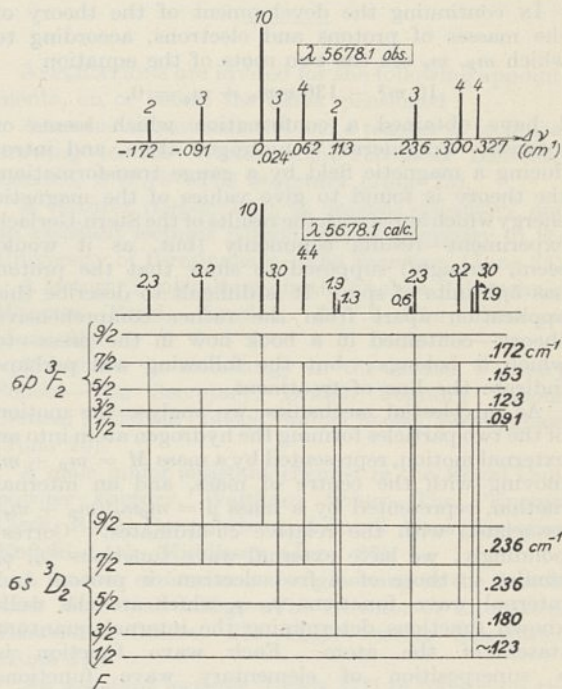


FIG. 1.

irregular and do not obey Landé's interval rule. Next, the line $\lambda 4060.2$ classified by me as $(^4S)5d^5D_0 - (^2D)6p^3D_1$ consists of three components:

$$0.000 (4), +0.081 (3), +0.121 (2) \text{ cm}^{-1}.$$

Numbers in parentheses represent the intensities. Since the j -value of the lower term is 0, the intervals of the components give directly the fine structure intervals of the upper term $(^2D)6p^3D_1$. Here the $F5/2-7/2$ interval is smaller than the $F3/2-5/2$ interval, a phenomenon which has never been observed in any term of another spectrum.

One might, at first sight, interpret such a breakdown of Landé's interval rule as due to perturbation by terms lying very near to $(^2D)6s^3D_2$ or $(^2D)6p^3D_2$. But I have failed to discover such terms. On the other hand, Casimir³ has proposed the theory of nuclear electric moment, in order to account for a small systematic deviation from Landé's interval rule. Further extension of his theory will perhaps be able to account, at least qualitatively, for the remarkable anomalies in the iodine spark spectrum.

It may be noted that the data given here are not in agreement with those recently published by

Tolansky⁴. Moreover, the fine structure schemes for the terms $6p^3D_1$ and $6s^3D_2$ reported by him are apparently incorrect, since they can interpret neither his own experimental results nor mine without ambiguity.

Full details will be published in the *Proceedings of the Physico-Mathematical Society of Japan* in the near future.

K. MURAKAWA.

Aeronautical Research Institute,
Imperial University,
Komaba, Tokyo.
April 16.

¹ *Sci. Pap. Inst. Phys. Chem. Res. Tokyo*, **20**, 285 (1933).

² *Ann. Physique*, **3**, 5 (1935).

³ *Physica*, **2**, 719 (1935).

⁴ *Proc. Phys. Soc.*, **48**, 49 (1936).

Structure of Light Waves

SIR J. J. THOMSON has explained in his recent letter to NATURE¹ that the discontinuity in the structure of light waves (a 'singularity'), to which I directed his attention in my comments² upon his views on the nature of light³, need not be provided, as I wrote, by a permanent "guiding" cylinder of different medium, but can be generated inside the atom and travel with the wave packet.

I do not wish to criticise this hypothesis here, especially as Sir J. J. Thomson apparently does not claim to find yet a complete explanation of the process of ejection of singularities from the atom, but only suggests the way of finding this explanation. However, in view of the fundamental nature of the problem, I think it useful at this stage to formulate briefly the common points and the essential differences in our methods of approaching it.

We both had a common object in view, namely, to connect light and material corpuscles. In pursuing this object, Sir J. J. Thomson in his communication to NATURE, and I in my previous paper⁴, both used the same physical idea of axially symmetrical electromagnetic waves propagating along the axis, and up to a point followed exactly the same method of mathematical analysis, but the solution of the Maxwell equations which I rejected, mainly in view of the existence of singularities in this solution, proved to be useful to Sir J. J. Thomson just because of it. This was by no means accidental, but very logically followed from the essential difference in the approach to the problem. While Sir J. J. Thomson wanted to introduce singularities (a "core") into the photon, I endeavoured not only to avoid them in the light waves, but also to eliminate them from the "material" corpuscles (and the matter as a separate entity as well)⁵.

Which method of approach may prove more fruitful can be judged only from future developments. While I am naturally inclined to regard the method on which I am working as more promising, I fully appreciate the importance of Sir J. J. Thomson's contribution in suggesting the alternative method.

N. S. JAPOLSKY.

Davy Faraday Laboratory,
Royal Institution,
London, W.1.
May 21.

¹ NATURE, **137**, 823, May 16, 1936.

² NATURE, **137**, 663, April 18, 1936.

³ NATURE, **137**, 232, February 8, 1936.

⁴ *Z. Phys.*, **54**, 1 and 2, 121 (1929).

⁵ *Phil. Mag.*, **19**, 934, *ibid.*, **20**, 417 and 641 (1935).

Viscosity of Air

IN deducing the value of the electronic charge, Millikan assumed for the viscosity of air $\eta_{23} = (1822.7 \pm 0.9) \times 10^{-7}$. Recently Kellström¹ has obtained the value $\eta_{23} = (1834.8 \pm 3.0) \times 10^{-7}$, by a rotating cylinder method. This higher value, together with Millikan's data, leads² to $e = (4.816 \pm 0.013) \times 10^{-10}$ E.S.U., in agreement with the X-ray-grating-crystal estimates of e .

During the last few months, I have measured the viscosity of dry air (at atmospheric pressure) by a capillary tube method. The ends of a wide-limbed 'U' tube containing paraffin oil (of density 0.87) were connected by a closed system consisting of two capillary tubes in series. Initially the oil is displaced, and in attaining equilibrium it drives air through the capillaries. Care was taken to avoid constant and systematic errors; and two 'U' tubes, two sets of calibrated capillary tubes, and two methods of drying the air were used. The experiments were carried out at temperatures ranging from 13.6°C. to 16.9°C. Assuming that η increases by 4.93×10^{-7} per degree centigrade rise in temperature³, I find

$$\eta_{23} = (1834.7 \pm 0.8) \times 10^{-7}.$$

I had expected that my result would confirm the lower estimate of the viscosity; but it is in good agreement with Kellström's value.

Using Millikan's and the more recent oil-drop data⁴, together with my value for the viscosity, I deduce the two estimates:

$$e = \begin{cases} 4.816 \pm 0.005 \\ 4.800 \pm 0.005 \end{cases} \times 10^{-10} \text{ E.S.U.}$$

W. N. BOND.

University,
Reading.
May 4.

¹ G. Kellström, NATURE, **136**, 682 (1935).

² R. T. Birge, *Phys. Rev.*, **48**, 918 (1935).

³ R. A. Millikan, *Ann. Physik*, **41**, 759 (1913).

⁴ E. Bäcklin and H. Flemberg, NATURE, **137**, 656 (1936).

An Interesting Infra-Red Absorption Band in Fused Quartz

To check the calibration of an infra-red spectrometer, we attempted to locate a fairly sharp band of fused quartz reported by Dreisch¹ as existing at 2.75μ with an intensity of absorption of 75 per cent when a 5 mm. specimen was used, and located by Parlin² at 2.71μ with an intensity of absorption of 55 per cent in a 2 mm. specimen. To our surprise, no such band appeared, although we used several different plate and lens specimens, the thickest sample having a thickness of 5 mm. In the meantime, a paper by Drummond³ has appeared, presenting a careful plotting of the spectra of crystalline and fused quartz. With 6 mm. samples of the latter, he found a 2.73μ band with a 20 per cent absorption. His paper is particularly interesting because it plots for comparison the values of the absorption coefficient K for fused quartz and for the ordinary and extraordinary rays of crystalline quartz. Throughout the 4–8 μ region, the graph for fused quartz assumes a kind of average position for the other two, which are qualitatively similar to each other. But in the 3 μ region there is a profound difference, a fact discovered by Dreisch¹, who ascribed it to a destruction of the crystal lattice upon fusion, the inference being

that fusion shifts a 3μ crystalline band to the new position.

An examination of the curves of Dreisch or of Drummond justifies this conclusion. But the variation in the depth of the 2.7μ band in the investigations cited, and its absence in all of our specimens, makes this interpretation doubtful. To account for the variation displayed one would have to postulate an ageing effect; yet it is probable that some of the specimens used by Drummond were older than ours.

It is more probable that the 2.7μ band arises from an impurity which occurs in some samples but not in others. Correspondence with representatives of two companies that manufacture fused quartz ware indicates that this is not an impossible interpretation. A clue to the source of the impurity is contained in a paper by Lord Rayleigh⁴, who points out the existence of water and carbon dioxide in at least SiO_2 in the form of pure sand. If the band is caused by either or both of these materials, they must exist as in solution in the fused quartz, since not enough molecules could exist as gas in pockets at a reasonable pressure to produce the depths of band observed. Carbon dioxide has a well-known band at 2.7μ , and recent work of Plyler and Williams⁵ on the spectrum of solutions of water in acetone, and as yet unpublished work of Ellis and Kinsey on the absorption of a very dilute solution of water in carbon disulphide seem to indicate that the 3μ band of water in dilute solutions assumes a position more nearly equal to that of water vapour near 2.7μ .

J. W. ELLIS.
W. K. LYON.

University of California
at Los Angeles.
April 23.

- ¹ T. Dreisch, *Z. Phys.*, **42**, 426 (1927).
² W. A. Parlin, *Phys. Rev.*, **34**, 81 (1929).
³ D. G. Drummond, *Proc. Roy. Soc., A*, **153**, 318 (1936).
⁴ Rayleigh, *Proc. Opt. Convention*, I, 41 (1926).
⁵ Plyler and Williams, *Phys. Rev.*, **15**, 197 (1936).

Radioactive β -Decay and Nuclear Exchange Force as a Consequence of a Unitary Field Theory

THE hypothesis is put forward that positive electron, neutrino, positive proton and neutron are four different quantum states of one elementary particle. Such an assumption would be trivial unless transitions between the different states occur. It is required that Dirac's equation follows from the theory, and that the conservation law of electric charge holds, so only a small number of transitions are allowed. If in addition we satisfy a certain symmetry condition (corresponding to the conservation law of Jordan's neutrino charge¹) the number of possible processes is further reduced. The permitted transitions are:

- (I) positive electron \rightleftharpoons neutrino
(II) positive electron \rightleftharpoons neutron
(III) positive proton \rightleftharpoons neutrino
(IV) positive proton \rightleftharpoons neutron.

Any one of these transmutations can occur only if another one of them takes place in the reverse direction.

Process (IV) (from right to left) and (I) (from left to right) give rise to a transmutation of a neutron into a proton, while simultaneously a positive

electron (being in one of the negative energy states of Dirac's theory) becomes a neutrino. Thus a 'Dirac hole' (to be identified with a negative electron) and a neutrino are produced. An explicit calculation according to this theory gives the Fermi² formula for radioactive β -decay.

If the transformation (IV) of one particle is coupled with the same transformation (of a second particle) in the reverse direction, the corresponding interaction energy is the one postulated by Majorana³ in order to explain nuclear constitution (exchange force neutron-proton).

Combining I, II, III and IV, there is a number of further reactions possible which will be discussed elsewhere together with the complete theory⁴. As soon as the neutrino theory of light⁵ can be formulated in a satisfactory way, we have a unitary field theory, its field variable being a spinor of 16 components.

ERNEST C. G. STUECKELBERG.

Institut de Physique,
Université de Genève.
May 7.

- ¹ Jordan, *Z. Phys.*, **98**, 759 (1936).
² E. Fermi, *Z. Phys.*, **88**, 161 (1934); Konopinsky and Uhlenbeck, *Phys. Rev.*, **48**, 7 and 107 (1936).
³ Majorana, *Z. Phys.*, **82**, 137 (1933).
⁴ To be published in the *Helv. Phys. Acta*. Note added in proof: It seems worth while to point out that combinations between (I) and (III) or between (II) and (IV) which lead to destruction of heavy particles, cannot occur if the negative electron and the positive proton are both considered as true particles (being the opposite of the 'holes' or antiparticles in Dirac's theory).
⁵ L. de Broglie, "Une nouvelle conception de la lumière", *Actualité scient.*, Hermann, Paris (1934). Further progress has been accomplished by Wentzel, Jordan, Kronig and Scherzer; for references compare Jordan (ref. 1) and *Z. Phys.*, **99**, 112 (1936). See also Kronig, *NATURE*, **137**, 149 (1936).

Influence of Oestrogens on the Prostate Gland

RECENT investigation¹ suggests that the benign enlargement of the prostate which occurs spontaneously both in elderly men and aged dogs is a consequence of oestrogenic stimulation. No evidence has, however, been found hitherto which demonstrates the identity of the histological changes throughout the naturally and experimentally enlarged prostates, and only such evidence can provide the conclusive step in the substantiation of the hypothesis. It is therefore important to record the fact that a specimen of a spontaneously enlarged prostate in a dog, which has recently become available for study, presents a histological picture identical with that provided by the prostates of dogs experimentally treated with relatively large doses of oestrone². The characteristic epithelial changes of the experimental prostate, which are not seen in the usual spontaneous enlargement, are reproduced in detail in this specimen, and it may be assumed that their usual absence is due to a lesser degree of oestrogenic stimulation than was the case in the animal under consideration.

The specimen will shortly be reported on in detail in collaboration with Mr. J. R. Groome, of the Department of Zoology, University of Oxford.

S. ZUCKERMAN.

Department of Human Anatomy,
Oxford.
May 27.

- ¹ S. E. de Jongh, *Arch. Int. Pharm. Therap.*, **50**, 348 (1935). H. Burrows, *Amer. J. Cancer*, **23**, 490 (1935). A. S. Parkes and S. Zuckerman, *Lancet*, **228**, 925 (1935). S. Zuckerman, *ibid.*, **230**, 135 (1936).
² S. E. de Jongh, *Acta Brev. Neer.*, **5**, No. 10 (1935).

Raman Effect of Gaseous and Liquid Sulphur Trioxide and of Mixtures of the Trioxide with the Dioxide

THE number of Raman frequencies to be expected for the molecule SO_3 is either three or four, according as it has the symmetry D_{3h} (plane form) or C_{3v} (pyramidal symmetry). The Raman spectrum of gaseous sulphur trioxide was determined with a Hilger E_1 spectrograph, but only the frequency 1068.5 ± 0.5 was found with certainty¹. A decision on the structure is thus not possible, as the infra-red absorption of sulphur trioxide is, so far as we know, unknown.

Bhagavantam examined the Raman spectrum of the liquid trioxide and its change with temperature. The intensities of the frequencies 535, 1068 and

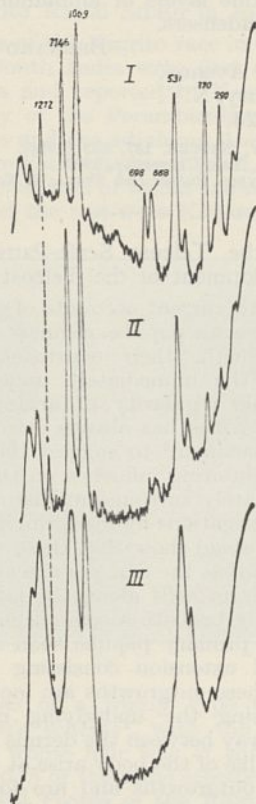


Fig. 1.

1403 as given by him increased with temperature, whereas the intensities of the other lines (290, 370, 666, 697, 1271 and 1489) diminished. His main results were confirmed by us; the changes in intensities with temperature, though very distinct, were found somewhat less pronounced. In long exposures the very weak lines 650 and 1516, mentioned by Venkateswaran², were also found.

The number of frequencies found for the liquid is far too large to be explained by the presence of only single molecules, SO_3 , even if one takes into account the possibility of resonance degeneracy causing the splitting up of one line into two others; this has led Bhagavantam³ to the hypothesis of the complexity of the liquid, a view put forward long ago for this substance by A. Smits on account of anomalies in the vapour pressure⁴. The group of lines the intensity of which increases with temperature is ascribed to $(\text{SO}_3)_1$; the other lines are thought to belong to a double molecule S_2O_6 .

If in the liquid an inner equilibrium between SO_3 and polymerised molecules $(\text{SO}_3)_x$ exists, it would be interesting to study the influence on the Raman effect of the liquid trioxide, when diluting it with another liquid with which it is miscible in all proportions. For that reason the Raman spectrum (at 60°) was determined of mixtures of the trioxide with sulphur dioxide, containing respectively 75, 50 and 25 molecular per cent of trioxide. In all mixtures the three Raman lines of the dioxide were found in intensities determined by the concentration of sulphur dioxide in the mixture. The influence on the Raman lines of the trioxide of diluting it with the dioxide is, on the contrary, very marked, as may be seen from photometer records for the three mixtures reproduced here (Fig. 1) (I, 25 per cent; II, 50 per cent; III, 75 per cent sulphur dioxide respectively). The intensities of the Raman lines 290, 370, 650, 668, 699, 1271, 1490 and 1516 diminish strongly with dilution compared with the lines of the dioxide, whereas the intensities of the lines 530, 1068 and 1390 increase considerably, when one takes account of the relative decrease in concentration of the trioxide, when going from mixture I to mixture III.

The influence of dilution on the Raman spectrum of liquid sulphur trioxide is thus very striking, and in complete agreement with the conception of an inner equilibrium in the liquid between single and polymerised molecules, in the sense of Smits's theory. The dipole moment of the gaseous substance is being measured, as it may facilitate a decision about the symmetry of the molecule. In the case of a plane molecule, the electric moment would be zero.

We are greatly indebted to Prof. Smits for his interest in the work.

H. GERDING.

W. J. NIJVELD.

G. J. MULLER.

Laboratory of Inorganic
and Physical Chemistry,
University, Amsterdam.
May 11.

¹ The vapour contains only single molecules; compare A. Smits and N. F. Moerman, *NATURE*, 134, 698 (1934).

² *Phil. Mag.*, (7), 15, 263 (1933).

³ *Ind. J. Phys.*, 5, part 1, 49 (1930).

⁴ A. Smits, *Versl. Kon. Akad. Amsterdam*, 32, 349 (1923); *NATURE*, 113, 855 (1924).

Raman Spectrum of the Ice-like form of Sulphur Trioxide

THE Raman spectrum of the ice-like form of solid sulphur trioxide (melting point 16.8°) was measured with the Hilger E_1 spectrograph and with a spectrograph of large aperture ($F/2$), but small dispersion, constructed by Kipp. The following lines were found: 292(1), 371(1d), 525(0), 662($\frac{1}{2}$), 698($\frac{1}{2}$), 1074($\frac{1}{2}$, not sharp), 1273(2).

A comparison with the results obtained with the trioxide and with mixtures of it with the dioxide (see preceding letter) reveals the fact that the Raman lines of both the molecules $(\text{SO}_3)_1$ and $(\text{SO}_3)_x$ are present, those of $(\text{SO}_3)_x$ having here by far the greater intensities. This is in contrast to the liquid, as may be seen for the strongest frequencies 1068 ($(\text{SO}_3)_1$) and 1272 ($(\text{SO}_3)_x$) from two photometer records reproduced here (Fig. 2: I, liquid at 70° ; II, solid at 12°). It is therefore necessary to assume that the lattice of the solid ice-like modification of sulphur trioxide consists of molecules $(\text{SO}_3)_x$ (for the larger part) and single molecules $(\text{SO}_3)_1$ (in small quantities); in agreement with the hypothesis of the complexity of

the solid sulphur trioxide put forward by A. Smits and his co-workers for explaining the vapour pressure anomalies of this remarkable substance¹.

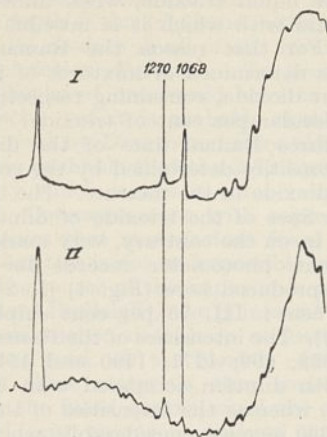


FIG. 2.

We wish to thank Prof. Smits heartily for the interest he took in the work.

Laboratory of Inorganic
and Physical Chemistry,
University, Amsterdam.

May 11.

¹ A. Smits, *NATURE*, **113**, 855 (1924); A. Smits and N. F. Moerman, *NATURE*, **134**, 698 (1934).

H. GERDING.
N. F. MOERMAN.

Deposits of Colloidal Graphite

IN describing the design of an α -particle counter that comprises a leaflet of aluminium attracted to an insulated point conductor, Wassiliew¹ mentions the use of indian ink for fastening a cylindrical conductor to an insulator. Of the conducting contact materials that might be used for this and similar purposes, it is interesting to note that experimenters in the United States have found aqueous colloidal graphite generally useful.

In this instance, a globule of concentrated colloidal graphite in water provides a firm contact accompanied by a decrease in the usual film resistance at the point of application. Such a cement spot not only provides a relatively large area with which to make contact, but also forms a comparatively strong binder for the so-called 'cat's-whisker' type of connexion frequently made for vacuum-condensed substances. It is said² that vacua of the order of 10^{-8} mm. mercury can be obtained when several graphite contacts are utilised in one device.

Similar contacts³ to sample insulating materials for the purpose of determining their volume and surface resistivities, dielectric losses and constants, in no way alter the physical properties of the substances in question or interfere with the treatment of specimens between tests. Commercially, colloidal graphite is used to cement carbon filament ends to lead wires in the base of carbon lamps.

Wassiliew also suggests¹ that leaflets of glass sputtered metallically may be employed rather than foils of aluminium or platinum as cathodes of the counter system. For those wishing to eliminate metallic sputtering in the preparation of such conductive leaves, the same result could be obtained by painting with a camel-hair brush a deposit of

graphite on sheets of material like Cellophane, glass leaflets or even paper bases.

On an ebonite surface the resistance of a graphite coating formed from a fairly dilute solution is about 3,000 ohms per cm. square, the same being decreased to 2,000 ohms for a polished surface.

Other applications where colloidal graphite deposits may serve in place of metallic sputtering include the coating of Rochelle crystals in piezo-electric problems, the formation of guard rings for evacuated apparatus, coating of plate glass for electrostatic condensers, and the construction of electrodes in ionisation chambers. Commercially, colloidal graphite films are said to be desirable on the cuprous oxide layers of copper oxide rectifiers and on the oxide layers of aluminium foils used in electrolytic condensers.

BERNARD H. PORTER.

444 Madison Avenue,
New York City, N.Y.

April 23.

¹ S. S. Wassiliew, *NATURE*, **137**, 533 (1936).

² C. L. Henshaw, Yale University, 1935.

³ Church and Daynes, *Rubber Ind. Trans.*, **6**, No. 1 (1930).

Origin of the Teleost Scale-Pattern and the Development of the Teleost Scale

ACCORDING to current accounts of scale formation in Teleosts, the scale papillae originate as independent centres of growth, their constituent cells being derived from the immediately underlying dermis. The remarkable regularity of arrangement of the scales in most fishes has always attracted attention and has led Backman¹ to suggest that each papilla exercises an inhibiting influence on the development of the immediately surrounding tissue.

Recent investigations by me (principally on species of the genus *Salmo*) show that these views are quite incorrect. In *Salmo* the first papillae arise as aggregations of mesoderm cells along the lateral line, each one immediately beneath a sense organ (neuromast). Each of these primary papillae soon shows a dorsal and a ventral extension consisting of outgrowing fibroblasts. These outgrowths are inclined obliquely forward, crossing the underlying myotomes and pushing their way between the dermis and epidermis. The other papillae of the body arise at intervals along these oblique outgrowths and are formed by local multiplication of the fibroblasts. This accounts for the regular sequence of diagonal scale rows which is so characteristic of Teleosts. As regards the spacing of the papillae along each outgrowth, it may be pointed out that it is a general characteristic of fibroblasts to multiply when packed tightly together. It seems possible that after advancing for a distance the rate of movement of some of the cells is checked, thus producing a 'piling up' of the cells following and resulting in the concentration necessary to induce mitotic activity. This would automatically permit a further advance and a similar check.

It seems likely, therefore, that the general process of scale formation is induced by the lateralis branch of the vagus nerve. In *S. trutta* an apparent exception to the scheme outlined above is to be found in a small mid-dorsal patch of papillae which arise as an independent centre of fibroblastic activity a little behind the supratemporal canal.

Most recent investigators have concluded either that the fibrillary plate of the scale is laid down first or that the plate and the 'hyalodentine' layer are

formed simultaneously. Actually the 'hyalodontine' layer is formed first. It is laid down after the manner of membrane bone, surrounded by osteoblasts. The term 'hyalodontine' should accordingly be dropped. The fibrillary plate is laid down against the bony layer, being formed probably from substances which have penetrated between the older osteoblasts.

FERRIS NEAVE.

Dept. of Zoology,
University of Manitoba,
Winnipeg, Man.
April 25.

¹ *Verh. anat. Ges. Jena*, 41.

Negrito Racial Strain in India

THE remnants of the Negrito race in the aboriginal population of South India were first discovered by Dr. B. S. Guha and reported in NATURE¹. In an extensive survey of the Perambiculam Hills within the Cochin State and the adjoining Anaimallais Hills of the Coimbatore district he found, in all, 16 individuals with spirally curved hair of whom one was a Pulayan, one a Mälsar and the rest were Kadars. The hair of



FIG. 1.

these people was of a frizzly type equivalent to No. *g* of Martin's scheme², with the exception of two individuals whose hair was of the woolly type and more like No. *h* of the same scheme. In a recent survey of the Hill People of the Rajmahal Hills of Santal Parganas, I came across a boy of about fourteen years of age in a place called Lilkotidhāorā (Rajmahal subdivision) belonging to the *Bāgdi* group with short spirals of a distinctly woolly type (No. *h*) (Fig. 1). He was very short (1,354 mm.). The head was round and short, the maximum length and breadth being 166 mm. and 142 mm. respectively, and the proportions between the two was 85·54. The nose was flat and broad and the face was round and short. The lips, however, were moderate and no prognathism was noticed. The skin colour was black, corresponding to No. 33 of von Luschan scale.

The Negritos found by Dr. Guha were equally pigmented, but appeared to possess a more elongated head, only two showing a cephalic index of 77·34 and 79·29 respectively. Discussing the origin of these people, Dr. Guha has suggested³ that the basis of the Indian Negritos was probably brachycephalic, but large admixture with a primitive dolichocephalic Nisadic element had afterwards modified the head shape. The Rajmahal boy with woolly hair discovered

by me would appear to lend support to this contention, and to indicate, as suggested by Dr. Guha, that the Negritos in India, like the Andamanese, were originally round-headed; and the change of the head shape has been due, as noticed to a smaller extent among the Semangs, to the large absorption of the blood of a primitive dolichocephalic race which is the dominant element among the aboriginal population of Southern and Central India at the present time.

S. S. SARKAR.

Bose Research Institute,
93 Upper Circular Road,
Calcutta.

¹ NATURE, 121, 793 (May 19, 1928); and 123, 942 (June 22, 1929).

² "Lehrbuch", Second Ed., 1, 213.

³ "Census of India", 1, Pt. iii, p. ii, 1935.

Occurrence and Distribution of Chromosome Aberrations in Nature (Diptera)

THE problem of the frequency, types and distribution of chromosome aberrations in Nature has so far not been studied. Yet in analyses of spontaneous mutations, of the divergency of species and of the structure of population, this problem is of the greatest importance. Several separate cases on the occurrence and distribution of different aberrations in Nature have been described (Sturtevant, Blakeslee, Brink and others).

In the summer of 1935, 1,666 chromosome complexes from the salivary gland cells of the larvæ of *D. melanogaster* from five populations (Kutais, Gori, Batoum, Souchoum, Gelendzhik) were studied. Five different inversions were detected in the large autosomes. Rather high concentrations of inversions were observed in the populations (the percentages of heterozygotes were 5·24; 1·02; 8·28; 0·0; 14·8), owing to which individuals homozygous for inversions were found.

The most frequent chromosome aberration in *D. melanogaster* which contained an inversion in each of the limbs of the second chromosome (C1IL-C1IR) proved to be an allelomorph of the inversion C1ILCy-C1IR which was found by Ward in Michigan (1918). Genetic experiments have shown that the individuals possessing two of these inversions are viable and an analysis of the salivary gland chromosomes has shown that they are identical.

The chromosomes of *D. funebris* were studied in 1935-36 in populations taken during December and January in two localities of Moscow. 220 individuals were investigated. About 75 per cent of them contained inversions. Due to this high concentration, some of the individuals were homozygous for inversions and others were heterozygous for two or three of them.

A preliminary study of populations of *D. obscura* and other species of *Drosophila* has also shown the existence of inversions.

An investigation of 250 larvæ from three wild populations of Chironomidae has shown 20, 43 and 65 per cent of individuals heterozygous for inversions.

All 434 chromosomes bearing inversions have been found. In the species studied about 30 per cent of individuals were heterozygous for inversion.

The outstanding fact that all other types of chromosome aberrations except inversions are missing, proves that their concentration in the populations of the species is very low. This may be caused either by

the peculiarities of the process causing spontaneous mutation or by the differential action of selection for inversions on one hand, and against other aberration types on the other.

The widespread part played by inversions in the divergence of species is apparently reflected in phylogeny (as described in this work), the laws governing the distribution of inversions in populations and the fact that wild populations are saturated with chromosome aberrations.

N. P. DUBININ.
N. N. SOKOLOV.
G. G. TINIAKOV.

Institute of Experimental Biology,
Moscow.

Institut Pasteur,
Paris.

P. LECOMTE DU NOÛY.

Points from Foregoing Letters

SIR ARTHUR EDDINGTON gives an outline of his theory on the interrelation between the mass of the proton and that of the electron. He states that the theory leads to values for the magnetic energy of the proton in agreement with those found experimentally by the Stern-Gerlach method (deviation of streams of protons in a non-homogeneous magnetic field).

From the fine structure observed by Dr. K. Murakawa in the lines $\lambda 5678.1$ and $\lambda 4060.2$ of the first spark spectrum of iodine, the fine structure intervals of the terms $(^2D)6s^3D_2$ and $(^2D)6p^3D_1$ have been deduced, and are found to deviate considerably from Landé's interval rule, which states that the successive separations of the components of a multiple term are nominally proportional to the larger value of the inner quantum numbers (l) involved.

The essential difference in connexion with the recently expressed views on the nature of light consists, according to Dr. N. S. Japolsky, in that Sir J. J. Thomson introduces singularities (a 'core') into the photon, while he (Dr. Japolsky) not only avoids singularities in the light waves, but also tries to eliminate them from the 'material' corpuscles.

From the intensity ratio of components of the resonance lines of silver, Dr. D. A. Jackson and H. Kuhn deduce a nuclear spin of value $\frac{1}{2}$ for the silver isotopes of mass 107 and 109. The authors also calculate a probable value for the magnetic moments.

Dr. W. N. Bond confirms Kellström's value of 1834.7×10^{-7} at 23°C . for the viscosity of air. In conjunction with Bäcklin and Flemberg's oil-drop data, this leads to a value of 4.800×10^{-10} for the electronic charge, in agreement with that obtained from X-ray-grating-crystal experiments.

The absorption of infra-red radiation of wavelength 2.7μ by certain specimens of fused quartz may be due, according to Prof. J. W. Ellis and W. K. Lyon, to the presence of traces of water or of carbon dioxide, which substances have absorption bands in or near that region.

The hypothesis that any of the four transitions: positive electron or positive proton \rightleftharpoons neutron or neutrino can occur provided any given transition is accompanied by a change in the reverse direction, is put forward by Prof. E. C. G. Stueckelberg. He

Origin of the Word 'Monolayer'

PROF. DONNAN asks in NATURE of May 30, p. 910, who originated the word 'monolayer'. I may say that I think I coined it, for my own use, in July 1924 (*Journal of Experimental Medicine*, 40, 133; 1924).

I had not seen it used before, and therefore explained, in the introduction to my paper, why I thought it advisable and convenient to shorten the cumbersome expression "monomolecular layer". But I should be glad to learn if someone else, unknown to me, was struck by the same idea.

considers the four entities as different quantum states of one particle.

A spontaneously enlarged prostate in a dog is found by Dr. S. Zuckerman to have a structure identical with that of the same organ enlarged experimentally by treatment with the sex-hormone, oestrone. This supports the view that enlargement of the prostate, which may occur spontaneously in elderly men and aged dogs, may be due to oestrogenic stimulation.

On dilution of liquid sulphur trioxide with liquid sulphur dioxide, the relative intensity of certain lines in the Raman spectrum (wave numbers 530, 1068 and 1390, ascribed to single molecules, $(\text{SO}_3)_1$) increases, while the intensity of other lines assumed to be due to double molecules, $(\text{SO}_3)_2$, decreases. This is taken by Prof. H. Gerding, W. J. Nijveld and G. Muller to confirm the view that liquid sulphur dioxide consists of several kinds of molecules. In the case of the solid, ice-like form of sulphur trioxide, the Raman spectrum indicates the presence of a great proportion of complex molecules $(\text{SO}_3)_x$ with a smaller number of $(\text{SO}_3)_1$.

Prof. B. H. Porter points out that homogeneous films formed with the aid of aqueous dispersions of colloidal graphite may be used in the construction of α -particle counters, guard rings, ionisation chambers, electrolytic condensers, etc., such films being conducting and easily applied.

S. S. Sarkar describes the physical characters of a boy of low stature with spirally curved hair belonging to the Bāgdi group, from the Rajmahal Hills of India. The head measurements support the view that the basis of the Indian negritos was originally broad-headed, and that there has been a change in head shape due to a large admixture with a primitive long-headed race, which is the dominant element among the aboriginal population in southern and central India.

A study of the chromosomes of various strains of fruit flies shows, according to Prof. N. P. Dubinin, N. N. Sokolov and G. G. Tiniakov, that the only common naturally occurring aberration is that due to inversion (in the order of the character-bearing genes). In *Drosophila melanogaster* the inversion occurs most frequently in each of the limbs of the second chromosome.

Research Items

New Guinea Pygmies

AMONG the more interesting results of Lord Moyné's expedition to New Guinea, from which the collections are now on exhibition at 10 Grosvenor Place, London, S.W.1 (see NATURE, May 30, p. 898) is the confirmation of rumours as to the existence of a hitherto unrecorded group of pygmies inhabiting the Aiome foothills of the Middle Ramu region between Atemble (about seventy miles from the mouth of the Ramu) and Mount Hagen. Some further particulars of the information relating to this group obtained by Lord Moyné are given by Mr. H. J. Braunholtz in *Man* of June. The members of the expedition were not allowed to enter the villages of the pygmies, as they are 'uncontrolled'; but about twenty-five of the pygmies visited the expedition for trade. Twelve males who were measured averaged 54½ in. (1.385 m.) in stature and three females 51½ in. (1.31 m.). The extremes ranged from 52 in. to 57 in. and 50½ in. and 53 in., respectively. They were light brown in colour, of about the same shade as light-skinned Polynesians. Mr. Braunholtz points out that these are the lowest figures yet recorded for any pygmy group in New Guinea, and are about equal to those of the pygmies of the Congo. The Tapiro of the Mimika average 57 in., while the next group averages 58½ in., a fact which led H. J. T. Bijlmer in his report on the physical anthropology of New Guinea to question whether there is a pygmy race there at all, regarding these low-statured peoples as local variants of the variable Papuan stock. The Aiome group is, therefore, a new fact of outstanding importance. Several complete pygmy equipments were obtained, a typical outfit including: a bow, three arrows with wide bamboo blades for pig, one four-pronged arrow for birds, four barbed arrows for fighting, two plain pointed arrows; a small round shield slung on the left side in net bag, bone dagger, bamboo louse scratcher with wallaby fur puff, belt of plaited vine, neck pendants of various teeth and seeds, head-dress of bark-cloth, garters and arm bands, pubic covering of bark, pandanus mat for rain.

Wappo Ethnography

THE Wappo Indians, of whom the modern representatives live on the reservation near Geyserville, California, according to investigations by Mr. Harold E. Driver, who visited them in July 1932 (*Univ. California Pub. American Archaeol. and Ethnol.*, 36, No. 3), are possibly very nearly the most primitive people of whom there is record. The land on which they live, now occupied chiefly by Pomo families, was originally Wappo. Their country was a small territory fifty miles long and fifteen to twenty miles wide north of San Francisco Bay. They inhabited the fertile valleys of a hilly country. They were without writing, metals, agriculture, pottery or domestic animals, even dogs. Their chief food was the acorn, eaten in the form of mush. Small game furnished more of their diet than big game, though deer meat was an important food. They did not hesitate to eat rats, mice, grasshoppers, snails and the like. Homes were mostly of grass-thatch and could be constructed in a day or two.

Dress was the minimum, the men being nude and the women wearing a double apron. In cold weather a skin, or woven tulle cloak, was worn. The only art of any note was basketry, in which they excelled. In variety of size, shape, weave and quality of workmanship, it rivalled the famous Pomo baskets. In social organisation, they were without clans, real chiefs or definite tribal unity. The social unit was the bilateral kin, with the whole town or village community as the larger unit, numbering at most two or three hundred, but usually about one hundred persons. There was no central authority binding these units together. There was a lack of any far-reaching division of labour; arrow-head makers and clamshell bead makers being the only tradesmen giving their time to special tasks. Their only records were bundles of sticks, mnemonic devices to mark the moons and a few dates in the future. At the birth of a child the custom of *couvade* was observed by the father, strictly for four days and afterwards with lessening intensity.

South Wales Oysters

THE report on investigations into the condition of certain of the oyster beds in the South Wales sea fisheries district (June 1934) (*Fish. Invest.*, Series 11, 14, No. 5; 1935) by F. S. Wright shows good results following experimental work during recent years in order to increase the local oyster population. Especially in the Roads Haul near Mumbles Head, where adult oysters were laid down close together in a reservation in order to breed, were good spat-falls obtained, and it is suggested that work on the same lines be continued in this area. Free-swimming larvæ derived from oysters in the Roads Haul stand an unusually good chance of being transported by currents to adjacent banks which are favourable for their development. In Milford Haven, some Portuguese oysters were laid down, but it is suggested that this be discontinued in view of the fact that indigenous oysters are now available in the district, and restocking should be carried on with this species. The importance of restoring the natural oyster beds is becoming more and more recognised, and the present report is distinctly encouraging.

A New Tomato Eelworm

A SHORT account by Mr. P. H. Williams (*Gardeners' Chron.*, May 16, 1936) announces the appearance of a new gall-forming disease of the tomato. The galls appear on the stem of an affected plant, are spongy in texture, and are caused by *Anquillulina dipsaci*, an eelworm which attacks a wide variety of plants. The disease has been reproduced upon healthy tomatoes by spraying with a suspension of eggs and living eelworms. Fortunately, the malady is quite rare.

Dimorphous Basidiospores

MR. E. J. H. CORNER has studied two species of fungi, *Hygrophorus firmus* and *H. hypohemactus*, and finds that they produce two kinds of basidiospores. Large spores with dense contents are borne upon large basidia, whilst small vacuolated spores occur

on small basidia ("Hygrophorus with Dimorphous Basidiospores"; *Trans. Brit. Mycol. Soc.*, 20, Pt. 2, 157-184, January 1936). The paper also contains a full account of a detailed microscopic study relating to the development of the fruit body. *H. hypohæm-actus* is described for the first time, and Mr. Corner shows, by the description of sixteen varieties, juvenile forms and overgrowths, that *H. firmus* is an extremely variable species.

Camomile Lawns

THE modern concept of a lawn can scarcely be associated with any other kind of plant than grass, but in the days before the invention of the lawn mower, broad-leaved herbaceous plants were of frequent occurrence in any well-established sward. Mr. R. B. Dawson, director of the Golf Green Research Station at St. Ives, Bingley, Yorks, discusses the potentialities of camomile (*Anthemis nobilis*) as a lawn plant (*J. Board of Greenkeeping Res.*, 4, No. 14). He has examined a number of lawns in the Royal gardens where camomile is established, and finds that this species is an aggressive coloniser, and very tolerant of drought. Its densely-woven runners supported a mat of deep green foliage when the surrounding grass was parched and dry; it was free from weeds, and gave a fragrant turf. In spite of these advantages, however, it seems unlikely that the plant will be suitable for the closely-mown lawns demanded by modern conditions, and there is a possibility that the resistance to drought would diminish if too many leaves were removed by keen cutting.

Plant Cover as Protection against Soil Erosion

THIS topic is dealt with very fully by Mr. J. Kramer and Prof. J. E. Weaver of the University of Nebraska, in Bulletin 12 of the Conservation Department of the University, recently published. The controlling of wastage of land through soil erosion is one of the major economic problems in America, and was brought forcibly into the public interest by the great dust storms of 1935. The authors have standardised a technique in which undisturbed samples of field soil of reasonable size can be lifted, with the crops they bear uninjured, and then exposed to erosion by a stream of water directed on to the surface from a hydrant. Numerous data obtained by these methods are assembled and discussed, but the striking general result is the very great protection against rain erosion provided by the above-ground portions of the plant compared with the root system alone. The authors conclude that the character of the crop is a principal factor in erosion control, the effect with plant cover intact exceeding that of underground parts alone from 3 to 7 times. Maximum protection was afforded by winter wheat and sorgo; oats and alfalfa were less effective. Among pasture plants, well-established Hungarian brome grass was found most effective. The authors naturally conclude that the weakening of grasses by over-grazing, trampling and injudicious burning may contribute materially to soil erosion.

Surveys in Central Asia

A SUMMARY of the state of surveys in Chinese Central Asia including Tibet and Sinkiang is shown on a map produced by the Survey of India and republished in the current volume of the *Himalayan Journal* (8, 1935). The whole of the Himalayas

except in parts of Bhutan and Assam are covered at least by exploratory surveys, though some of the work at altitudes above 15,000 feet is still rough. About one quarter of Tibet is now covered by exploratory surveys, and several other parts have a network of explorers' routes; but large areas still remain of which little is known. In those parts early travellers and 'pundit' explorers are the only authorities. In Sinkiang, exploratory surveys seem to cover nearly half the area, and they are almost entirely due to Sir Aurel Stein and his Indian assistants.

Analysis of a Tropical Hurricane

THE *Monthly Weather Review* of November 1935 contains two papers dealing with the remarkable tropical hurricane that visited the Atlantic coast of the United States early in that month. The first paper, by Willis E. Hurd, gives a detailed account of the life-history of the storm, which apparently began as a feeble disturbance outside the tropics—a very unusual event—a little east of Bermuda in lat. 32° N., on October 30. It moved west by north, passing just north of Bermuda, but turned unexpectedly south-westwards during the night of November 1-2, then almost south on November 2, crossed the northern fringe of the Bahamas on November 3 and the lower part of the Florida peninsula on November 4. In the Gulf of Mexico it described part of a loop that brought it back to the neighbourhood of Florida, where it dissipated on November 8. In addition to the extraordinary nature of the track, it is the first storm on record to develop hurricane winds in the Florida peninsula so late in the season. The hurricane winds covered only a narrow track, but they did damage estimated at five and a half million dollars in and around Miami. The rainfall at Miami was very eccentric—0.24 in. before the arrival of the fifteen mile wide calm centre and 3.80 in. afterwards. The storm was not circular, and had some characteristics more appropriate to extra-tropical cyclones. It did not cause any very abnormal tides. The second paper, by H. R. Byers, is an attempt to relate the development of the storm to the different polar and tropical air masses present over the Atlantic at about the time of its formation. Charts are shown on which the various fronts are depicted, and a cross-section of the atmosphere from Omaha to Washington based on upper air soundings. Upper air conditions were also examined with the view of explaining the change of movement of the storm centre during the night of November 1-2; an isobaric chart for a height of 3,000 metres showed a distribution of pressure favourable for strong northerly winds, and it is concluded that these carried the centre southwards. The decay of the system set in when dry westerly winds at high levels spread gradually down to sea-level.

Thermostats

No. 276 of the series "Actualités scientifiques et industrielles" (Paris: Hermann et Cie., 15 francs) is entitled "Les Thermostats pour les Températures moyennes" and is written by Dr. André Lalande. It deals in a more general manner than has been previously attempted with the conditions which make for the efficient operation of thermostats of all types, including those which depend on mercury triode valves. References to more than seventy regulators are given.

Infra-red Sensitisers

THE effect on the sensitising properties of the cyanine dyestuffs of introducing various atoms or radicals in different parts of the cyanine molecule is of considerable interest for the possible extension of photography into the infra-red region. In a recent paper, A. Corbellini and R. Fusco (*Rendiconti del Reale Istituto Lombardo di Scienze e Lettere*, **68**, 961; 1935) describe the preparation of a number of tricarboyanines in which one of the hydrogen atoms in the seven-membered CH ring is replaced by halogen atoms. The α -halogen derivatives of glutacetaldehyde-dianilide hydrochloride were condensed with various heterocyclic nuclei, namely, the ethiodides of quin-aldine, β -naphthoquinaldine, α -methylbenzthiazole, and methyl- α -naphththiazole. The resulting tricarboyanines all absorb and act as sensitisers in the infra-red, but the presence of the halogen atom in the CH chain does not influence the sensitising power.

Radiations from Sodium and Mercury Vapour Lamps

WE welcome the first two numbers of *Philips Technical Review* published in English by the well-known Philips' lamp factory at Eindhoven in Holland, which is affiliated with Philips Lamps Ltd., of 145 Charing Cross Road, London. It deals with technical problems relating to the products, processes and investigations carried out by this firm, and judging by the early numbers it should be of value and interest to the whole engineering profession. A paper compiled by G. Heller in the first number describes how the visible radiations from sodium and mercury vapour lamps are generated. The processes in the two cases are entirely different. Sodium is excited by the impact of electrically accelerated electrons against atoms in their normal state. In general, the efficiency in light production of the sodium vapour is higher, the lower the vapour pressure, the current density and the luminous intensity. In high-pressure vapour lamps, on the other hand, the radiation is produced by the temperature of the mercury vapour. Unlike the sodium vapour lamp, the efficiency diminishes with the vapour pressure, the current density and the luminous intensity. The characteristics of a sodium tube lamp of 100 watts are compared with those of a super high-pressure mercury lamp of 1,400 watts. The sodium lamp is surrounded by a double-walled vacuum flask which diminishes heat conduction, but in the mercury lamp the vapour discharge is cooled by running water. The mercury molecules give a spectrum composed of wide bands instead of sharply defined lines. The light output of sodium and mercury lamps will be discussed further in a later issue.

Acoustics of Telephony

THE transmission of speech over a distance involves problems of both an acoustical and an electrical nature. Normally there is but one medium, the air, between the speaker and the listener; but in order to carry the energy to a distance, the telephone engineer interposes an electrical system between the two. A brief survey, in popular language, of the acoustical characteristics of the two ends of such a telephone system forms the subject of the most recently issued of the Post Office Green Papers (No. 25). This pamphlet, entitled "Acoustics of Telephony", has been prepared by Dr. E. G. Richardson. It commences with an illustrated description of the human ear and the manner in which the voice operates to produce the sounds of ordinary

speech, a circuit diagram being given of an electrical analogue of this voice. A cathode ray oscillograph equipment for the recording of speech wave-forms is described, and some typical oscillograms of vowel sounds by various speakers are shown. The importance of obtaining freedom from interference in ordinary telephony is noticed, and reference is made to the sound-absorbing properties of various materials and the principles of sound-proofing systems, such as the ordinary telephone kiosk. This interesting publication should do a good deal in directing public attention to the important progress which technical acoustics has made in recent years in connexion with the development of communications engineering.

Telluric Acids

M. PATRY (*Bull. Soc. Chim.*, **3**, 845; 1936) finds that orthotelluric acid, $\text{Te}(\text{OH})_6$, is stable below 100° ; between 100° and 220° metatelluric acid, H_2TeO_4 , is formed. The reaction is complete in a few minutes at 200° . This loses water to form the trioxide, TeO_3 , above 220° , and above 395° the trioxide decomposes into the dioxide, TeO_2 . Complicated results are obtained by heating orthotelluric acid in a sealed tube. Mylius found that the acid fused at 136° in such circumstances and was converted into a soluble so-called allotelluric acid, $(\text{H}_2\text{TeO}_4)_n$. Metatelluric acid is a white amorphous hygroscopic powder, very slowly soluble in water. Tellurium trioxide is an orange yellow, non-hygroscopic powder, insoluble in water. Allotelluric acid is a viscous mass, soluble in water. It is now shown to be a mixture containing one constituent to which it owes its peculiar properties. A large proportion, unlike orthotelluric acid, is soluble in cold alcohol or nitric acid, and this part is regarded as pure allotelluric acid. In the sealed tube experiment, a grey, hard form of the trioxide, called $\text{TeO}_3(\beta)$, is formed on prolonged heating. Allotelluric acid in solution passes into orthotelluric acid; the change can be followed by the electrical conductivity.

Optically Active Disaccharides

AMONG the carbohydrates, many examples of optical antipodes have been prepared in the monosaccharide series and in the simple glycosides of the monosaccharides. Optical antipodes among the disaccharides are theoretically possible, but were not previously described. L. C. Kreider and W. L. Evans (*J. Amer. Chem. Soc.*, **58**, 797; 1936) have now prepared such antipodes, their work being based on the following principle. If a molecule of the optically inactive keto-triose, dihydroxyacetone, could be joined in true biosidic linkage with a molecule of the *d*-form of an optically active monose, a true optically active disaccharide would result. Then if dihydroxyacetone could be joined in the same manner to the *l*-form of the same optically active monose, a second optically active disaccharide would be formed which should be the exact optical antipode of the first. This has been achieved with *d*-arabinose and *l*-xylose as the monosaccharides. The compounds β -*d*-arabinosidodihydroxyacetone tetraacetate and the corresponding β -*l*-compound, β -*d*-xylosidodihydroxyacetone tetraacetate and the corresponding β -*l*-compound, and β -acetobromo-*l*-xylose, were prepared. These contain examples of the first disaccharide to have a pentose and a triose as its constituent parts and the first examples of pairs of synthetic optical antipodes among disaccharides; the first disaccharide racemate was demonstrated in the case of β -*dl*-arabinosidodihydroxyacetone tetraacetate.

Determination of Sulphur in Organic Products

THE methods in general use for the determination of sulphur in animal and vegetable products for sulphur-balance experiments with cattle and sheep depend upon the oxidation of not more than a gram of material with copper nitrate (S. R. Benedict, 1909) or fusion with sodium peroxide (R. E. Evans, 1931). From a material like hay with a small percentage of sulphur, the amount of barium sulphate finally obtained from 1 gm. does not exceed 2.5 mgm., so that liability to error is considerable.

To overcome this disadvantage, F. J. Warth and T. S. Krishnan have devised a method in which much larger amounts of the substance can be treated, consisting in a nitric acid oxidation followed by alkali fusion, the latter step being essential for complete oxidation of the sulphur (*Ind. J. Veterin. Sci. and Animal Husbandry*, 5, Pt. 3, September 1935, p. 210). For urine, 100 c.c. may be treated with 10-15 c.c. concentrated nitric acid and slowly heated on a sand bath until gentle effervescence commences. The beaker is then removed, and the reaction allowed to proceed in the cold until complete. After re-heating, and cooling overnight, nitrophenols and hippuric acid are filtered off, the filtrate is concentrated to a small volume, rediluted and again concentrated, this treatment being repeated until dilution causes no turbidity. The yellow solution is then made up to 100 c.c., and an aliquot taken for fusion, for which 5 c.c. of 50 per cent sodium hydroxide are added, mixed, and the whole is transferred to a silver basin. The water is evaporated off, and the dry residue is heated on the sand bath and finally fused. The fusion is completed in a few minutes, resulting in a pure white melt which is dissolved in water, treated with

hydrochloric acid to remove nitric acid, filtered to remove small amounts of silver chloride and silica, and is then ready for precipitation of barium sulphate in the usual way.

For foodstuffs, such as hay and cake, and faeces, 5-10 gm. of substance is oxidised with boiling nitric acid for six hours. The contents of the flask are transferred to a beaker, diluted and allowed to stand overnight. The liquid is filtered, the filtrate concentrated in a beaker to a volume of 25 c.c., covered with a watch glass, and gently boiled and concentrated, which causes further oxidation with production of brown fumes. More acid is added, if necessary, until oxidation is complete. The liquid is then cooled, diluted and, if necessary, filtered. It is then evaporated on the water-bath, 10 c.c. of 50 per cent sodium hydroxide and 1-2 gm. of potassium nitrate are added, the whole is transferred to a silver dish, dried and fused.

For some materials, for example, grass, it may be desirable to deal with 100 gm. of material. For this, 100 gm. or thereabouts is weighed into a litre beaker, 500 c.c. of dilute (1:3) nitric acid is added, and the whole is heated in order to start a gentle reaction. The source of heat is then removed, and the reaction is allowed to proceed to completion, with stirring. The beaker is then again heated, covered and the contents boiled vigorously for twelve hours, with addition of water to maintain the volume. The mixture is allowed to stand overnight, filtered on a Büchner funnel and thoroughly washed with nitric acid-water. The filtrate and washings are finally made up to 2,000 c.c., and an aliquot of 100 c.c. used for the determination of sulphur by fusion.

Pleistocene Chronology

VARIOUS lines of scientific investigation are now converging on the chronological problems of geology, prehistoric archaeology and palaeontology. The investigation of sedimentary deposits in Scandinavia by De Geer, and A. E. Douglass's tree-ring chronology in the south-western United States are instances in point. The application of the results of the study of solar radiation to the Pleistocene chronology of Central Europe has been reviewed by Dr. Friedrich E. Zeuner in relation to the evidence of geology, prehistoric archaeology and palaeontology (*Geol. Mag.*, 72, 19, 350-376; 1935).

During the last twenty years, the Pleistocene of Central Europe has been investigated by a great number of geologists, with the result that a detailed stratigraphy has been established, which is generally applicable. When the 'radiation curve' of Milankovitch is applied to this stratigraphy, it becomes possible to date exactly fossils, skeletal remains and prehistoric implements from certain localities in thousands of years.

On the evidence of the north German area of glaciation, the Alpine area of glaciation and the 'periglacial zone' (middle and south Germany), it is possible to formulate a correlation for which, as a matter of convenience, the Alpine terminology of Penck and Brückner may be used. This system of stratigraphy extends over a wide area. The Silesian Pleistocene links up the north-west and mid-German areas with Poland and Russia, while the Ukrainian loesses admit of a detailed subdivision with the same accuracy as the loess of Central Europe. In north Russia the same conditions prevail as in Germany, and the Caucasian mountains exhibit the same Pleistocene divisions. The later glacial phases (Riss and after) are thus represented in the whole of Central and Eastern Europe.

An outstanding point to emerge is that every glaciation of the old north German and Alpine divisions now appears to consist of two cold phases, which belong closely together. The Würm glaciation, however, includes a third and smaller phase. Two

cooler phases of less intensity are intercalated between Mindel 2 and Riss 1 and between Riss 2 and Würm I. These have not yet been found outside central and south Germany. There are several cold phases older than Günz, but up to now they have only been proved for the Alps and a few river systems. They are older than the 'Diluvium', and possibly are contemporary with the earliest Pleistocene and Upper Pliocene of England.

In Milankovitch's radiation curve (all calculations are as from A.D. 1800) there are strong minima of solar radiation in a group of three at 23,000, 72,000 and 115,000 years; of two at 188,000 and 230,000 years; a long period without stronger minima of radiation stands between 240,000 and 430,000 years; there is another group of two minima at 435,000 and 476,000 years; and an early group of two minima at 550,000 and 591,000 years. It can scarcely be coincidence that this arrangement is exactly the same as was found for the glacial phases of the Pleistocene. Not only are the threefold Würm and the doubled Riss, Mindel and Günz represented by strong minima of radiation, but also the great interglacial Mindel 2-Riss 1 finds its equivalent in a period of nearly 200,000 years. The coincidence of so many details is almost amazing. An application of the curve solves many of the old problems of stratigraphy, as well as raises new.

The absolute chronology thus afforded also dates the remains of fossil man and his cultures more accurately than hitherto, but only provided their exact position in the stratigraphical succession has been determined. The most ancient find in Central Europe, *Homo heidelbergensis* from the Mauer sands, cannot be later than the interglacial between Günz 2 and Mindel 1. Many have correlated him with the Chellean, but it is not impossible to assign him a pre-Chellean culture with a place in the absolute scale of about 500,000 years. The Acheulean at Achenheim occurs in the loess of Riss 2 and falls within a glacial phase, though the evidence from Markleeberg suggests that it may extend further back, giving a possible antiquity of 183,000 years. The Mousterian stations Taubach and Ehringsdorf show that Neanderthal man was present in Germany in the last phase of the Interglacial Riss/Würm, and was still living there when the climate became colder

with the advance of the Würm glaciation; while Wallertheim shows that he was there after the maximum of Würm 1. This dating indicates an antiquity covering the period from 140,000 to 105,000. The Aurignacian, on the evidence from Linsenberg near Mayence, belongs to the beginning of Würm 2 and is dated from 95,000 to 69,000 and is followed by the Solutrean of Předmost, of which the precise age has still to be determined; but it is suggested on the strength of evidence from Kesslerloch that the Solutrean stands at 67,000. The Kesslerloch Magdalenian site was inhabited some time after the maximum of Würm 2, and most German Magdalenian is of about the same period; while in north Germany (Balver Höhle, Westphalia) the end of the Magdalenian is Würm 3. The whole Magdalenian is dated at 65,000 to 18,000; while the Mesolithic, after Würm 3, is assigned to 15,000 to 7,500 and the Neolithic in the post-glacial Atlantic phase dated 7,500 to 4,000. (All dates are reckoned in years before A.D. 1800.)

In palæontology, the new chronology makes it possible to date the disappearance of ancient species and the appearance of new ones very exactly. We are enabled to study migrations and other alterations in the distribution of species with precision. For example, the hippopotamus, absent in Central Europe, except in the Rhine Valley, where it is typical of the early Pleistocene, persists into late Middle or even Upper Pleistocene in England. It can thus be shown to have survived in western Germany for a 100,000 years after it had disappeared from the rest of mid-Europe, while it survived in the oceanic climate of England for another 200,000 years longer.

The new chronology also enables us to estimate the time necessary for adaptation and other alterations of specific characters, of which the most intelligible instance is afforded by the elephants. Thus *E. antiquus*, a forest species, in 450,000 years developed very little; but in the same period *E. primigenius* shows a very marked specialisation owing to a new biotope. The Siberian mammoths may be about 15,000 years old. For the whole evolution of the mammoth the absolute chronology allows about 450,000-500,000 years. It is thus seen to afford a criterion for the speed of evolution, of which we know very little.

Coal and Gas in Great Britain

AT the seventy-third annual meeting of the Institution of Gas Engineers in London on May 26-29, the address of the president, Colonel W. Moncrieff Carr, referred to "perhaps the most serious problem in the history of the Industry"—the proposed coal selling scheme, under which not only the prices but also the choice of gas coal would be apparently at the discretion of the coal industry, which would thus acquire uncontrolled monopolistic power. It is feared that the coal industry's policy will be influenced by a desire voiced by its spokesmen and indicated by its commercial actions to discourage the replacement of raw coal by the products of coal carbonisation, even though this conduces to public amenity and hygiene and to private convenience.

Moreover, freedom of choice of raw material is vital to any manufacturing industry and especially where the raw material can be so variable as coal.

At the moment, the public gas supply is being concentrated into fewer and larger units by several paths—amalgamations of adjacent undertakings, by the establishment of 'gas grids' where local circumstances are favourable, and by the formation of holding companies controlling many but not necessarily adjoining undertakings. The merits and demerits of these activities are engaging much attention, to which a paper by Mr. F. C. Briggs on the Dudley Gas Amalgamation contributed. In south Yorkshire the coking industry produces an abundant supply of gas as a by-product which the

gas grid controlled by the Sheffield Gas Co. has made available over a wide area and at prices lower than customary. The Rotherham Corporation has also taken advantage of the local supply of coke oven gas, and in order to encourage the use of gas instead of coal has instituted a two-part tariff with a very low consumption charge (10d. per 1,000 cub. ft. of 500 B.T.U.). Mr. J. T. Haynes, formerly manager of the Rotherham undertaking, reported the success of the tariff, which has been adopted by consumers of all classes. The results show that, roughly speaking, 1,000 cub. ft. of gas does the work of 1 cwt. of domestic coal.

Mr. C. A. Masterman's paper on gas safety precautions contained much of interest. While considering steps to reduce the number of deaths from the use of gas, he indicated that the publicity given to such accidents creates a false impression of their frequency. Actually the fatality rate from coal gas in Great Britain is only a fraction of corresponding figures in other countries. The report of the Registrar General shows that coal gas accidents are only one fifth of those due to falling downstairs, while those due to products of combustion are insignificant.

Actually ten times as many people die as a result of falling out of bed as from the fumes of burning coal gas. Nevertheless, as a result of greater care in the service of gas appliances, the number of such accidents is diminishing, while the consumption of gas increases.

The paper by J. Jameson and Dr. J. G. King on the carbonisation of cannel at Edinburgh Gas Works gave interesting results which received an undesirable publicity in the daily Press. It was shown that a certain Scotch cannel yields on carbonisation not only a good yield of gas, but also of tar particularly suited for hydrogenation to give motor-spirit and a coke quite serviceable for domestic use. Unfortunately, it has been suggested that the carbonisation of cannel could be expanded almost to cover the nation's supply of liquid fuel. This is a myth which was exploded long ago, for example, during the War. Suitable cannels, as Messrs. Jameson and King indicated, are too irregular in supply and too variable in quality to form a basis of an industry of such magnitude. It is regrettable that the Press should be used to disseminate such perversions of the results of research.

The Carnegie United Kingdom Trust

THE Carnegie United Kingdom Trust's twenty-second Annual Report couples with its description of the work of the year 1935 a general account of progress achieved during the past five years and an outline of its five-year plan for 1936-40. Some idea of the range of the Trustees' activities during the past quinquennium can be gathered from the following summary classification of grants: libraries, £296,500 (being 44 per cent of the total of all the grants); playing-fields and play-centres, £125,000; village halls, rural community councils, new estates community associations, youth hostels and other schemes for rural development and social service, £162,600; adult education (including museums), £35,700; music and drama, £18,400; miscellaneous, £32,200.

Two big changes of policy, one negative and one positive, differentiate the current from the past five-years' programme. Libraries have enjoyed the lion's share of the grants ever since the Trust's foundation, and three-fourths of this share has gone to county and municipal libraries. Last year, however, the Trust decided that for the future these institutions might safely be left to rely upon other resources. A similar decision was reached in regard to grants for special libraries, for newly formed rural community councils and for playing-fields: "... in each of these fields they [the Trustees] have helped to set up a standard of achievement which should enable those who are responsible locally to carry on the work and develop it adequately, and ... to give further help would stultify the pioneer principle which is at the root of the policy which their founder laid down".

It is in projects for land settlement that the Trustees have found an outlet for the funds thus set free. So long ago as 1933, they commissioned Mr.

A. W. Menzies Kitchin, of the University of Cambridge Department of Agriculture, to investigate the potentialities of land settlement as an agency for social welfare, and ways and means for promoting it. His report, published last January, favours experiment along two lines: (1) co-operative small-holding schemes of 30-40 families, each holding being 3-10 acres of land; and (2) co-operative part-time subsistence holdings; and the Trustees have allocated £150,000 for schemes of these types. Already two schemes of type (1) are in being, both promoted by the Land Settlement Association, one at Potton (market garden holdings) on land given by Mr. P. Malcolm Stewart, and one at Andover (poultry and pig holdings), and the Trustees have allotted £10,000 towards the capital cost of establishing three more such schemes (forty families each) in distressed areas in co-operation with county councils. Another £10,000 is allotted towards starting thirty part-time settlements of forty men each on the group-holding (quarter to half-acre) system—an experiment recently taken over from the Society of Friends.

Another entirely new allocation is one of £30,000 for encouraging amateur choral and orchestral societies and for holding short schools for conductors. As in the case of the land settlement schemes, this new venture has not been undertaken without prolonged inquiry and consideration. It will be under the direction of a joint committee of the Trustees and a national federation of amateur societies recently set up on the initiative of the Incorporated Society of Musicians.

The whole report is extremely interesting. The Trust's activities have a value over and above their directly beneficial results in that they are often conducted in such a way as to have permanent value as pieces of scientific research.

Educational Topics and Events

CAMBRIDGE.—Dr. L. Howarth, of King's College, has been appointed University lecturer in the Faculty of Mathematics.

J. H. Lockhead, of Christ's College, has been appointed senior curator of the Museum of Zoology.

The Benn W. Levy research studentship in biochemistry will become vacant on September 30. Applications from candidates should be addressed to Sir Frederick Gowland Hopkins at the School of Biochemistry before July 31.

ACCORDING to the law of New York State, a licence to practise as an optician can be issued only to a person who has graduated in arts or science and in optometry at a university, and has passed the examination of the State Board. The announcement of the professional courses in optometry for the winter and spring sessions 1936-37 at Columbia University shows further that for admission to the University a candidate must have completed a four-year course of study at a secondary school in English, history, a foreign language, algebra, geometry, and either physics or chemistry. The first two years at the university are devoted to English, German, mathematics, contemporary civilisation, physics, chemistry, physiology and physical education; the third and fourth years to geometrical, physical and physiological optics and workshop practice. The work is done on the eleventh floor, of 10,000 square feet, of the Pupin Physics Laboratories of the University. The cost to a student is estimated at about 600 dollars per annum for a student living at home and 900 dollars for one living in one of the halls of residence. These are minimum figures, and do not include the cost of professional equipment, about 500 dollars, which the student would utilise in his or her practice.

In the recent report of the University Grants Committee, suggestions were made as to the need for improvements of methods and lecture systems in the universities of Great Britain, and it is therefore timely to learn of the proposals which are being advanced in the case of one of the oldest of the American technical institutions. When addressing the alumni of the Rensselaer Polytechnic Institute on the occasion of his induction, Dr. William Otis Hotchkiss gave an outline of the plans and purposes which, as its new president, he hopes to be able to carry into effect (*R.P.I. Bulletin*, 34, extra to No. 4, Dec. 1935). Dr. Hotchkiss takes 'efficiency' as his ideal, defining it in the best and broadest sense as the use of the time, ability and opportunity of the student, not only in the classrooms but also in the wider activities of life. The time allotted to courses should be properly proportioned between three groups: (a) English and other general subjects such as economics; (b) fundamental mathematics and science; (c) applied engineering subjects. While group (a) is necessarily distinct from the other two, it may well be objected that groups (b) and (c) should not be separated, but that the ideal to aim at is the successful blending of the two. In engineering and other technical courses, mathematical and fundamental scientific principles should be taught and developed on the most logical lines, but should

also be translated, at every stage, directly into their practical applications. A course in accordance with these ideals would require new modes of presentation and of examination, no doubt; but it is in this direction alone that the most efficient use of time and energy, both of teachers and students, may be attained.

Science News a Century Ago

Criminal Statistics for England and Wales

At a meeting of the Statistical Society held on June 20, a paper was read by S. Redgrave on "Some Data on the Present State of Crime in England and Wales". The main object of the paper was to show the proportionate amount and degree of crime in the different counties of England and Wales in 1835. The numbers given only related to persons proceeded against, and not the number of offences committed. The total number of persons charged with indictable offences at the assizes and sessions in 1935 was 20,731—17,275 males and 3,456 females—being in the proportion of 1 in 631 to the population. As a result of the trials, 523 were sentenced to death, 3,629 to transportation, 9,915 to imprisonment, 58 to be whipped, 357 were fined and 242 were discharged on sureties. Of the total, 4,034 were acquitted, and 1,943 discharged without trial.

Sunspots and Temperatures

ON June 23, 1836, *The Times* published the following note: "M. Colomb Menard de Nismes, the French astronomer, states that whenever the sun exhibits spots on its disc, its temperature becomes much colder, and that when the spots are not visible the heat is much greater, and storms are of more frequent occurrence and greater violence. Herschel also came to the same conclusion after more than 20 years observation. . . . Never have so many of these spots been observed as during the present year between February and the end of May. Up to the 22nd of April M. Menard had counted 10 and up to the 19th of May 13, and the season had been remarkable for its coldness."

Museums and Libraries of Vienna

REFERRING to the institutions for the encouragement of science and literature at Vienna, the *Athenæum* of June 25, 1836, said: "These consist of the Imperial Museum of Antiquities, Medals and Coins, including the Egyptian collections; the Museum of Natural History; the Museum of objects specially interesting to the students of history and the arts; the Museum of Arts and Manufactures, and different collections belonging to the University, the Theresian and Chirurgical Academy. All are gratuitously accessible to the public; but certain days and hours are set apart for scientific persons who wish to examine the different collections more minutely than they are enabled to do on public days. Besides the Imperial Library . . . there is a University Library, which possesses 100,000 volumes. The fine private library of the Emperor, an heirloom in the Imperial family, is also accessible to the public. Free admission is given to every person, without any previous application, and no instances have occurred of books being purloined. . . ."

Societies and Academies

PARIS

Academy of Sciences, May 11 (*C.R.*, 202, 1541-1628). LÉON LECORNU: The elasticity coefficients of an anisotropic body. RICHARD FOSSE, PAUL DE GRAEVE and PAUL EMILE THOMAS: The synthesis of cyanic acid by the action of phosgene on ammonia. Phosgene and cold aqueous ammonia give urea only as a secondary product; the primary product is cyanic acid. JEAN BAPTISTE SENDERENS and JEAN ABOULENC: The action of sulphuric acid, in the gaseous phase, on alkyl chlorides and bromides. The monosubstituted derivatives give carbon, hydrochloric acid (or bromine), sulphur dioxide, carbon monoxide and dioxide. Less carbon is formed with the di- and trisubstituted derivatives. Carbon tetrachloride gives phosgene. HENRI LAGATU and LOUIS MAUME: On the possibility of variations in opposite sense and of great amplitude, in the course of the same year, for the nitrogen, phosphorus, potassium equilibrium in the leaf of a cultivated plant. GEORGES PÓLYA: The number of isomers of certain chemical compounds. EUGÈNE BLANC: The distance of two ensembles. ANDRÉ KOLMOGOROFF: The Betti groups of metric spaces. ENRICO VOLTERRA: The deformation of elastic arcs. STEPHAN SERGHIESCO: A mechanical theory of the corpuscle of light. LABARTHE, VICHNIEVSKY and MLE. MANSON: The nature of the vibratory phenomena due to certain combustions of the fluid developed in a thermal motor. HENRI MÉMERY: A solar period of 100 years. ANDRÉ LALLEMAND: The determination in absolute values of stellar magnitudes. ALBERT ARNULF, DANIEL BARBIER, DANIEL CHALONGE and MLE. RENÉE CANAVAGGIA: Colour temperatures and continuous absorption of hydrogen for stars of the first spectral types. MAX GELOSO: The mechanism of the electrolysis of manganese salts. NICOLAS KÜRTI, PAUL LAINÉ, BERNARD VINCENT ROLLIN and FRANZ SIMON: The appearance of ferromagnetism in some paramagnetic salts at very low temperatures. Experiments carried out with the large Bellevue magnet. Ferric ammonium alum, at temperatures below 0.03 K., behaves as a ferromagnetic body. PIERRE JACQUINOT: The Zeeman effect and Paschen-Back effect in the case of the extreme j - j coupling. Example of the $2p^6ns$ configurations of neon. GEORGES ALBERT BOUTRY: Talbot's law in photo-electric photometry. MARC ANTOINE FOËX: Separations by decantations of liquid layers in fused boron-alkaline earth glasses. Proof of differences in the concentration of lime and baryta in the two layers obtained after fusion of boro-lime-baryta glasses. The ratio of the densities of the two layers is constant at a given temperature for all the alkaline earth glasses. JULIEN BRÜLL: Kinetics of the hydration of some cobalt complex compounds. OSIAS BINDER and PIERRE SPACU: The substitution of water for chlorine in the cobaltdichloro-*trans*-diethylenediamine ion. JEAN LOUIS DELSAL: The polarimetric study of aluminium malate. ERNEST TOPORESCU: The preparation of sodium bicarbonate. Reply to a criticism of B. Neumann and R. Domke. JEAN VINCENT HARISPE: 2, 4-Dimethylphenylacetic acid. Its preparation starting with pinonic acid. GUSTAVE VAVON and LOUIS BOURGEOIS: The reactivity and structure of the primary fatty amines. B. BRAJNIKOV: The essential constituent of the Normandy

"argile à silex". V. AGAFONOFF: The red and brown soils with carbonate crust in Tunis. A. ROBAUX: The nummulitic Flysch on the Malaga (Andalusia) transversal. JEAN CHEVRIER: Relations between the electrical conductivity of the air and some meteorological factors at the Observatory of Ksara (Liban). The electrical conductivity of the air was found to increase with the temperature, to diminish as the relative humidity increased. The effects of pressure changes were irregular, with a tendency to a fall in conductivity as the pressure increased. NICOLAS P. PÉNTCHEFF: The proportion of neon in natural gases. Studies of the rare gases obtained from a spring at Kovanlik, Bulgaria. JEAN PIVETEAU: An ancestral form of the tailless amphibians in the lower Trias of Madagascar. ANDRÉ EICHHORN and ROBERT FRANQUET: Chromosomic nomenclature and nuclear evolution in *Koelreuteria paniculata*. MLE. FERNANDE FLOUS: Polyphyletism in the Abietae. JEAN GIAJA and STEFAN GELINEO: Barometric pressure and resistance to cold. The resistance to cold of the rat is reduced when the pressure is reduced to that corresponding to an altitude of 2,000 metres. If the animal is protected against cold, its body temperature can be maintained at much lower pressures. LOUIS LAPICQUE: Remarks on the preceding communication. A warning that the results cannot be applied to man, on account of the difference in size. MLE. MARIE LOUISE VERRIER and RAYMOND PANNIER: Researches on the composition of the retinal purple and its relations with the visual cells. JEAN RÉGNIER and ANDRÉ QUEVAUVILLER: The influence of the suppression of electrolytes, in preservative liquids, on the values of the excitability parameters and on the resistance to the galvanic current of the motor nerve of *Rana esculenta*. RICHARD JAHIEL and MME. SIMONE DELAUNEY: The difference of the action of the polypeptides according to their mode of introduction into the organism. The toxicity of the polypeptides depends on the mode of introduction into the organism. Small repeated daily injections have no toxic effect, but under the conditions of experimental anaphylaxy the toxic effect is large. LOUIS C. MAILLARD and JEAN ETTORI: The distribution of titanium in the organs of man. The amounts of titanium found in eighteen organs are given: no general conclusions can be drawn from the data. GUSTAVE GUITTONEAU and MLE. JEANNE BRIGAND: Resistance to staining acquired by heating of certain microbial bodies in milk. PIERRE LÉPINE and MLE. VALENTINE SAUTTER: The existence in France of the murin virus of lymphocytary chorio-meningitis. ALEXANDRE BESREDKA and LUDWIK GROSS: The nature of the immunity in rabbits vaccinated against epithelioma.

Moscow

Academy of Sciences (*C.R.*, 1, No. 5, 1936. I. VINogradov). A new improvement of the estimation of trigonometrical sums. N. G. CHUDAKOV: Zeros of the function $\zeta(s)$. D. L. SHERMAN: A contribution to the method of N. I. Muschelishvili on the problem of elasticity theory. S. BACHALOV: A couple of congruences. N. MOISEJEV: Probability of stability according to Liapunoff. E. K. ZAVOISKIJ and B. M. KOZYREV: Changes of absorption of weak electric fields of high frequency in certain substances as a function of the strength of these fields (2). V. V. SCHULEJKIN: Origin of the periodic variations of the

regime of Atlantic currents. N. N. MALOV: Measurements of resistance of human bodies, and its connexion with the strength of the current over a wide range of frequencies. K. MISUTCH: Collateral oxidation processes during reduction of nitrogen compounds of the aromatic series. Role of a salt of bivalent iron in the reduction process. A. J. CHARIT and N. V. CHAUSTOV: Flavins and metabolism (5). The effect of the introduction of alloxan and thymonucleic acid into the food of rats on the flavin content in their liver. N. LAZAREV: Distribution in the blood and the intensity of action of anaesthetics. D. KOSTOFF: Studies on polyploid plants (13). Haploid *Nicotiana rustica*. B. VASILJEV: A haploid plant of durum wheat, *Triticum durum* Desf.

SYDNEY

Royal Society of New South Wales, April 1. H. FINNEMORE, S. K. REICHARD and D. K. LARGE: Cyanogenetic glucosides in Australian plants. (3) *Eucalyptus cladocalyx*. It is shown that these leaves, which have long been known to be fatal to animals and to be cyanogenetic, contain as much as 0.6 per cent of hydrocyanic acid, the whole of which may be liberated by autolysis. The acid occurs in the form of the glucoside prunasin, previously found by Finnemore and Cox in *Eremophila maculata*. A simplified process for its isolation is now described. The powdered leaves are percolated with cold acetone, the acetone extract washed with petroleum ether, the purified residue extracted with boiling ethyl acetate, from which the glucoside separates on cooling, especially if a little chloroform be added to the solution. The yields are very good. R. D. WILSON: A bacterial disease of snake beans. The occurrence of a bacterial disease of snake beans (*Vigna sesquipedalis*) in New South Wales in 1935 is recorded. The results of comparative studies between the causal organism and cultures of the cowpea spot, lilac blight and citrus pit organisms are given. Differences were observed only in the fermentation of raffinose and in the degree of pathogenicity to various hosts. It is proposed that the snake bean pathogen should be designated *Bacterium syringae* (van Hall) E. F. Smith. A 'rough' strain of the snake bean pathogen is described. The disease was shown to be seed-borne. ADOLPH BOLLIGER: A new reaction for the determination of creatinine. A ten per cent solution of 3.5 dinitro-sodium-benzoate and normal sodium hydroxide are added to the fluid to be examined. If creatinine is present in a concentration of more than 5 mgm. per cent, immediately after adding the sodium hydroxide a purple colour will appear which deepens considerably on further standing. After about 15 minutes, the colour will change towards red or pink, and will ultimately become yellow. If the concentration of creatinine is less, it will take 5-15 minutes for the colour to appear. The colour reaction can be used, with a colorimeter, for quantitative estimation of creatinine.

WASHINGTON, D.C.

National Academy of Sciences (*Proc.*, 22, 195-247, April 15). FRED L. WHIPPLE and CECILIA PAYNE GAPOSCHKIN: On the bright line spectrum of Nova Herculis. On July 4, 1935, two components were observed. Spectrographically, certain lines were doubled, corresponding to the two components. It

is considered that two gaseous masses of low density were ejected from the central star; the former give rise to the doubled bright lines and the latter to the continuous background. CARL D. LARUE: Tissue cultures of spermatophytes. Pieces so small as 0.5 mm. in length from immature embryos of dandelion, ox-eye daisy, wild lettuce and tomato have been grown in culture to complete plants. It is believed that it is important to use tissue which has recently been differentiated; the presence of growth hormone (auxin) and agar-agar with the nutrient solution also favour growth. LINUS PAULING and CHARLES D. CORYELL: The magnetic properties and structure of hæmoglobin, oxyhæmoglobin and carbonmonoxyhæmoglobin. Magnetic measurements show that oxy- and carbonmonoxyhæmoglobin contain no unpaired electrons (free oxygen has two); hence oxygen undergoes a profound change in electronic structure on attachment to hæmoglobin. New nomenclature, based on recent data, is suggested for hæmoglobin and related compounds. HANS BAUER: Structure and arrangement of salivary gland chromosomes in *Drosophila* species. W. E. CASTLE: Further data on linkage in rabbits. Cross-over percentages for the two linked genes for rex (short coat) and also for the three linked genes, albinism, yellow fat and brown pigmentation, have been determined. Crossing-over in one region of a chromosome 'interferes' with crossing-over in another region, as in *Drosophila*. LEONARD M. BLUMENTHAL: The metric characterisation of a class of spaces. NORMAN LEVINSON: On the non-vanishing of certain functions. W. W. COBLENTZ and R. STAIR: The evaluation of ultra-violet solar radiation of short wave-lengths. The most recent method employs a titanium photo-electric cell calibrated against a standard of ultra-violet radiation. A radiant flux is observed, by this and older methods, almost twice as large as that calculated from early observations of the ultra-violet spectral energy curve. The average intensity of ultra-violet solar radiation of wave-length 3132 Å. and less in the clearest midsummer weather at midday in Washington, D.C., is 75 microwatts per cm.²; the corresponding figure for San Juan (there is less ozone in the stratosphere at the tropics) is 95 microwatts per cm.². Extrapolation of all the data indicates an intensity of 600 microwatts per cm.² outside the solar atmosphere; this is a 5-8-fold increase, as compared with a 20-30 per cent increase in total solar intensity of all wave-lengths. A. A. ABRAMOWITZ: The double innervation of caudal melanophores in *Fundulus*. A large group of fish, in each of which a band of melanophores was denervated by an incision in the tail, was kept in an illuminated black tank for a fortnight. Each fish was then removed periodically to a white background for 10 minutes or stimulated electrically, and the melanophore condition recorded photographically under the microscope. The fish was replaced on a black background for 10 minutes and the same area rephotographed. Some cells showed full contraction but not full expansion, others neither contraction nor expansion, suggesting regeneration of two sets of nerves, discrete and opposite in action. ROSS G. HARRISON: Relations of symmetry in the developing ear of *Amblystoma punctatum*. Axes of symmetry become fixed at different stages, at which also other tissue determinations occur. W. G. CLARK: Errata to the paper "Note on the effect of light on the bio-electric potentials in the *Avena* coleoptile" (*NATURE*, Feb. 29, 1936, p. 373).

Forthcoming Events

Thursday, June 25

ROYAL SOCIETY, at 4.30.—Prof. F. S. Kipping, F.R.S.:
"Organic Derivatives of Silicon" (Bakerian Lecture).

ASSOCIATION OF TECHNICAL INSTITUTIONS, June 26–27.—
Annual Summer Meeting to be held at Bath.

Official Publications Received

Great Britain and Ireland

Stonyhurst College Observatory. Results of Geophysical and Solar Observations, 1935; with Report and Notes of the Director, Rev. J. P. Rowland. Pp. xx+46. (Blackburn: Stonyhurst College Observatory.) [195]

Conference of Empire Survey Officers, 1935. Report of Proceedings. (Colonial No. 111.) Pp. vi+377+36 plates. (London: H.M. Stationery Office.) 20s. net. [195]

Department of Scientific and Industrial Research. Forest Products Research Records, No. 9 (Wood Preservation Series, No. 2): Methods of Applying Wood Preservatives. Part 1: Non Pressure Methods. By J. Bryan. Pp. 17. (London: H.M. Stationery Office.) 6d. net. [195]

Technical Publications of the International Tin Research and Development Council. Series A, No. 36: Factors Influencing the Rate of Attack of Mild Steels by Typical Weak Acid Media. By Dr. T. P. Hoar and D. Havenhand. Pp. ii+27. Free. Series A, No. 37: Methods of Detinning Tinplate for Examination of the Thickness and Continuity of the Alloy Layer. By A. W. Hothersall and W. N. Bradshaw. Pp. ii+10. Free. Series A, No. 38: A Study of the Origin of Porosity in the Tin Coating of Tinplate. By A. W. Hothersall and J. C. Prytherch. Pp. ii+15. Free. (London: International Tin Research and Development Council.) [205]

Rubber Latex. By Dr. Henry P. Stevens and W. H. Stevens. Fourth edition. Pp. 224+11 plates. (London: Rubber Growers' Association.) [215]

Empire Cotton Growing Corporation. Report of the Administrative Council of the Corporation submitted to the Fifteenth Annual General Meeting on May 20th, 1936. Pp. ii+65. (London: Empire Cotton Growing Corporation.) [215]

Annual Report of the Zoological Society of Scotland for the Year ending 31st March 1936. Pp. 62+8 plates. (Edinburgh: Zoological Society of Scotland.) [215]

Royal Observatory, Edinburgh. Forty-sixth Annual Report of the Astronomer Royal for Scotland, 1935. Pp. 8. (Edinburgh and London: H.M. Stationery Office.) 2d. net. [215]

British Trust for Ornithology. Second Report, Spring 1936. Pp. 24. (London: British Trust for Ornithology.) [225]

Ministry of Health. Costing Returns: Year ending 31st March 1935. Part 2: Poor Law Institutions; Separate Casual Wards. Pp. 27. (London: H.M. Stationery Office.) 1s. 3d. net. [225]

Board of Education. Report of the Advisory Council of the Science Museum for the Year 1935. Pp. 63+2 plates. (London: H.M. Stationery Office.) 1s. net. [225]

The University of Leeds: Department of Leather Industries. Report of the Advisory Committee on the Work of the Department during the Sessions 1928–29 to 1934–35. Pp. 11. (Leeds: The University.) [255]

The British Science Guild. Gabrielle Howard Memorial Lecture: Telegraphs and Telephones. By Prof. W. L. Bragg. Pp. iv+48+3 plates. (London: British Science Guild.) [265]

The Scientific Journal of the Royal College of Science. Vol. 6: containing Papers read during the Session 1935–1936 before the Imperial College Chemical Society, the Royal College of Science Natural History Society, the Royal College of Science Mathematical and Physical Society. Pp. 136. (London: Edward Arnold and Co.) 7s. 6d. [265]

Rubber Growers' Association. Rubber and Agriculture Series, Bulletin No. 1: Pneumatic Equipment for Farm Tractors. By Alexander Hay. Pp. 18. (London: Rubber Growers' Association.) Free. [275]

Department of Scientific and Industrial Research. Summary of Progress of the Geological Survey of Great Britain and the Museum of Practical Geology for the Year 1934. Part 2. Pp. iv+65+4 plates. (London: H.M. Stationery Office.) 1s. 6d. net. [275]

Other Countries

Iwata Institute of Plant Biochemistry. Publication No. 2: Katalytische Wirkungen der Metallkomplexverbindungen. Von Prof. Keita Shibata und Prof. Yuji Shibata. Pp. xiv+219. (Tokyo: Maruzen Co., Ltd.) 2.50 dollars. [155]

Canada: Department of Mines: Mines Branch. Analyses of Canadian Crude Oils, Naphthas, Shale Oil and Bitumen. By P. V. Rosewarne, H. McD. Chandler and A. A. Swinnerton. (No. 765.) Pp. vi+21. (Ottawa: King's Printer.) 10 cents. [185]

Norske Videnskaps-Akademi i Oslo. Geofysiske Publikasjoner, Vol. 14, No. 1: Mittel und Extreme der Lufttemperatur. Von B. J. Birkeland. Pp. 155. (Oslo: Grøndahl and Sons Boktrykkeri.) 15.00 kr. [185]

Industrial Development in South Africa and Facilities for the Establishment of Factories. (Published by the Department of Commerce and Industries.) Pp. xvi+235. (Pretoria: Government Printer.) 1s. [195]

Organon: International Review. Vol. 1. Pp. vii+304. (Warsaw: Mianowski Institute for the Promotion of Science and Letters.) [185]

Observatoire de Paris: Section d'Astrophysique à Meudon. Cartes synoptiques de la chromosphère solaire et catalogue des filaments de la couche supérieure. Par L. D'Azambuja. Vol. 1, Fasc. 4, Année 1934. Pp. 32. (Meudon: Observatoire de Paris.) [215]

Royal Agricultural Society, Egypt. Bulletin No. 24 of Technical Section and No. 2 of Royal Agricultural Society and Imperial Chemical Industries, Ltd. Joint Agricultural Research Scheme: Experiments in Egypt on the Interaction of Factors in Crop Growth. 2a: Residual Effects of Nitrogenous Manuring and Spacing of the Cotton Crop on the Following Wheat Crop; 2b: Inter-relation of Nitrogenous Manuring, Variety and Spacing for the Wheat Crop. By Dr. Frank Crowther. Pp. 35. (Cairo: Royal Agricultural Society.) [215]

State of Connecticut. Public Document No. 24: Fifty-eighth Report of the Connecticut Agricultural Experiment Station, New Haven, for the Year 1934. Pp. xii+713. (New Haven, Conn.: Connecticut Agricultural Experiment Station.) [225]

Bulletin of the American Museum of Natural History. Vol. 71: The American Land and Fresh-Water Isopod Crustacea. By Willard G. Van Name. Pp. vii+535. (New York: American Museum of Natural History.) [225]

Conseil International des Unions scientifiques. Quatrième rapport de la Commission pour l'étude des relations entre les phénomènes solaires et terrestres. Pp. 159. (Firenze: Conseil International des Unions scientifiques.) [225]

Smithsonian Miscellaneous Collections. Vol. 95, No. 5: Molluscan Intermediate Hosts of the Asiatic Blood Fluke, *Schistosoma japonicum*, and Species confused with Them. By Paul Bartsch. (Publication 3384.) Pp. ii+60+8 plates. (Washington, D.C.: Smithsonian Institution.) [255]

U.S. Department of the Interior: Office of Education. Bulletin, 1935, No. 15: Reorganization of School Units; a Report of the Proceedings of a Conference called by the Commissioner of Education, Washington, D.C., June 17, 18 and 19, 1935. Edited and compiled by Katherine M. Cook. Pp. iii+91. 10 cents. Bulletin, 1936, No. 18—II: Youth—Leisure for Living. By Katherine Glover. Pp. vii+126. 15 cents. (Washington, D.C.: Government Printing Office.) [255]

Canada: Department of Mines: Mines Branch. Petroleum Fuels in Canada; Deliveries for Consumption, Calendar Year 1934. Prepared by John M. Casey. (No. 772.) Pp. ii+20. (Ottawa: King's Printer.) 10 cents. [255]

Indian Forest Records (New Series). Vol. 1, No. 2: A Study of the Soils in the Hill Areas of the Kulu Forest Division, Punjab. Part 1: An Investigation of Soil-Profiles under Deodar, Spruce, Blue Pine and Chir. By E. McKenzie Taylor, I. D. Mahendru, M. L. Mehta and R. C. Hoon. Pp. 289–346+3 plates. (Delhi: Manager of Publications.) 2.2 rupees; 4s. [255]

Stanford University Publications: University Series. Biological Sciences, Vol. 2, No. 8: Contributions toward a Monograph of the Sucking Lice, Part 8. By Prof. Gordon Floyd Ferris. Pp. 108+3 plates. 1 dollar. Contributions from the Dudley Herbarium of Stanford University. Vol. 1, No. 6: A Report on several Species of *Lycium* from the Southwestern Deserts. By Ira L. Wiggins. Pp. 195–206+2 plates. (Stanford University, Calif.: Stanford University Press; London: Oxford University Press.) [255]

Union of South Africa: Department of Agriculture and Forestry. Bulletin No. 155 (Chemistry Series No. 142): The Rising of Fat in Milk in the Course of Delivery. By Dr. L. Denis-Lester. Pp. 6. Bulletin No. 157 (Chemical Series No. 144): Influence of Period of Lactation on the Freezing Point of South African Milk. By Dr. L. Denis-Lester. Pp. 8. (Pretoria: Government Printer.) [255]

Union of South Africa: Department of Mines: Geological Survey. The Geology of Ventersdorp and adjoining Country: an Explanation of Sheet 53 (Ventersdorp). By Dr. Louis T. Nel, H. F. Frommurge, J. Willems and Dr. S. H. Houghton; with a Chapter on the Diamondiferous Alluvials, by Dr. A. L. du Toit. Pp. 102. (Pretoria: Government Printer.) 5s., including Map. [265]

Proceedings of the United States National Museum. Vol. 83, No. 2933: Notes on the Butterflies of the Genus *Enodia* and Description of a New Fritillary from Peru. By Austin H. Clark. Pp. 251–259. (Washington, D.C.: Government Printing Office.) [275]

U.S. Department of Agriculture. Technical Bulletin No. 498: The Flour Beetles of the Genus *Tribolium*. By Newell E. Good. Pp. 58. (Washington, D.C.: Government Printing Office.) 10 cents. [275]

Smithsonian Miscellaneous Collections. Vol. 95, No. 6: New Species of American Ecdioasteroidea. By R. S. Bassler. (Publication 3385.) Pp. 33+7 plates. Vol. 95, No. 7: The Gold-Banded Skipper (*Rhabdoidea cellus*). By Austin H. Clark. (Publication 3386.) Pp. 50+8 plates. (Washington, D.C.: Smithsonian Institution.) [275]

Catalogues

Books and Manuscripts on Genealogy, Heraldry, Archaeology, Architecture, Armour, Brasses, Cathedrals, Charters, Domesday, Maps, Mediaeval History, Numismatics, Place-Names, Records, Stained Glass, Views, etc., embracing the Genealogical and Heraldic Portion of the Library of the late W. Bruce Bannerman. (No. 201.) Pp. 36. (Leicester: Bernard Halliday.) [275]

A Supplement of Scientific Books. No. 1. Pp. 24. (Cambridge: W. Heffer and Sons, Ltd.) [275]

Dr. Ashworth's Ultra-Violet Ray Meter. Pp. 2. (London: Negretti and Zambra.) [275]

The New Hilger Wavelength Spectrometer: with a Complete Range of Co-ordinated Accessories forming Spectrometers, Spectrographs, Monochromators and Spectrophotometers for the Visible, Ultra-Violet and Infra-Red. (Publication No. 241.) Pp. 54. (London: Adam Hilger, Ltd.) [275]

The Educational Focus. Vol. 7, No. 2, June 1936. Pp. 24. Bausch and Lomb Magazine. Vol. 12, No. 2, May 1936. Pp. 24. (Rochester, N.Y.: Bausch and Lomb Optical Co.) [275]

Watson's Microscope Record. No. 38, May 1936. Pp. 24. (London: W. Watson and Sons, Ltd.) [275]

Zeiss Nachrichten. Heft 10, Januar 1936. Pp. 48. (Jena and London: Carl Zeiss.) [275]