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Physiology in General Education

UNTIL within very recent times, the study of the human body was practically solely the concern of physiological departments in medical schools. Undergraduates outside the medical curriculum had no opportunity of studying human physiology, and the people of Great Britain as a whole seemed well content to leave the control of their lives with respect to health and disease to the guidance of the medical profession. Thus, when 'science' was first introduced into the schools, educationists turned to chemistry and to physics, and, even to-day, such biology as is taught in schools deals almost wholly with plants and lower animals. That "the proper study of mankind is man" was the keynote of the discussion on "Physiology in General Education" in Section I (Physiology) of the British Association during the recent Nottingham meeting.

All the speakers in the discussions were unanimous that this loss of contact between human physiology and general education is a misfortune, not only for a modern democracy but also for physiology itself. Experimental psychology, which, as practised to-day, is but a branch of experimental physiology, has hived off from physiology, largely due to the absorption of physiologists in the needs of medical students. Biochemistry is shifting its camp from physiology to organic chemistry probably for the same reason.

This unfortunate lack of facility for study of human physiology in British universities reacts on school education and on adult education. The future school teacher has to rely almost wholly on training centres for instruction in human physiology and hygiene. These facilities, although admirable in many cases, are not to be compared with those already in being in our universities.

The end-result is that the content of physiological knowledge of the 'man in the street', and even of his legislators, is at a dangerously low level.

Moreover, whenever there is loss of contact between the practising scientific investigator and the public, there arises inevitably the risk of loss of understanding and of sympathy. The agitation against vivisection is very largely due to ignorance, on the part of the public, of physiological practice, and of the vital part played by physiological research in everyday life.

But the physiologist is not the only sufferer. From the cradle—and even earlier—to the grave, physiological first principles affect our health and well-being. In a modern civilized community it is no longer possible to rely solely on the bounty of Nature for our food and proper nourishment, or on our natural instincts for the conduct of our own and others' lives. The public, crassly ignorant for the most part of the elementary facts about the human body, ignores the simplest dietetic principles, falls victim to the specious advertisements of the vendors of fortified foodstuffs and of quack nostrums, and blindly follows the fatuous dictates of the latest fashion. Moreover, as one speaker in the discussion at Nottingham emphasized, all propaganda and legislation in the interests of public health must of necessity lose the greater part of their effectiveness if the public is incapable of appreciating the significance of, and reasons for, such activities.

After the comments made by Mr. H. G. Wells upon the teaching profession at this meeting of the British Association, it might have been expected that school teachers would not be in a mood to suffer tamely further suggestions from amateur, as

distinct from professional, educationists. Nevertheless, there was no protest at the suggestion that, to make way for the necessary instruction in human physiology, either some subject at present in the school curriculum would have to be dropped or a compromise effected by using human physiology as an introduction to, and a vehicle for, the teaching of general biology. It was pointed out that it is a sound pedagogic principle to proceed from the known, or at least the familiar, to the unknown. Study of the human body and of its functions is an admirable introduction to the study of other forms of life and of biological principles in general. Moreover, human physiology gives great scope for practical work with the minimum of apparatus; in short, it is good science, good biology and admirably adapted to school instruction.

Although the day is long past when all mention of human structure and of human function was taboo, yet some fear was expressed during the discussion that teaching of human physiology might lead to unhealthy self-consciousness and introspection on the part of the pupils. The

general opinion seemed to be, however, that such a danger is more likely to arise in the course of unofficial health talks conducted by enthusiastic but unskilled instructors than in routine school teaching. Indeed, Prof. Winifred Cullis, from her wide experience, believes that school instruction in human physiology, so far from inducing morbid preoccupation with the functions of the body, would rather tend to ventilate and bring into the unemotional atmosphere of the schoolroom, and thus into proper perspective, many matters which, even to-day, the modern child is shy of discussing with its elders.

The meeting was a very large one for a purely sectional discussion, and the fact that the practising physiologists were in an extremely small minority is an indication of the widespread interest the subject aroused. From every point of view it was unfortunate that a joint discussion with Section L (Educational Science) could not be arranged, for the time has clearly arrived when the place of physiology or human biology in school science courses must be given serious attention.

Registration and Privilege

THE extent to which the principles of 'free trade' are inbred in the people of Great Britain is well illustrated by the statutory provisions governing the registration of medical practitioners and pharmacists. For both professions the State establishes standards of education and examination, with a statutory register of those who reach them. To permit the public to differentiate between the qualified and the unqualified practitioner, the use of titles implying registration is prohibited and the signing of death certificates, the sale of poisons, and other minor matters are controlled. But in both medicine and pharmacy the practice of the calling by unregistered men has few statutory limitations.

By way of contrast, the lawyer is well protected. It is a statutory offence for a layman to practise as a solicitor, and in the High Court His Majesty's judges will neither see nor hear the advocate who is not a barrister. Accountants and architects have certain titles reserved to them, but few other statutory privileges. The high-water mark of protection for a calling is probably that given to dentists, the Dentists Act of 1921 making

it an offence for the unregistered to "practise dentistry".

Many attempts have been made in recent years to persuade Parliament to regulate the practitioners of a calling by means of a statutory register and to provide statutory privileges for the registered. The destruction of the Osteopaths Bill exemplifies the fate of such attempts. It is in the totalitarian States that there will be found the modern examples of restrictive legislation for the control and benefit of individual callings and their protection from competition. Whether the price to be paid compensates for the advantages, even to the sheltered practitioner himself, is a question the answer to which depends upon the temperament of the individual. The majority of the people of Great Britain are not temperamentally inclined to a régime of professional corporations, even for personal benefits, and that spirit is reflected in the attitude of Parliament towards Bills proposing to accord privileges to closed professions.

Nevertheless, there is a price to be paid for freedom. In the medical and pharmaceutical fields the price is the exploitation of the public by the

quack. Probably at no time in history has the British public provided so rich a field for the pseudo-scientific medicine-man with his tale of vitamins and hormones, rings, belts and exercises, massages and diets. *The Times* publishes its National Health Number, with the dominant note of healthy exercise outdoors, while from every hoarding, bus and tram an attempt is made to mesmerize the public into mass drugging.

A year ago, when the House of Commons was

invited to discuss this question on the second reading of the Medicines and Surgical Appliances (Advertisement) Bill, the House was counted out. It is small wonder that with public opinion so docile, the proprietary medicine industry was able to claim before the Select Committee on Medicine Stamp Duties in December last that the capital in the industry is £100,000,000, and that it spends between £12,000,000 and £15,000,000 annually in advertising its wares.

Air Raid Precautions

Air Defence and the Civil Population

By Dr. H. Montgomery Hyde and G. R. Falkiner Nuttall. Pp. xvi + 239 + 8 plates. (London: The Cresset Press, Ltd., 1937.) 12s. 6d. net.

THIS book has been written for the benefit of the 'man in the street'. It contains a moderate statement of the various risks to which the ordinary citizen may be subjected in an aerial bombardment, and explains the most effective methods of providing protection against them—collective, individual and structural.

The authors are generally in agreement with the recommendations made by the Air Raid Precautions Department of the Home Office, but they submit certain criticisms, the chief of which is the ineffectiveness of its propaganda, as public interest in the subject has not been aroused, nor has readiness on the part of the public to co-operate in defensive measures been achieved to the extent which both the seriousness of the international situation and the progress of military preparations throughout Europe plainly demand. They consider that, in the circumstances, instruction in passive defence should be as integral a part of the life of the nation as vaccination and the registration of vital statistics.

In striking contrast with this apparent apathy, the developments that have taken place in all Continental countries—including Holland and the Scandinavian group which were neutral in the Great War—are briefly summarized. In Germany, Italy and Russia a standard knowledge of anti-gas precautions is obligatory, and the whole civilian community is compelled to co-operate with the authorities in experiments of different kinds. 'Black-outs' are of common occurrence in all the chief cities, and the most realistic conditions are created, including the intentional bursting of water and gas mains and the daubing with red paint of the 'casualties' before they are

removed in the ambulances, in order to reproduce the situation that may have to be dealt with: everybody must take cover on the air raid warning being given, and even foreign tourists are punished if they disobey any of the orders. Public shelters are being built and municipal buildings strengthened, while in all important business premises and factories the provision of protection for the employees is compulsory. In Italy, instruction in passive defence measures is given from a series of gramophone records which are sold at specially reduced prices; while in Russia, General Eideman, the head of the Air Defence Department, was among the generals who were recently shot in Moscow, the official explanation given being that his organization was 'on the down grade'!

In Czechoslovakia a law has recently been enacted compelling all housing contractors to provide bomb-proof shelters in the cellars for the protection of their tenants; and in France, where the experience gained in the construction of the Maginot line has been of particular value, a Bill has been passed empowering the Government to evacuate the civilian population where necessary, and to build bomb- and gas-proof shelters: in the Seine Department alone, £1½ millions were voted two years ago to finance air raid precautions.

While all these measures are accepted by our neighbours with enthusiastic co-operation, our own lack of interest is all the more remarkable as we are exceptionally vulnerable to attack, and the outstanding characteristic of future air raids is that they may come suddenly and unexpectedly and may well precede any formal declaration of war. (When a practice 'black-out' was suggested in Brighton a few days ago an alderman was reported to have protested against frightening the visitors, while a councillor described the proposals as "this air raid nonsense".)

The authors are, however, by no means alarmist in their conclusions. They consider that poison gas should not be regarded as the deadliest weapon in the hands of a potential enemy; and that the heaviest type of high-explosive bombs against which, we are told, a roof covering of 12-15 feet of reinforced concrete is necessary, are so costly and the number that can be carried by aircraft so small, relatively, that their use in war will be confined to special objectives, and they will not be deliberately employed against the civil population. Incendiary bombs are now believed to constitute the greatest danger to civilian communities, as the agents available are greatly superior to those employed in the early Zeppelin raids on London, which proved to be very disappointing to the attackers in the results achieved. While certain public services, such as central telephone exchanges, must be protected from interruption at all costs, gas- and splinter-proof protection is all that should normally be aimed

at for private houses, after all inflammable materials have been removed from the attics.

This book is written in simple language, and should be widely read: a great deal of industry has been required to collect the material necessary for its compilation and the matter is well arranged. It is well established that the Italians used mustard gas in their Abyssinian campaign, but it will be news to most people in Great Britain that gas has been used by both sides in the civil war in Spain. The authors seem to have access to sources of information not supplied to, or at any rate not published by, our newspapers, so it is to be hoped that in future editions of their work details will be given of the effects produced and of the types and weights of the projectiles that are being used in the aerial bombardments there, as these are possibly being 'tried out' by nations who may be engaged in the next European conflict, if any, when it overtakes us.

C. H. F.

The Problem of the Portolan Charts

Hallucinations scientifiques (les portulans)
Par le Prince Youssouf Kamal. Pp. 96 + 39 plates.
(Leiden: E. J. Brill, Ltd., 1937.) n.p.

PRINCE YOUSOUF KAMAL is known not only as the owner of an unusually fine collection of early maps, brought together with little regard to cost, but also as a keen student of their history, so that anything written by him on the subject merits attention. His big folio volumes containing, or to contain, facsimiles of all the most important early maps of Egypt or of Africa as a whole (with which, as an Egyptian, he is specially interested) are monuments of sumptuous reproduction. The present work claims no such importance, and one cannot help wishing that he had waited to give a systematic discussion of the old Portolan Charts and their origin, for he should be well qualified to undertake such a study. As it is, the work is somewhat scrappy and disjointed, its main object being to combat the theory put forward by a recent writer, Prof. J. H. Kramers of Leyden, who believes that the nautical charts produced in the Western Mediterranean, which make their first known appearance, already in fully developed form, about A.D. 1300, owed much to previous work of the kind in the East, especially that of the Arab geographers El Bakri and Edrisi. It is this to which the term "Hallucinations" of the title is applied.

One must allow that no convincing arguments have been produced in support of the theory, and Prince Kamal's counter-arguments will no doubt on the whole meet with approval, though perhaps open to criticism in some particulars. He holds that the charts were first produced, in the West, to meet the practical needs of sailors in that part of the world, at a time when trading voyages began to be extended farther afield than previously—the north coasts of Africa for example. He has no difficulty in showing that the point of view of men like El Bakri and Edrisi was quite different from that of the chart-makers, their descriptions being almost entirely based on land-routes. As the appearance of Arabic names on the charts of previous Western literature having mostly adopted those of the Greeks and Romans—this was an obvious necessity if the charts were to be of practical value. This may be conceded, but surely does not follow, as Prince Kamal seems to imply, that nothing in the way of charts, distinct from sailing directions, had been used in the East previous to about 1300. Similar results might be expected to produce a similar help.

Prince Kamal also rejects the idea that the wind-roses of the charts, with the elaborate system of radiating lines, may be an indication of Eastern (perhaps Greek) influence. He holds that the chief object of the lines was not that of direction-pointers, but of helping the draughtsman

copy his sources, like the 'squaring' used by modern map-makers. Curiously enough, he seems almost to regard the figures produced by the intersection of the lines as the reason for drawing them, instead of being merely an incidental result.

The general tone of the work, and the occasional long and somewhat involved sentences, make it a little difficult to grasp the writer's motive in producing it, for he begins by stressing the small likelihood there is of arriving at any conclusion—one section is actually headed "Conclusion (sans conclusion)". Similarly, he thinks that no good result can be gained by a detailed comparison of the respective contents of the charts and the Oriental works, yet he is at great pains to supply the material for such a comparison, for the sake

of such as wish to make it. This forms the most substantial part of the work, including not only reproductions of the North African portions of the most important early maps down to and including the Portolan Charts, but also comprehensive lists of names, distances, and geographical co-ordinates derived from the early literature, both Eastern and Western. This part will supply a useful basis for study to those who may not have access to the bigger works in which the field had been covered previously to some extent.

On one point at least one may cordially agree with the author—that relative accuracy in a map is no proof that it is later in date than another, as is too often assumed. It is not to be thought that every map-maker would be conversant with all the best work of his predecessors.

E. H.

Fundamentals of Zoogeography

General Zoogeography

By Prof. V. G. Heptner. (In Russian.) Pp. 548. (Moscow and Leningrad: Gosudarstvennoe Izdatelstvo Biologicheskoi i Medizinskoi Literatury, 1936.) 13.50 roubles.

THE recent rapid advances in the study of animal ecology, historical geology and palæoclimatology are making inadequate the old formal zoogeography, which consisted mainly in the accumulation of distributional facts and in the parcelling out the earth's surface into rigidly defined zoogeographical regions, provinces, etc. An urgent necessity for revising the fundamental conceptions and methods of zoogeographical research, in order to bring it into line with allied sciences, is felt by all biologists working on distributional problems, whose aim is not merely to register facts, but also to find the most probable scientific theories accounting for their origin. There is no lack of attempts at such revisions, but none of them can be considered sufficiently balanced. Usually there is a distinct bias either towards pure ecology, which is taken to provide a complete explanation of all distributional facts, or the stress is laid on geological history, and very ingenious theories are built on an incomplete foundation.

The book under review represents another attempt of this kind and certainly a very successful one. The first part contains a most instructive introduction to the subject-matter of modern zoogeography and a clear representation of basic ecological principles, namely, factors of existence,

ecological valency, optimum and pessimum, habitat concept, biological types (life-forms) and biocænoses. The second part is devoted to a more detailed analysis of the environment and of environmental factors, both in water and on dry land, and ends with a classification of the main ecological formations (biotops) of dry land, with their characteristic faunas. The problems of the dispersal of animals and of the area of a species occupy the longest, and the best, part of the book, where special attention is given to various types of discontinuity and their origin. The final (fourth) part deals with comparative zoogeography, that is, with brief descriptions of the different zoogeographical regions, and has special sections on the fauna of the U.S.S.R., and of the seas.

The most valuable quality of the book is the abundance of reliable and fresh facts most carefully collected from an immensely scattered literature. In this respect, the author can be criticized only for paying too much attention to vertebrates and for neglecting to a certain extent the literature on invertebrates, more particularly on insects, where a great amount of very valuable data has been recently accumulated with the development of modern ecological trends in entomology.

Amongst other points deserving to be mentioned in a critical review is the omission of the consideration of palæoclimatic factors in the evolution and movements of animal populations. One may not accept without reservation the Koeppen-Wegener schemes of displacements of climatic zones in the

past, but they should be at least mentioned in a book of this kind. Another weak point is the lack of discussion on ecoclimates of the actual animal habitats, which very often enable an animal to survive in a region the general climate of which is wholly unsuitable for it.

On the whole, however, the book represents an outstanding contribution to the development of

biogeographical science, and it is a matter of regret that its language will make it inaccessible to most workers and students outside Russia. Biogeography is now entering a period of intense development and there is no text-book in any language that could be recommended more thoroughly than the present one.

B. P. UVAROV.

Latin Clarity and the Sciences of Life

Encyclopédie française

Tome 4: La vie. Dirigé par André Mayer. Pp. 582. (Paris: Société de gestion de L'Encyclopédie française; Libr. Larousse, 1937.) n.p.

THE great difficulty confronting all those who wish to give a connected account of the sciences of life is that of steering between the Scylla of excessive popularity and the Charybdis of technicality. Where certain special but fundamental sciences are concerned, such as biochemistry and genetics, the relative unfamiliarity of their concepts to the general reader leads to a failure to do them justice and hence to an unfair emphasis. The present volume of the French Encyclopædia, in which some fifty French scientists have collaborated to describe the main outlines of the sciences of life, seems to overcome these difficulties better than any English book. The excellent "Animal Biology" of Haldane and Huxley is very short, while the two-volume "Life" of Thomson and Geddes suffers particularly from the failure just referred to.

The book now under review gives a good initial impression, for its several fascicules are bound in loose-leaf style, suggesting that new ones may be issued as important advances occur, to take the place of some of the present ones. After a quite striking frontispiece, which represents a binocular microscope against the background of a monster Purkinje cell, the book opens with a section on the cosmic setting of life, its chemical actions on the outer world, and such subjects as the cycles of carbon, nitrogen and other elements. The second section deals with the constitution of living organisms. Concise accounts of the colloidal state, of the main groups of chemical substances from which living matter is built up, and of the actions of enzymes, are given. Section 3 is entitled "The Structure of Living Beings", and is devoted to experimental cytology, the equilibrium of the cell with its environment, etc.; Section 4, "The Actions of Living Beings", deals with movement,

adhesion, phagocytosis, luminescence, muscular contraction, ciliary movement and similar topics. In Section 5, "The Forms of Life", a wide survey of comparative physiology shows how morphology and function are intertwined in many groups of animals, and Section 6, "The Maintenance of Life", discusses metabolism, reflexes, the fixity of the internal medium, cicatrization, regeneration, etc. Latent life, radiation effects, chemical agents and immunity have a section to themselves under the head of "Repairs and Alterations in Living Organisms", while the book ends with a section on the transmission of life in which the whole of embryology and genetics are passed under review.

The outstanding impression left by the work is one of clarity and logic. The arrangement of the sections is unusually clearly thought out, although the comparative anatomy of animals and plants is throughout in the background, though it would follow from the predominantly physiological outlook with which the book is written. Where such a broad canvas has so successfully been painted, it would be almost pettifogging to complain of the confusingly wrong formula for vitamin B₁ on p. 4.12-5 or of the persistent absence of magnification data in the illustrations, so that a guileless reader might obtain almost any fantastic idea of the sizes of the biological objects shown. But it must be admitted that some of the sections, perhaps especially those on oxidation-reduction and fermentation, give the impression of having been written about ten years ago. One might also suggest that the formulæ of substances should be given where their physiological functions are discussed, or at least a cross-reference inserted, for example, adrenaline and acetylcholine on p. 4.36-15, auxin on p. 4.60-9. In general, however, the book will be of immense value to all Frenchmen of reasonable intelligence who wish to gain an accurate view of modern biology, and it is a pity that Englishmen will not be able to share with them unless someone should attempt the heavy task of a translation. JOSEPH NEEDHAM.

Interracial Marriage in Hawaii :
a Study of the Mutually Conditioned Processes of
Acculturation and Amalgamation. By Romanzo
Adams. Pp. xviii+353+11 plates. (New York :
The Macmillan Co., 1937.) 18s. net.

STUDENTS of the inter-relationships between groups of people of different racial and cultural origins have long been interested in Hawaii, "the melting-pot of the Pacific", where Americans, Japanese, Chinese, Filipinos, Portuguese, native Hawaiians and others have worked out a *modus vivendi* with, apparently, the minimum of friction. Dr. Adams has given us an elaborate and well-documented analysis of this situation.

An examination of the present racial composition of the population and degree of race mixture is followed by a series of investigations of the component groups and the part they play in the communal life. Valuable correction of census material is embodied throughout. A most interesting section deals with the social background of interracial marriage. There is no general theory of racial inequality or any organized public sentiment against intermarriage between members of the different racial groups. Personal and family sentiment against it is shown to exist, but it is argued that the frequency in practice is so great that it would be difficult for a widespread adverse social sentiment to form. The author attributes this situation to a variety of historical reasons, including the absence of white women at the earlier stages of intermixture, the marital freedom of the native Hawaiians, the advent of the early missionaries from New England and not from the Southern States of America, and the absence of a single "dominant race". He has perhaps underestimated here the importance of the compatibility of the physical traits, temperament and intelligence of the Hawaiians with those of the immigrants, in facilitating intermarriage on a basis of equality (relations between European and Maori in New Zealand may be compared with this).

It is possible also that the low rate of marriage of "Other Caucasian" (mainly non-Latin) women with other groups such as the part-Hawaiian, and the tendency to increasing cultural segregation of the part-Hawaiian group have been minimized by the author in his prediction that, by the end of the present century, the majority of the people of Hawaii will constitute a stable race mixture of hybrids, culturally homogeneous. But fact and inference are clearly separated in the book, which is an extremely valuable study in an important field. One looks forward to seeing more publications on this subject, sponsored, as in this case, by the enterprise of the University of Hawaii. R. F.

The Subject Index to Periodicals, 1936
Issued by the Library Association. Pp. xii+300.
(London : Library Association, 1937.) 70s.

THE Library Association and its general editor, Mr. T. Rowland Powel, are to be congratulated on the coming of age of the "Subject Index to Periodicals",

this being the twenty-first year of the existence of the Index. As was also the case last year, the volume for 1936 appeared only five months after the close of the year covered.

The volume for 1936 contains references to more than 27,000 articles selected from no fewer than 597 periodicals. Of these periodicals 547 are English and American, 27 French and Belgian, 21 German and 2 Italian. The articles are arranged under headings such as 'Floodlighting', 'Mural Painting' and 'Radioactivity', but under each heading the order is that of authors' names. The subjects selected for indexing cover a wide range, but verse and fiction are excluded.

With some important exceptions, no attempt has been made to index periodicals covered by the following publications : *Agricultural Index, Engineering Abstracts, Engineering Index, Index Medicus, Journal of the Society of Dyers and Colorists, Photographic Abstracts, Revue de Géologie, Minéralogie et Crystallographie, Royal Meteorological Society's Bibliography, Science Abstracts* and *Technical Institute Journal*.

These Subject Indexes are much appreciated by those to whom a knowledge of the latest researches on scientific problems is of importance, for without such works of reference at hand it is quite possible that many a valuable paper may be overlooked. We congratulate the Library Association on the promptitude with which these annual volumes are published.

Gravimetric Analysis :

a Laboratory Manual with Special Reference to the Analysis of Natural Minerals and Rocks. By W. van Tongeren. Pp. xi+278. (Amsterdam : D. B. Centen's Uitgevers-Maatschappij N.V.; London : H. K. Lewis and Co., Ltd., 1937.) 14s. net.

THIS text-book, written by one having considerable practical experience, will be welcomed by mineralogists and analytical chemists generally. It gives a critical description of modern gravimetric analytical methods in a very convenient form.

The plan adopted by the author is the logical one based on geochemical principles. The text is well illustrated by useful diagrams, where the technique involves such for clearer explanation, and the tables are clearly set out. The few typographical errors seem to constitute the only minor drawback to the book. There are three indexes, devoted to apparatus, reagents and determinations respectively, and this arrangement makes reference unusually easy.

Assay methods, or as the author prefers to designate them, "docimastic methods", for the noble metals are beyond the scope of this book ; their inclusion would not have added to its value and would certainly have added greatly to its bulk. The bibliography is adequate, accurate and up-to-date, and naturally the names of such well-known workers in this field as Hillebrand, Hevesy and Goldschmidt constantly recur in it. Of all the names mentioned only some six per cent are those of British investigators, indicating that insufficient attention is paid in Great Britain to the scientifically and economically important subject of geochemistry. C. S. G.

The Ohio-Mississippi Floods of 1937

By R. W. Davenport, U.S. Geological Survey

SOME of the recent floods in the United States have indicated that, in any appraisal of the potentialities of a river system for producing floods, more significance than has perhaps been customary should be attached to the magnitude

settlement of the region by white men, thus making a skeleton record going back one to three hundred years, varying with the time of such settlement. The available records may be sufficient to show with considerable reliability the char-

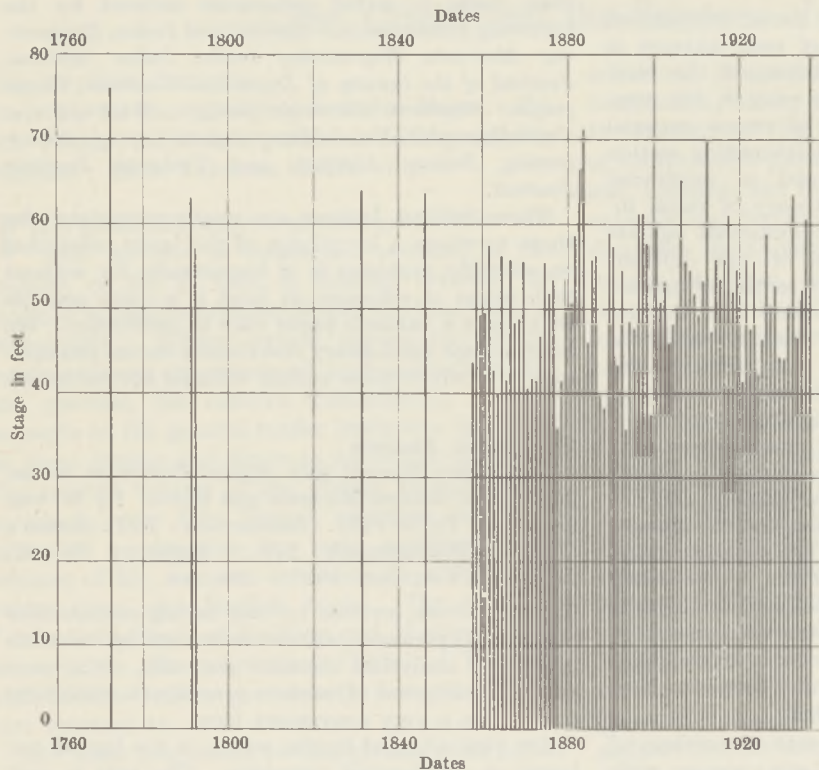


Fig. 1.

MAXIMUM ANNUAL FLOOD STAGES, OHIO RIVER, CINCINNATI, OHIO, 1858-1937.
(CHRONOLOGICAL ARRANGEMENT).

of the great floods of the past, as disclosed by Nature's records of them. A conspicuous part of the work of rivers in the processes of dynamic geology is associated with the occurrence of major floods, and significant information with respect to such floods may be appropriately and reliably interpreted from the flood plains, terraces, earlier river channels, and other evidences of erosion and deposition which record a river's past behaviour.

Systematic records of flood stages on rivers in the United States do not generally extend back more than fifty or sixty years at most. Knowledge of earlier flood stages may cover, with considerable completeness for some rivers but usually without much detail, the outstanding floods since

acteristics of a river in respect to the magnitude and frequency of lesser floods, but such records are entirely inadequate for disclosing the expectancies of the rare floods of great magnitude.

In March 1936, flood occurred in the north-eastern part of the United States which caused crests on many rivers that were higher by several feet than had been recorded since the settlement of the country. Similarly, the more recent extraordinary floods of January and February 1937 in the Ohio and mid-Mississippi Valley were greater than any known since the time of white settlement. Stages higher than previously recorded occurred on the Ohio River from Point Pleasant, W. Va. to its mouth at Cairo, Ill., a distance of about 700 miles, and on the Mississippi River from the

mouth of the Ohio to a point below Helena, Ark. a distance of more than 300 miles. The excess of the flood crests above the highest previous records was greatest in the vicinity of Louisville, Ky., where all previous stages were exceeded by 10-11 feet. At Cincinnati, Ohio, the flood crest was 8.9 feet higher than had occurred in eighty years of continuous record and 4 feet higher than the highest previously known stage, which is reported to have occurred in 1773. With rare exception the protective levee systems were overtopped and great damage to property and considerable loss of life were caused in cities, towns, industrial establishments and transportation routes that occupied the flood plain.

Fig. 1 shows by bars in chronological order the maximum yearly stages of the Ohio River at Cincinnati, Ohio, continuously for the eighty years, 1858-1937, inclusive, and for certain major floods prior to that period.

Fig. 2 shows, as explained thereon, the maximum yearly stages at this place for the eighty years above specified, arranged in order of magnitude and plotted upon arithmetic-probability paper. The graduations on this paper have the characteristics that if a series follows the laws of normal probability the plotted points will define a straight line. This type of graduation is used because it seems to show the observed data effectively.

In so far as Fig. 2 illustrates the magnitude-frequency characteristics of the Ohio River in the production of floods at Cincinnati, the river does not seem to have departed far from its demonstrated character in producing the excessive stage of 1937. However, on the basis of the records prior to 1937, it is probable that the deduction would have been warranted that such a stage as occurred in 1937 would be of such rare occurrence as to justify little consideration with respect to protective works or occupancy of the flood plains. In the popular mind a flood of such magnitude was considered essentially impossible.

The series of rains which caused these record-breaking Ohio-Mississippi floods began toward the end of December 1936, continued through most of January and were unusually excessive in the latter month. The associated weather conditions resulted from abnormal movements and interactions of air masses over a large region. The distribution of barometric pressure "resulted in a continuous northward and north-eastward movement of tropical air masses over the area roughly from Louisiana and Tennessee eastward to the Atlantic States, New England and New York, while air masses of polar origin moved southward almost continuously over much of the western half of the United States. . . .

"The extremely heavy rainfall over the Ohio Valley, Tennessee and Arkansas and part of the adjoining areas was in general caused by the fact

that this area was so located with relation to the very deep areas of high pressure on either side that at the earth's surface the line of contact between the warm, moist air from the south, and the dense, cold air of polar origin that came in over the Ohio and middle Mississippi Valleys on many days from the north and north-east, lay somewhere over this area much of the time; and the less dense warm air from the south (or south-west) was forced to rise over the cold and denser air. The rapid lifting of the very moist air of tropical origin resulted in abundant precipitation."*

The total rainfall for the month of January

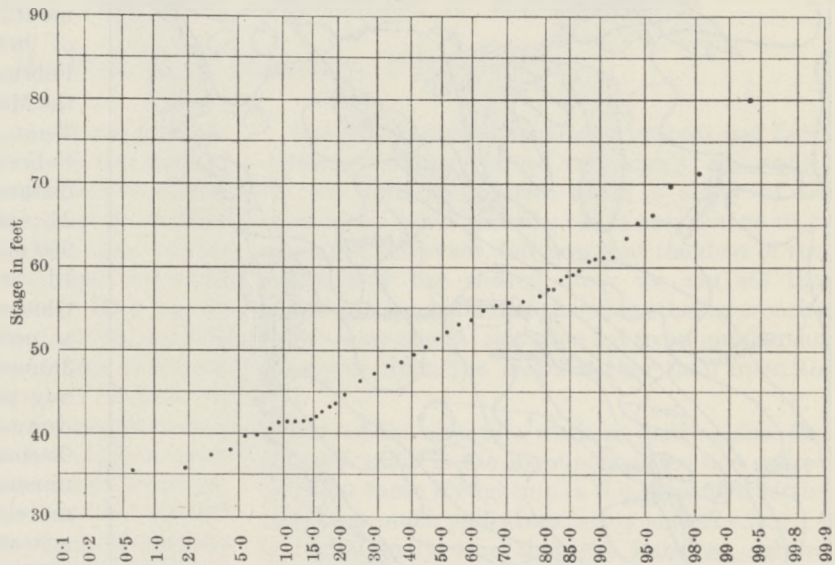


Fig. 2.

MAXIMUM ANNUAL FLOOD STAGES, OHIO RIVER, CINCINNATI, OHIO, 1858-1937. RECORDS PLOTTED IN ORDER OF MAGNITUDE ON ARITHMETIC PROBABILITY PAPER. FOR THE MID-48 YEARS, THE PLOTTED POINTS CORRESPOND TO THE MEANS OF SUCCESSIVE GROUPS OF THREE YEARS IN ORDER TO AVOID CONFUSION CAUSED BY A MULTIPLICITY OF PLOTTED POINTS.

was four times the normal, or more, over approximately 35,000 square miles. The area of heaviest precipitation included the middle and lower Ohio River valley, mainly along the Ohio River and the lower valleys of its tributaries (Fig. 3). The rainfall occurred not so much in a progression of general storms through the region as in a progression of somewhat sporadic storms marked by considerable variation in local distribution, and moving in a general north and north-east direction. The average rainfall in January over the drainage basin (203,000 square miles) of the Ohio was slightly more than 11 inches.

The floods occurred in a season when normally there might have been considerable snow, but, because of the prevalence of exceptionally

*Statement by C. L. Mitchell, forecaster, United States Weather Bureau, *Monthly Weather Review* February, 1937, p. 72.

warm winter temperatures, the snowfall was light and had no appreciable influence on the floods.

The rains in December and early January reduced the capacity for surface storage and absorption by the ground that otherwise would have been available, and filled the channels of lower reaches of the rivers which later were sub-

1936 originated in the tributaries of the upper Ohio River and caused record-breaking stages at Pittsburgh, Pa., and for a distance of approximately 100 miles below that city. The peak which occurred at Pittsburgh on March 18 reached Louisville, Ky., a distance of about 600 miles, 11 days later, on March 29. In contrast, the 1937 flood

reached its crest at Pittsburgh on January 26 and at Louisville on January 27, thus giving evidence of extreme concentrations of flood waters nearly simultaneously in several hundreds of miles of the channel of the Ohio River. The flood was at crest at the mouth of the Ohio River, a distance of 980 miles below Pittsburgh, on February 3. This crest moved down the Mississippi and reached Memphis, Tenn., a distance of 227 miles, on February 10; Vicksburg, Miss., a distance of 602 miles, on February 21; and New Orleans, a distance of 960 miles, on February 28. At Cairo, Ill., at the mouth of the Ohio, the Ohio and Mississippi were higher for a period of nineteen days, from January 24 until February 11, than any previous record. Preliminary computations indicate that the mean discharge of the Ohio River for this nineteen-day period was approximately 1,650,000 c.f.s. from a drainage area of 203,000 square miles—about 8 c.f.s. per square mile. The maximum discharge was about 1,850,000 c.f.s.

Topographic maps show a pronounced flood plain adjacent to the Ohio River, in the middle and lower valley. At the margin of the flood plain the reduction of spacing of the contours is so marked as to produce an effective visual impression as to the location of this margin. A definition by outline of the overflow areas of the 1937 floods indicates the apparent flood plain to have been almost wholly occupied from the vicinity of Cincinnati to the mouth. Above Cincinnati, as the excess above previous crests decreased, increasingly more of the flood plain appears outside the overflow area.

In order to produce the characteristic topography of this valley, the Ohio in past ages must many times have occupied the flood plain in a degree similar to that of 1937. The evidence and experience seem to demonstrate that there is a place in the planning of flood control works for

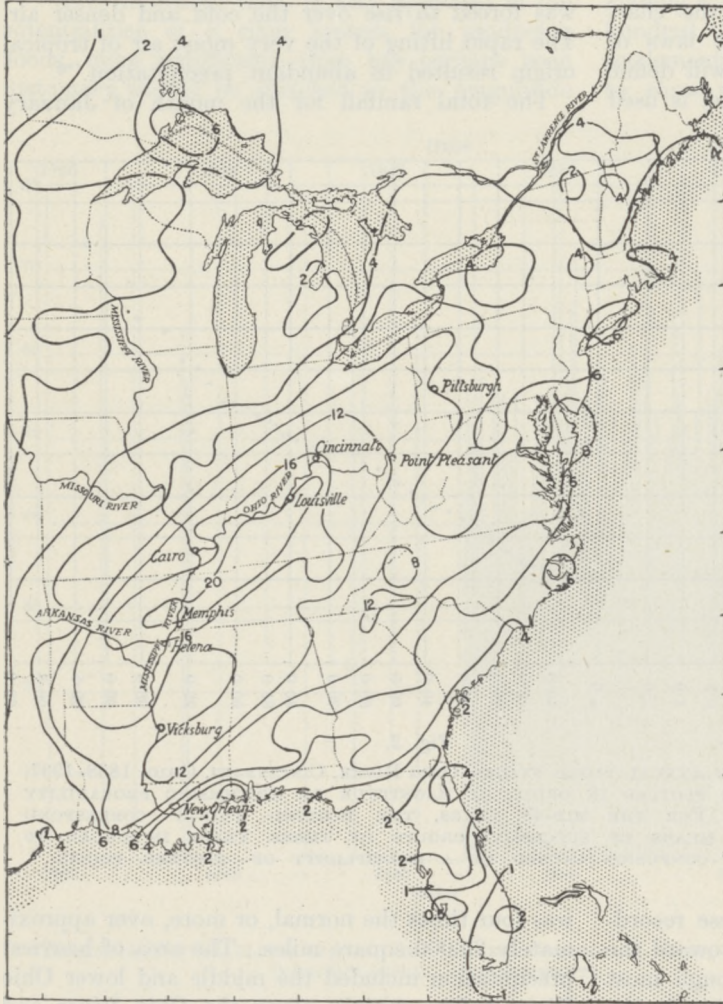


Fig. 3

TOTAL PRECIPITATION IN INCHES, JANUARY 1937, FROM UNITED STATES WEATHER BUREAU *Monthly Weather Review*, JANUARY 1937.

ject to the most excessive rainfall. As a result, an exceptionally large part of the heavy rainfall of January 20-25 ran into the streams. The especially heavy rainfall in the middle and lower Ohio Valleys was essentially superimposed upon full rivers resulting from the preceding days of rain in the upper parts of the basin.

The peculiarities of the floods of 1937 may be illustrated by a comparison with the floods of March 1936 in relation to the progression of flood crests down the Ohio River. The floods of March

appropriate consideration of the recurrence of the great floods which geological evidence shows have occurred many times in the past. Such consideration would serve as a corrective against failure to realize adequately that a series of rains like that which produced the 1937 floods can recur, and also would tend to produce a more sound understanding and befitting humility as to the

limitations of the works of man in effectiveness against all possible floods. Nature can produce floods which it may not be practicable for man to control, and it behoves man in the municipal and industrial development of river valleys not to overlook the need for meeting those events that are associated with flood catastrophes which it is not practicable for him to prevent.

Modern Study of Plants in Relation to Education *

By Prof. E. J. Salisbury, F.R.S.

IF we cast our minds back on the general attitude adopted towards botany in the latter part of the eighteenth century, we cannot but be struck by the almost apologetic phraseology of its votaries and the curious grounds upon which they rationalized its pursuit. Rousseau, for example, described botany as a study of pure curiosity that has no other real use than that which a thinking, sensible being may deduce from the observation of Nature and the wonders of the universe. I venture to think that many otherwise educated people to-day would express similar sentiments, though in more modern and probably less complimentary language.

The teaching of our subject has been in no small degree to blame for the widespread misconceptions as to its aims and content. For long regarded as a harmless and elegant occupation for the female sex, botany only survived as a study of practical utility because of the continued necessity for medical practitioners to acquire some knowledge of *materia medica*. How perfunctory was much of this teaching is indicated in that charming book, "Leaves from the Life of a Country Doctor", where the late C. B. Gunn describes how as a medical student in 1878 "the botany class gave me a 'scunner' at the subject which has lasted ever since".

The old technological significance for medicine has long since gone, but a newer and vastly more important significance remains, both cultural and vocational, which has rarely been stated, let alone stressed. Despite the vastly enlarged content of botanical knowledge since those days, the general conception of botany has remained much what it was then. The high value of botany as an educational subject and indeed its absolute necessity in any system of real cultural development are aspects which botanists have failed to present and emphasize.

The protagonists of compulsory Greek and Latin of the last century valued very highly, and rightly so, the cultural content which a study of the humanities could provide. It is easy for us to be wise after the event, but now that the dust of that controversy has cleared away we can see that failure to apprehend that there are other approaches to the same mental salvation led to an unfortunate insistence upon the means rather than upon the end.

But whilst scientific workers justly claim that cultural value is the monopoly of no one subject and that those brought up in the classical tradition may be as much philistines as any man of science, it is undoubtedly true that the immense cultural potentialities of scientific thought have too often been neglected for the sake of mere erudition. There is a general tendency for university teaching to become more and more vocational as the specialized demands of occupations become increasingly exacting. Thus, not only do technological aspects grow more obtrusive, especially in the final courses of certain subjects, but also there is a trend, in the direction of this change, making its influence felt, further and further back in the student's training, so that we find, for example, certain sections of the medical profession demanding that the preliminary education should have a more direct bearing on the future occupation of the student, despite the fact that this can only be accomplished at the expense of their general education and culture. With the long course of training which most professions to-day require and the financial strain that this often involves upon parents, one cannot but sympathize in the wish to provide some relief, but if this is to be accomplished without detriment to the ultimate standing of the professions themselves, it can only be by an increased concentration on the more general aspects of culture in the schools. So far as biology

* From the presidential address to Section K (Botany) of the British Association, delivered at Nottingham on September 2.

is concerned, there is a widespread recognition for the need of greater attention to training in observation in the schools, allied to what may be termed the scientific study of natural history. Too much attention in this as in other subjects is paid to the acquisition of mere information, especially if recent, too little to the principles which are involved.

This is not intended as a stricture upon the teachers, since, with our present system, earlier and earlier in the students' career they are striving to achieve a dual objective—the training which should be their chief concern, and preparation for university examinations at a stage in mental development which cannot adequately appreciate the educational content of the curricula. Thus the student who has taken the intermediate examination from school is often handicapped in comparison with those who would appear to be starting their university career in a less advanced stage.

Just as the increased demand for material things facilitated the replacement of the products of the craftsman by mass production of machine-made articles, so, too, the rapid increase of population following the Industrial Revolution inevitably led to something analogous to mass production in the education of children and the training of teachers.

Many there are who blame the examination system, which, however, with all its faults, if rightly used, is in reality a fairly efficient sieve for separation where large numbers are involved. But the examination machine is often expected to effect a grading of the human material with which it deals that can only be attained by more individual methods. As a consequence, undue importance is attached to examination results and a wrong emphasis is often laid on their significance. This leads to a premium being placed on mere erudition, and so subjects are liable to be taught not as living realities but, in the forceful phraseology used by Winston Churchill in one of his novels, "Knowledge is presented as a corpse which bit by bit we painfully dissect".

Furthermore, our educational methods are, I fear, too often divided in their allegiance; on one hand we aim at the provision of a liberal culture which will make for the greatest happiness of the individual, considered in terms of mental contentment and an abiding resource in later life; whilst on the other hand we aim at the equipment of the student for the earning of his daily bread to ensure bodily comfort. We are not sufficiently trustful that the provision of the former is, to employ the expressive northern phraseology, the "gainest way" to the latter end, and so we adopt a sort of mental squint, which permits neither of the clear vision of the full beauty of integrated knowledge nor even of keeping our eyes on the main chance.

It is no more possible in education than in ethics to serve both God and Mammon. It is not merely good education but the apotheosis of worldly wisdom to seek first the cultural background and to believe that the vocational proficiency will be added unto you.

The universities cannot be held blameless for the lack of appreciation by the general public of the implications of our subject. May I, in this connexion, quote a passage from an American report on university education which loses none of its cogency on this side of the Atlantic: "Appointing authorities too often place undue stress on specialisation, instead of placing adequate emphasis on scholarly background, versatility of intellectual interest and general culture".

Whilst activity and distinction in research is a necessary qualification of the teacher, the capacity to impart knowledge to others is no less essential. Too often in the selection for university posts aptitude as a teacher, which should be a first consideration, is entirely subordinated to distinction as an investigator. No one, it is true, can be an inspiring teacher who does not possess intellectual initiative and who is not engaged in creative pursuit, but most of us have suffered at one time or another from the investigator "whose thoughts are too full for words". Furthermore, we must avoid the undue sacrifice of breadth for depth for other reasons.

The accumulation of data and the provision of information bear much the same relation to the advancement of knowledge as artificial fertilizer to crop production. Just as our fertilizers must be properly balanced, so, too, our information must be so correlated and concerted that ignorance in one department does not become the limiting factor in our utilization of extensive data in others. In these days of extreme and increasing specialization, such correlation of effort is becoming more and more important, and it is to the universities, old and young alike, that we must look for the maintenance of that contact and synthesis which is essential to real progress. In particular, I should like to urge that the time has come when the curriculum required of those proceeding to university degree in science should be reconsidered. It is, in the present state of knowledge, as much an anachronism that a student should be able to proceed to a degree in chemistry having no knowledge of biology as that he should proceed to a degree in botany with a mere smattering of either physics or chemistry. Anyone who aspires to a degree in science should in my opinion have an adequate appreciation of the principles of physics, chemistry, mathematics, especially as regards statistical methods and probability theory, and, lastly, but by no means least, one biological

subject. It may be stressed that some biological training is to-day an essential to any liberal culture and should be as much an obligatory part of a school curriculum as arithmetic.

One great merit of botanical study from the point of view of general education is that, if properly taught, it provides perhaps the best medium for training in accurate observation. Observation consists essentially of two separate processes, namely, seeing the object or phenomenon and the apprehension of what is seen. The visual perception of the good and bad observer may be alike adequate, but it is in the degree of their

apprehension that they differ. To train such powers it is essential to check the accuracy of appreciation either by means of verbal description or graphic representation. The graphic method is clearly more suited to the adolescent mind, whose limited vocabulary and limited feeling and understanding of the nuances of meaning of words unduly restricts his verbal precision. Drawing, if regarded strictly as a statement of observed facts, offers the best means of such training, and botanical material, because of its well-defined organization, is peculiarly suited for this purpose.

[To be continued.]

Surface Action in Biology

A JOINT symposium including Sections A (Mathematical and Physical Sciences), B (Chemistry) and I (Physiology) was held on this topic at the recent meeting at Nottingham of the British Association.

Since the development of the Langmuir trough in 1917, several new methods have been introduced into our armoury of weapons used for attacking the problems connected with film structure and film reactions. Of these, two have been developed in some detail and have provided us with numerous interesting and novel results, which appear to have far-reaching biological implications.

In the first method, a number of mono-layers of barium stearate are successively built up on a chromium-plated surface. Brilliant interference colours are observed when the film is viewed at a suitable angle in polarized light, conveniently obtained with the aid of a 'Polaroid' screen. The interference minima are so sharp that increments in thickness so small as 1.6 Å. can be detected. If in the outer layer the divalent barium ions be replaced by ions of a higher valency, for example, thorium, the surface is now 'conditioned' in that it will adsorb monolayers of a variety of substances, for example, proteins or cholesterol. On these surfaces in turn adsorption of a second monolayer can take place, for example, digitonin on cholesterol but not on epicholesterol. It is found that many of these selective adsorptive reactions are highly specific.

By superimposing instead of a series of barium stearate monolayers, mixed films containing barium stearate and stearic acid are employed, the composite mixed membrane may be leached with stearic acid solvents, and a skeleton membrane of barium stearate remains. Such a skeleton can be refilled with various liquids, and the successful penetration followed by observing the changes in

the refractive index of the layers. By sensitization of such a skeleton film and coating with a monolayer, it is evidently possible to examine the permeability of adsorbed monolayers to different solvents.

This optical method of examination provides us in the first place with an elegant means of determining whether adsorption has taken place or no, for example, in such reactions as the antibody antigen reaction. If in this case the surface reaction is indeed as specific as the bulk colloid reaction, it is evident that the method may well prove an agreeable substitute for the usual precipitation technique. In respect to sensitivity, we may note that one square centimetre (ample for optical examination) requires only 10^{-7} gm. for deposition. In the second place, the optical examination of skeleton membranes permits us to investigate both their permeability and ease of penetration by a variety of solvents. Since such penetration involves not only considerations of pore size but also of the extents of interaction between the penetrating molecular species and the material of the membrane, it is evidently a convenient method for obtaining information on each of these factors.

The second method of investigation involves determination of the force area characteristics, and the modification in the phase boundary potential caused by the presence of the film. Since in general terms the force area values give us information about the non-polar and the phase boundary potential provides us with knowledge about the polar portions of a complex organic molecule, it has been found possible to make fairly detailed analysis about the orientation of even complex film-forming systems. This applies especially to substances existing in what is termed the homalic state, that is, extended on the surface, such as are found in the protein or cellulosic monolayers.

Since chemical action involves an alteration in the magnitude of the dipole moment of at least a portion of the reacting molecule, this method is found most convenient for following rates of reaction which may involve either an interaction between molecules in the film with those in one of the bulk phases, or interaction between molecules existing in the film itself. In this latter case, a more or less continuous polymeric film can be built up. Such polymeric films present interesting properties in respect to their elastic behaviour when solid and in their viscosity when liquid, and merit detailed examination.

Since in many cases the molecular orientation in the monolayer can be affected by a change in pressure exerted on the film, it is possible to examine the effects of molecular orientation in the kinetics of film reactions. Very remarkable changes in reaction velocity can be effected in some cases by a minute change in the surface tension; furthermore, in photo-chemical reactions in films we can control the extinction coefficient and thus the quantum efficiency of surface photo-chemical action.

In addition to such enzyme and chemical reactions, it is also possible to examine those loose molecular associations frequently termed 'complexes' in some detail. We have already referred to the adsorption of digitonin by cholesterol, and similar reactions are involved with other glucosides such as saponin and even with much simpler molecules. Thus long-chain alcohols, especially secondary alcohols, and long-chain acids, form remarkably stable mixed films, although no ester formation is involved. These complexes involve interaction between both the polar head groups and also between the non-polar chain or ring systems of the reactants. Many of the polar head group interactions can be interpreted in terms of a hydrogen bond, but both dipole - dipole and dipole - ion interactions are also involved. The

film technique also permits us to examine the mechanism of penetration of one molecular species into a monolayer of another, and here again both polar and non-polar portions of each molecular species are involved. It is also possible to examine the anchoring together of a number of molecules in the surface monolayer by a polymeric substance introduced into the substrate, for example, the polyphosphoric acid systems on calcium stearate or tannin on a protein.

The method reveals that these molecular associations involving free energy changes of the approximate order of $\Delta F = 10,000$ cal. are extremely common in those relatively complex organic compounds met with in biological fluids and it does not seem unreasonable to assume that they are actually present in living systems. For example, lipoids and proteins form lipoprotein films possessing interesting properties, and we might anticipate the presence of such lipoproteins in sera containing both proteins and lipoids. We might emphasize the remarkable degree of specificity obtainable not only by a change in the orientation of a polar group, but also by a similar change in orientation, for example, by movement of a double bond in the non-polar portion of the molecule.

Whilst it is possible to examine the polar and non-polar interaction separately by this method much further work is required before a definite statement as to the actual number of bonds and the individual bond energies involved can be made. This goal is important in that it will then permit us to calculate, as Eyring has pointed out, the absolute reaction rates. But it is at least interesting to note that in a protein 'complex' we are satisfied by this experimental technique that a large number of bonds are involved. The process of denaturation must involve, according to theory, the breaking of a large number of bonds to form the activated state for denaturation. ERIC K. RIDEAL.

French Society of Chemical Industry

SEVENTEENTH CONGRESS IN PARIS

UNDER the presidency of Sir Robert Mond, member of the Institut de France, the Société de Chimie Industrielle held its seventeenth Congress and at the same time celebrated the twentieth anniversary of its foundation by the late M. Paul Kestner, between the dates of September 26 and October 3. Arrangements made by various committees presided over by M. J. Gérard, M. J. Bougault and M. G.-J. Painvin, were appreciated by a large gathering of French chemists and about

two hundred and fifty delegates from different countries, including more than twenty from Great Britain. British delegates bearing congratulatory addresses were sent by the Royal Society, the various chemical societies and the Institute of Metals.

After the proceedings had been opened in the large hall of the Maison de la Chimie by the Under Secretary of State for Commerce, Sir Robert Mond gave an address on the evolution of the

nickel industry, and in the same hall, throughout the Congress, were delivered important addresses on such subjects as the chemistry of silicates, by M. Artigas (Madrid), corrosion of metals, by Prof. W. J. Müller (Vienna), sterols, by Prof. I. M. Heilbron (Manchester), and the influence of fundamental research on daily life, by Dr. I. Langmuir (United States). In the Hall of the Sorbonne, M. Georges Claude gave a two hours' lecture with experimental demonstrations on the part he had played in utilizing acetylene, liquefying gases, separating the rare gases, and an account of his attempts (illustrated by a film) to obtain by pumping cold water from great depths of the sea such a temperature difference as would enable an engine to be worked.

Sectional meetings were held in numerous branches of applied chemistry, and to these contributions were made by the following British chemists: J. Muir, on dyeing of fabrics; Prof. C. S. Gibson, on the production of gold mirrors; Sir Robert Robertson, on some of the work of the Water Pollution Research Board; and Dr. F. S. Sinnatt, on hydrogenation.

At the closing session, the President of the French Republic being present, addresses were given by Sir Robert Mond and others on the history and influence of the Société de Chimie Industrielle, and at this ceremony were presented new honorary members of the Society. These included Prof. F. G. Donnan, president of the Chemical Society.

It will, of course, be readily believed that the occasion was marked by characteristic French ceremonial and hospitality, both official and offered by Sir Robert and Lady Mond, who entertained all the delegates to a banquet. The banquet in the Exhibition will remain in the minds of those who were present on account of the artistic and colourful spectacle afforded by a boat

anchored in the Seine and under the windows of the dining-hall, for from it rose jets of water coloured by internally reflected lights, governed by a manual on which the executant played as on an organ.

Apart from the excursions to works and laboratories, including one to the Palais de la Découverte in the Exhibition, which is surely its most notable feature for a scientific man, a three days' excursion attended by about a hundred members was arranged to Mulhouse, where the founder, Paul Kestner, was born in 1864, and thereafter to Lausanne, where he died early this year. Sir Robert Mond, having by his side M. Emile Dollfus, president of the Société Industrielle de Mulhouse, paid homage to Paul Kestner, describing his career and his achievements in chemical industry, such as his apparatus for dealing with corrosive liquids, his evaporators, his plant for maintaining constant humidity and temperature and his foundation in 1917 of the Société de Chimie Industrielle, mentioning also his award of the medals of the British Society of Chemical Industry and the honorary membership of the American Chemical Society. But he also made mention of the features of his fine personality and helpfulness, by which he is remembered by many in Great Britain. It was pleasing to see Madame Kestner at this celebration. At Lausanne, Sir Robert laid a wreath on Kestner's grave.

During this part of the programme, visits were made to the potash mines of Alsace and the chemical works of Thann and Mulhouse, where the production of various salts of potassium, of heavy acids, of titanium compounds and much else of interest was shown to the visitors.

In all its aspects, this Congress proved both instructive and enjoyable to the many delegates who attended it.

R. R.

Obituary Notices

Prof. M. Maclean

PROF. MAGNUS MACLEAN, emeritus professor of electrical engineering in the Royal Technical College, Glasgow, who died on September 2 last, was born in 1858.

If there was one feature about Prof. Maclean which distinguished him from his academic colleagues, it was his outstanding position in non-academic circles. From a humble beginning in Skye he worked his way to the University of Glasgow and became Kelvin's assistant, lecturer in physics to medical students (1892), and in pure and applied electricity to engineering students (1895), whence he was promoted to the chair of electrical engineering at the Royal Technical College, Glasgow (1899). During this progress, he

showed his love of his native Gaelic language by his writing and teaching of its literature. If, therefore, Maclean was pre-eminent as a "great Highlander", he earned his position; and the same admiration which he earned among his fellow clansmen and islesmen he gained in all his other activities, whether masonic or professional. Indeed, wherever Maclean was seen, he was in high places. Should these remarks appear to under-estimate his scientific work, it should be remembered that it is not easy for an outsider—especially for an Englishman—to appreciate his local influence, no matter whether it be called esteem, hero-worship or what else.

Maclean's appointment to the Royal Technical College preceded the present fine building in George

Street, where his influence and wisdom succeeded in carving out a magnificent suite of laboratories and lecture rooms—and no part of them on the “Box and Cox” principle. For this fine department—probably the best in the kingdom—his successors will ever be grateful.

Although Maclean published numerous papers and books on electrical subjects and practice, he stands out in the memory as a mathematical physicist—indeed the very man whom Kelvin could appreciate. Maclean was extremely loyal to his old chief and to his Alma Mater, and he carried with him to the Royal Technical College the methods and traditions he had learnt in his youth. The autocracy of the department so evident in Scottish and German universities, the restricted outlook, the traditional lecturing to the junior students, together with many traits more closely associated with Kelvin, all showed themselves in his strong personality. It was during his professoriate that the Royal Technical College became affiliated with the University.

As an engineer, the limitations of his surroundings must be borne in mind. Glasgow never was, is not, and possibly never will be, a centre of electrical engineering. In Scotland, electrical engineers are largely agents and factors of English concerns, and there is not the creative atmosphere which is so marked a feature in manufacturing districts. The close band of salesmen would not be primarily interested in local production, and electrical engineering did not flourish like mechanical engineering and shipbuilding. To-day most of the leading electrical engineers in Scotland are Englishmen. Personally, Maclean held a high place in the regard of his electrical associates.

Maclean had high academic distinctions—D.Sc. and LL.D. of Glasgow—the latter honour being conferred on him in 1919, as a leader and a first-rate authority in electrical science, and distinguished alike in the Gaelic language and literature. He was a member of the Institutions of Civil and of Electrical Engineers, and of many of the learned bodies.

In his private life Maclean suffered deep sorrows in the loss of his wife and of two of his sons. He was an elder in the Westbourne Gardens Church, Glasgow. Maclean loved open-air recreation—he was a keen and good golfer and he enjoyed a game of bowls. His death has left a gap which will not be filled.

S. P. S.

Sir Herbert Sloley, K.C.M.G.

THE death is reported from Cape Town of Sir Herbert Sloley, formerly resident commissioner of Basutoland, which took place on September 22 at the age of eighty-two years. His successful rule of the turbulent Basuto, like that of his predecessor Sir Godfrey Lagden, was based upon an intimate knowledge of Sesuto language, beliefs and customs. He was a pre-eminent example of the type to which anthropologists, Sir William Ridgeway and Sir Richard Temple, for example, were accustomed to point when urging upon the Governments of their day the advantages of a training in anthropology

for the administrator of backward races in obviating the long apprenticeship, which had been a necessary foundation of their successful work.

Sir Herbert Sloley was helped by his personal characteristics, but even he went through a long apprenticeship. Nearly the whole of his working life was passed in Basutoland, which under the rule of Sir Godfrey Lagden and himself was transformed from the most disturbed to the model native territory of South Africa, the crowning achievement being the formation of a Native Council, which brought the commissioner and natives into direct touch and co-operation in matters of administration.

Sir Herbert was born in Calcutta on February 4, 1855, and was educated in England at the Greenwich Proprietary School. After a brief period in a bank, he went to South Africa and joined the Cape Mounted Rifles in 1875. He was appointed captain in a native contingent in the Basuto War of 1880–81. Seizing the opportunity to make a career in Basutoland, he became sub-inspector in the Basutoland Mounted Police in 1884, inspector in 1886, assistant commissioner in 1889, and Government secretary in 1898. On the retirement of Sir Godfrey Lagden, who had accepted the office of commissioner of native affairs in the Transvaal, Sloley was appointed resident commissioner in 1900 and held that office until 1916, when he retired and took up his residence in Cape Town.

Dr. A. C. Fryer

WE regret to record the death of Dr. A. C. Fryer, Local Government Board inspector and a distinguished antiquary, which took place suddenly at Bristol at the age of eighty-two years at the beginning of September.

Dr. Fryer was born at Manchester in 1855 and was educated at Queenswood College, Owens College, Manchester, and the University of Leipzig, where he graduated D.Ph. in 1882. On his return to England he was appointed assistant to Dr. Angus Smith, chief inspector of alkali works under the Rivers Pollution Acts. On the death of Dr. Smith, Dr. Fryer was sent to Bristol as inspector of alkali works for south-west England, and continued to hold that office until his retirement in 1920.

Dr. Fryer was a versatile writer, his published work covering a variety of topics, including verse, stories for children and collections of folk and fairy tales from the north of England and the Harta Mountains. As an antiquary his interests lay mainly in the early Middle Ages. He published many communications dealing with the classification of fonts and medieval monumental effigies in *Archæologia*, the *Archæological Journal* and the *Transactions of the Bristol and Gloucestershire Archæological Society*. He was the author of an illustrated volume on “The Wooden Monumental Effigies in England and Wales” of “Llantwit Major”, a fifth century university, and of lives of Cuthbert of Lindisfarne and St. Aidan, the apostle of the North Country. Dr. Fryer was a member of the Advisory Committees for the care of churches of the dioceses of Bristol and Bath and Wells

News and Views

Sir Harold Carpenter, F.R.S.

At its general meeting in Düsseldorf, Germany, on October 10, the Verein deutscher Eisenhüttenleute awarded its Carl Lueg Gold Medal to Sir Harold Carpenter, while Mr. James Henderson was elected an honorary member of the Association. The Carl Lueg Gold Medal was founded in 1904 to celebrate the uninterrupted period of twenty-five years during which Dr. Carl Lueg had held the presidency of the Association. The last occasion on which the Medal was presented was in 1934, and Sir Harold is the first Englishman to receive the Medal. Sir Harold Carpenter is professor of metallurgy at the Royal School of Mines, Imperial College of Science and Technology, South Kensington, London. From 1898 until 1901 he was a research fellow and demonstrator of Owens College, Manchester; in 1901 he was one of the first to join the staff of the newly founded National Physical Laboratory, being appointed head of the Chemical and Metallurgical Departments. From 1906 until 1913 he was professor of metallurgy in the Victoria University, Manchester. Sir Harold's researches have covered a field too wide for individual mention, but reference may be made to his pioneer work on the determination of the freezing point of iron and the complete iron-carbon equilibrium diagram (in collaboration with B. F. E. Keeling), to his investigations on high-speed cutting tools and other special steels, on the growth of cast-iron on repeated heating and on the constitution of alloys and to his classical researches on the growth of single crystals in metals and their properties. Sir Harold is the great-great-grandson of Henry Cort, the inventor of the puddling process and of the use of grooved rolls for rolling metals.

Mr. James Henderson

HONORARY membership of the Verein deutscher Eisenhüttenleute is likewise a mark of great distinction. Since 1881, when the Association was founded, only sixteen honorary members have been elected. Of these, only one was an Englishman, namely, Sir Hugh Bell, who was accorded that honour in 1910. Mr. James Henderson's enrolment in the list of honorary members of the Association is thus a very high tribute. Born in Glasgow in 1868, Mr. Henderson's first appointment was in the laboratory of the Glasgow Iron and Steel Co., Ltd., at Wishaw. At that time, 1886 roughly, a plant for the making of steels by the basic Bessemer process was being laid down under the supervision of Mr. Maximilian Mannaberg, who had come from Gebrüder Stumm, Neunkirchen. This association with Mr. Mannaberg was renewed when, in 1889, Mr. Henderson moved to Frodingham in North Lincolnshire, where the basic open-hearth process was being developed and where he was to remain for the rest of his active business life. Starting as chief metallurgist, he passed through various departments before eventually becoming

managing director. For forty-five years he has been associated closely with a number of significant developments. The Frodingham Works adopted the Talbot direct metal process as early as 1906; towards the end of the last century experiments began at Frodingham in the use of blast-furnace gas in gas engines and culminated in the installation of one of the first Cockerill (Seraing) gas-engined generating sets: the application of blast-furnace gas to blowing and power engines was continued consistently, and represents to-day a major item of economy at Frodingham: the Appleby plate mills which, on their completion in 1927, represented the last word in plate rolling practice in Europe, were a landmark in Mr. Henderson's term as managing director. He joined the Iron and Steel Institute in 1892, has been a member of Council since 1925, and honorary treasurer since 1934. In September 1936, he officiated as acting president at the Autumn Meeting of the Iron and Steel Institute held in Düsseldorf.

Dr. F. W. Eurich and Anthrax Research

THE Council of the Textile Institute has decided to award its medal to Dr. F. W. Eurich, on the occasion of his retirement from the Anthrax Investigation Board for Bradford and District, to mark its appreciation of his services to the wool industries. The medal was founded in 1919 and has hitherto been awarded mainly for services to the Institute. In 1905 the Home Office, in co-operation with the Bradford Chamber of Commerce, constituted the Anthrax Investigation Board for Bradford and District, and Dr. Eurich was appointed bacteriologist. The investigation involved the bacteriological examination of about 14,000 samples of wool and hair. The virulent nature of the anthrax bacillus was a constant and serious danger to the investigator. Dr. Eurich was the first to cultivate anthrax organisms from the wool. He also found that, contrary to expectation, wools might be as dangerous when clean as when dirty. The infection was through the blood stream of the animals, and the tenacious adherence of the blood serum throughout processing, hitherto unsuspected, was exposed as a significant factor in the problem. Dr. Eurich discovered that many varieties of wool and hair are liable to infection and listed them roughly in order of danger. The nature of the anthrax bacillus, the mode of infection, and the conditions under which it persisted were discovered. With Mr. Elmhurst Duckering, Dr. Eurich succeeded in killing anthrax spores and bacilli in a wool sample with formaldehyde, and this was found to have no deleterious effect on such processes as spinning and dyeing. In addition, Dr. Eurich introduced improved treatment of the disease when contracted, and effectively reduced its fatality. Workers in wool owe a large debt of gratitude to him for his long-sustained work on the dreaded "Bradford disease".

Mr. R. H. Hodgkin

MR. ROBERT HOWARD HODGKIN, who has been elected provost of Queen's College, Oxford, to succeed the late Canon Streeter, had retired from Oxford at the end of last term, relinquishing the position of senior history tutor of Queen's College, which he had held since 1910. Mr. Hodgkin is now in his sixty-first year. He was born at Newcastle-upon-Tyne on April 24, 1877, the son of Dr. Thomas Hodgkin, a banker and distinguished historian of Europe in the Middle Ages. Mr. Hodgkin was educated at Repton, Leighton Park School, Reading, and Balliol College, Oxford, taking first-class honours in the Final School of Modern History. He was appointed lecturer in modern history of Queen's College in 1900; and was University lecturer in modern history in 1928-34. His most considerable contribution to historical literature is his "History of the Anglo-Saxons" (1935), in which the scientific data of anthropology and archæology are drawn upon to the full to serve the purpose of historical research. Although a member of a distinguished Quaker family, Mr. Hodgkin held a commission in the 1st V.B. Northumberland Fusiliers for some years, and thereupon was obliged to withdraw from the Society of Friends. During the Great War he served as captain in the Seventh Battalion of his old regiment, and on the General Staff (Operations) at the War Office.

Evans' Biological Institute

A COMPANY of some seventy-five medical men attended the Evans' Biological Institute at Runcorn, Cheshire, on October 7, when an extension was formally opened by Lord Derby. In introducing Lord Derby to the company, Mr. T. Edward Lescher directed attention to the fact that the organization known as Evans' Biological Institute is the result of continuous development during the last twenty-five years, and that it originated as a laboratory and farm station in connexion with the Liverpool Institute of Comparative Pathology under the ægis of the University of Liverpool. It was in 1903 that Prof. (afterwards Sir Rupert) Boyce, professor of pathology, and Prof. (now Sir Charles) Sherrington, professor of physiology, together with Dr. H. E. Annett, then lecturer on comparative pathology, conceived the idea of establishing a farm station at Higher Runcorn for the study of comparative pathology. Included in the committee of management was Mr. J. J. Evans, the first chairman of Evans Sons Lescher and Webb, Ltd., and his son Mr. J. H. E. Evans, who is the present chairman of the company. Shortly before the Great War, the University was compelled to relinquish activities at Runcorn, and the laboratories and farm station and laboratory personnel were taken over by the above firm. Although to some extent the activities were restricted during the War and for some years afterwards, valuable work was done and much experience gained. Gradually the scope of the work carried on was extended and accommodation increased, and in 1928 a commodious new building, containing up-to-date laboratories and equipment, was erected. Additional stables were

erected in due course, and this year another new building has been completed.

DURING all these years, the work originated by the Liverpool Institute of Comparative Pathology has been continued at Runcorn along similar lines. A close study is made of the vital processes of living organisms, in the hope of evolving measures for the prevention of disease rather than the introduction of new palliative measures for use in treatment. In recent months the scope of the research work carried on at the Institute has been extended to chemotherapy, as it was discovered in 1935 that it is possible to control streptococcal infections by means of an important new drug intended for use in the treatment of various bacterial infections. The Institute is licensed under the Therapeutic Substances Regulations and thus is intimately linked with the Ministry of Health administration. Under these regulations, practically all the products with which the Institute is associated must maintain a very high standard. It has always been insisted upon that research and production should be conducted on strictly ethical lines, and no consideration has allowed any alteration to this policy. Lord Derby said that he felt it was a privilege to be associated with the opening ceremony, especially as in his office as chancellor of the University of Liverpool he knew those who were originally connected with the work. He looked forward to the research activities of the present staff leading to the introduction of still better ways of dealing with disease.

Historical Relations of Pharmacy and Physic

THE historical relation of pharmacy and physic was the subject of Sir Humphry Rolleston's address at the opening of the ninety-sixth session of the College of the Pharmaceutical Society. He showed how, in the field of medicine, as in most other fields, evolution has brought with it specialization, and that among the roots of the tree of medical knowledge is the legend of Cosmos and Damian, the patron saints whom pharmacy shares with medicine, surgery, barbery and midwifery as evidence of their common origin. The process of decentralization and specialization of medicine has been repeated at very different dates in the world's chronology. In Egypt medical specialism had reached its acme in the fifth century B.C. when every medical man confined his activities to one disease. On the other hand, in Europe it is difficult to trace a distinction between medical practitioners and the representatives of modern pharmacists until the approach of the Renaissance. In Great Britain, the process of specialization and separation was slow and painful. From so early as 1447, the Grocers Company in the City of London had the right of inspecting shops for the sale of drugs, ointments and plasters, and its members were the recognized drug sellers of the day. From the specialist grocer the apothecary developed and in due time became a thorn in the flesh of the physicians, so that in 1540 the Royal College of Physicians obtained the power to "search, view and see the apothecaries' wares, drugs and stuffs". The apothecaries, balancing

between trading and professionalism, temporarily came down on the wrong side of the fence, being united with the Grocers Company by charter in 1606. But this inconvenient marriage was dissolved in 1617, when the Society of Apothecaries obtained its own charter, James I saying that the apothecaries practised an art as well as a mystery, whereas the grocers were merely merchants.

THE apothecaries used their new freedom for still further specialization. They enhanced their reputation by devotion to the sick at the time of the Great Plague and rapidly developed into the general practitioners of medicine, a position ultimately recognized by registration under the Medical Act. They gradually abandoned pharmacy for physic and left the way open for the pharmacist as he is known to-day to take their place. Sir Humphry Rolleston did not follow the progress of specialization in recent years. Had he done so he might have shown how to-day, with the progress of medical science, specialization advances apace in both the medical and the pharmaceutical professions. In medicine, the physician and the surgeon find at their elbow the bacteriologist, the pathologist, the radiologist, the psycho-therapist. In pharmacy, the pharmacologist, the biochemist and the serologist are supplanting the galenic pharmacist. It is well for the patient, for whose benefit alone these 'mechanized troops' take the field, that so far they remain auxiliaries and have not yet displaced the 'private of the line'—the general practitioner and the pharmacist at the corner of the road.

Flints and Flint-Working

A SPECIAL exhibition to remain for three months has been arranged at the British Museum, Bloomsbury, at the head of the main staircase, to illustrate the changes in flint, and the various methods of chipping it into implements. This supplements the permanent series in the Prehistoric Saloon (Case R), and is intended to make the grammar of the subject clear to those with restricted opportunities of observing or collecting specimens. Patina has not yet been scientifically explained, but the examination of its varieties is a necessary step in solving the problem, and attention has been paid to the depths attained by patina on several specimens. Some old pieces have been re-chipped by living practitioners; and among those whose skill is exemplified may be mentioned Mr. J. Reid Moir, Mr. J. H. Sewell of Saskatoon, M. Coutier of Paris and Prof. A. S. Barnes. Some peculiar forms assumed by flints when fractured by man or natural forces are exhibited, and the technical terms used in prehistory are illustrated by typical specimens. Drawings of flaking methods presumably practised in the Stone Age are reproduced from Warren K. Moorehead's "Stone Age in North America", and a special feature is the wood-technique (blows delivered by a wooden baton) which is believed to have been adopted by St. Acheul man, the long narrow flake-scars due to this method helping to distinguish work of that date from the preceding Chelles or Abbeville culture.

Origins of Civilization and the Hittites

THE early history of Anatolia and of the races from which the Turkish people is held to be derived was given due prominence in the communications presented by the numerous foreign members attending the second session of the Historical Congress at Istantoul. In particular, it is stated by the correspondent of *The Observer* in the issue of October 11, much importance was attached to a discussion by Prof. E. Pittard of Geneva of the origin of the early brachycephalic racial type, which, first appearing in Europe in the Mesolithic age, introduced to that continent the domestication of animals and agriculture. He pointed out that nowhere except in the Near East and in the region extending eastwards to Afghanistan were cereals to be found growing in the original wild state, while the same habitat was assigned to the wild prototypes of the domesticated animals. Prof. Pittard then went on to show that a close study of the Hittites indicated that all these elements of civilization were well known to them from early times, this leading to the supposition that we are indebted to this people for their evolution. Recent discoveries and excavations indicate a possibility of demonstrating that Anatolia possessed, just like Europe, a palæolithic period, from which the mesolithic was evolved, and that the remotest origins of civilization may be found in Anatolia. As the views put forward by Prof. Pittard are said to coincide with the point of view of the Turkish Society for Historical Research, it is possible that they will stimulate much-needed intensive study of Hittite origins. It is eminently desirable, however, that this should be extended to include the Caucasus regions to the north of the Hittite area, with which certain of the evidence, especially of philology, appears to indicate a cultural affinity.

Maiden Castle, Dorchester

Two discoveries are announced at the close of the season's excavation of Maiden Castle, Dorchester, by the Society of Antiquaries and the Dorset Natural History and Archæological Society under Dr. R. E. Mortimer Wheeler and Col. C. D. Drew. The first is that of a long barrow of remarkable size, no less than eight hundred feet long, overlying the neolithic town, of which the remains have been identified at various points in the eastern part of the site. Evidently the village must wholly, or largely, have ceased to be occupied when this enormous tomb was constructed. Consequently, as is pointed out by Dr. Wheeler, according to a report in *The Times* of October 11, the discovery is of importance. The superposition of the neolithic barrow over the earlier neolithic town will make it possible to classify the successive phases of neolithic civilization in this part of Britain with greater precision than is possible at present, and it will thus afford a standard of chronological comparison for the interpretation of other neolithic settlements and mounds in this part of the country. The second discovery, which was made not far from the point at which the dismembered neolithic skeleton, previously reported, was found, was that

of the grave of a Saxon warrior of the early part of the seventh century. Its importance lies in the fact that the body had been interred with full battle equipment. A *scramasceax* or cutlass-knife lay across the thighs, and two knives and the remains of a spear-head were by the side. The burial is one of the few found in England which include this type of sword, commonly held to be a characteristic weapon of the Saxon tribesmen. The end of this season's work at Maiden Castle closes the fourth and final year's excavation of the site as a joint undertaking by the two societies; and the trenches are now being filled in. Excavation will, however, be continued on a small scale for some time to come.

Population Policy in Germany

WE have received, through the courtesy of Baroness von der Goltz, two papers, written by members of the "Reichsbund der Kinderreichen" of Berlin, dealing with the present population policy of the German authorities, both Government and municipal. These papers are interesting as showing the reasoned approval of the measures taken in Germany in recent years, on the part of many—perhaps of most—Germans who have studied the legislation in question. The first paper is entitled "Birth Policy and the Problem of Space", and is written by Dr. Danzer. The author stresses the view that national existence is bound up with the question of the birth-rate, and that neglect of the obvious tendency in western Europe must lead to disaster. He thinks that the world at large is too apt to consider that Germany is over-populated and that a large population is only desired for imperialistic purposes. He points out that England and Belgium have double the population density of Germany; and he remarks that unemployment is not necessarily caused by overcrowding, as is clearly evidenced by the case of the United States. As to space, the resources of Germany are not exhausted, and the more diligent and efficient a people is, the higher the birth-rate can safely be; and, in any event, it is impossible to lay down a theoretical optimum density, which must vary with varying conditions. He makes the point that there is no instance of the decline of any country being caused by a high birth-rate. In spite of the Great War, it has been found possible to increase agricultural production, so that Germany is now nearly self-sufficient, and only has to import eggs and fats. As to the Colonies, Germany only wants these back as a source of raw materials, and not for population purposes. He ends by saying that the white race is seriously threatened, and that the day will come when every able-bodied white man, German, French, British or Italian, will be asked to save the civilization which they have built up in a millennium.

THE second paper, by Dr. Alfred Moritz, describes briefly the measures which have been taken by national socialism to relieve the economic burdens on the German family. The main purpose of these measures is the support of the financially weak.

Years ago, the Führer said that large, healthy families are the real wealth of the nation. The two-child family is mainly the result of egotism, or lack of courage to take responsibility. The policy of the "Reichsbund" is to relieve parents with at least four children. As is well known, a good deal has been done officially to encourage an increase in the birth-rate, and this policy seems to be meeting with some success. By the law of October 16, 1934, account is taken of the circumstances of those with many children. Thus, a worker with an income of 250 marks a month, with three children, pays no taxes; if unmarried he would pay 30 marks, and so on. Then there is the well-known system of wedding loans of 1,000 marks, the loan being reduced by 250 marks for each child. Then steps are being taken to provide better accommodation for large families: the houses will be provided with gardens, where this is possible. It is considered that, generally speaking, life in the big towns is unhealthy. There is a building programme for five million homes, with gardens, and easy access to the towns. Special financial help for large families is being considered in this connexion, including reduction of train fares; and much else is being done to improve the financial position of parents with large families.

New Form of Saccharimeter

THE saccharimeter, as constructed for many years, differs from the polarimeter in that it contains a system of dextro- and lævo-rotatory quartz wedges between the polarizer and analyser, the adjustment of the wedges replacing the rotation of the analyser. Monochromatic light must be used for polarimetric readings, but with the quartz wedge saccharimeter bichromate-filtered white light can be used since the rotation dispersions of quartz and carbohydrate solutions are almost the same. Until recently it has not been practicable to obtain monochromatic light of sufficient intensity and constancy for use under ordinary laboratory conditions, and the saccharimeter with white light illumination has almost universally been used for sugar analysis. A very satisfactory source of monochromatic light is now obtainable, however, in the form of an electric sodium lamp, and its introduction has led Messrs. Bellingham and Stanley, Ltd., to construct a saccharimeter, without the quartz wedge device, for use with sodium light: the instrument is identical in principle with the polarimeter and differs from the latter only in being provided with a sugar scale, reading from -30 to $+110$ International sugar degrees. This scale, like the angular degree scale of the polarimeter made by the same firm, is etched on a glass circle and, unlike the ordinary saccharimeter scale, requires no magnification; the Vernier attachment, also, is etched on a glass plate. The elimination of the quartz wedge system has several advantages. It obviates any error due to want of optical homogeneity of the quartz, it renders unnecessary the exact adjustment of the temperature of the apparatus to that of the observation tube and the reading is taken, not by reflected but by transmitted light.

Coloured Light for Motor-Car Headlights

As many motorists use headlights giving coloured lights, an authoritative and scientific statement as to whether coloured light is better than white light for night driving or during fog has for long been desired. A report by an illumination committee of the Department of Scientific and Industrial Research (Technical Paper No. 20. London: H.M. Stationery Office) has now practically settled the question. Adequate evidence is given that in conditions of slight or thick fog the range of visibility of objects seen in the beam of the headlight is not increased by the use of coloured light obtained from the original white light by means of a filter. One investigator has put on record that in clear weather the range of visibility of an object is increased about 6 per cent by the use of a yellow filter. This result was obtained at a distance of about 900 feet; but at shorter distances, at which the motorist is more concerned to see objects, the advantage of the yellow filter, in any event small, is still smaller. There is no experimental evidence that the power of the eye to perceive contrasts of brightness in the presence of a dazzling light is enhanced if similar colour filters are placed over the dazzling light and over the light illuminating the objects viewed. The evidence as to whether the use of coloured light obtained from white light by means of a coloured filter enables the eye to detect contrasts of brightness more easily is conflicting. Recent investigations have shown that there is a slight advantage, but this is inconsistent with the measurements of earlier workers. There is evidence for a slight increase in the power of the eye to perceive the details of a pattern in 'black and white' by the use of yellow light obtained from white light by means of a filter.

Technical Development and Manual Labour

IN a paper read before the Royal Society of Arts on March 17 on "The Displacement of Labour by Machinery" and recently made available, Mr. H. D. Henderson discussed the subject of the effect of technical progress on employment. The contention that invention is now flowing in a direction which merely leads to the introduction of machinery so automatic that scarcely any labour is needed to operate was described as plausible but devoid of substance. The distinction, on which it rests, between mechanization which is in the main co-operative with labour and that which is in the main competitive with it is illusory, since all mechanization diminishes the amount of labour employed per unit of output, while the inventions which have done most in the past to stimulate economic activity have entailed an especially large economy in this respect. He believes that the old economic argument, which sought to prove that technical progress serves in the long run to expand rather than to contract the demand for labour, is still valid. Owing to change in population trends, however, the process of technical development is likely to be accompanied in the future by greater difficulties and more awkward problems of adjustment. These problems cannot be escaped

by slowing down the rate of technical progress, so far as this depends on the extended use of machinery. Such action would only intensify our difficulties while depriving us of the benefits of mechanical advance.

Organization of Human Society

IN his Herbert Spencer Lecture at Oxford on May 27 entitled "Integrative Levels: a Revaluation of the Idea of Progress" (Oxford: Clarendon Press; London: Oxford University Press, 1937. 2s. 6d. net), Dr. J. Needham discusses Spencer's treatment of sociological problems in relation to the evolution of social organizations to meet the needs imposed by mechanization and the impact of science to day. He suggests that a democracy which produces is the form of society most in accord with what we know of the biological basis of human common life. Evolution is not yet finished, organization has not yet reached its highest level and we can see the next stage in the co-operative commonwealth of humanity, the socialization of the means of production. Every transition from the unconscious to the conscious implies a step from bondage to freedom from lower to higher level of organization, and Dr. Needham emphasizes that our present civilization is not in a state of stable equilibrium. The enormous advances in scientific knowledge and practical technique have made the economic system of Spencer an anachronism. He is of opinion that nothing short of the abolition of private ownership of resources and machines, the abolition of national sovereignties and the government of the world by a power proceeding from the class which must abolish classes will suit the technical situation of the twentieth century. The organization of human society is only as yet at the beginning of its inevitable triumphs.

Preservation of Salcombe Hill

IT has been agreed between the Rev. J. G. Cornish and the Sidmouth (Devon) Urban District Council that South Down Farm on Salcombe Hill and the adjacent South Combe Farm should be preserved in perpetuity as private open spaces. A similar agreement has been made with Dr. Vaughan Cornish concerning the eight hundred yards of cliff frontage to this property. Dr. Vaughan Cornish has also undertaken to maintain a right of way along the cliff even if falls of cliff destroy the existing path. These engagements have been made voluntarily by the Rev. Cornish and Dr. Cornish, and they ensure that the fields of the Salcombe Regis Valley will be preserved as an open space for all time. The Norman Lockyer Observatory is on the top of Salcombe Hill, and it is gratifying to know that, by one of these generous gifts, the fields on the south side of the road opposite to the Observatory are never to be used for building development.

Further Gifts to Oxford from Lord Nuffield

LORD NUFFIELD has offered £1,000,000 to the University of Oxford (including a site valued at £100,000) for the building of a new college to be devoted to the collaboration, particularly in social

(including economic and political) studies, of theoretical students and practical men of affairs. The site is situated to the west of Oxford between Worcester College and Pembroke College. Two further bequests by Lord Nuffield include £100,000 for the erection and equipment of a new laboratory of physical chemistry and £200,000 for the erection of buildings at hospitals associated with the medical research scheme endowed by him in 1936.

Discovery of Teeth of *Australopithecus*

At the time of going to press, we have received a further communication from Dr. R. Broom, dated October 5, supplementing his letter under this title which appears on p. 681. He writes: "Since the above letter was written two weeks ago, four more teeth of *Australopithecus* have been discovered. Two are teeth of a very aged animal with the crowns almost completely worn off. One of these is a lower premolar, and the other a third left upper molar, but these are of little scientific value. The third tooth is a first upper incisor. Unfortunately, part of the crown is broken off and part of the root, but enough is preserved to show most of the structure. It is remarkably human. The width of the crown is about 10 mm. and the whole length of the tooth probably about 32 mm. The fourth tooth is the beautifully preserved crown of a right third upper molar. It agrees closely with the wisdom tooth of the type, but it is slightly more worn and has fewer corrugations. It probably belongs to the same individual as the third right lower molar tooth."

Announcements

THE Lord President of the Council has appointed Dr. G. M. B. Dobson, Lieut.-Colonel J. H. M. Greenly and Mr. S. K. Thornley to be members of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research. Prof. A. Fowler, Sir Clement Hindley and Dr. T. Franklin Sibly have retired from the Council upon the completion of their terms of office.

THE first Radford Mather Lecture of the British Association will be given by the Right Hon. J. Ramsay MacDonald on Friday, October 22, at the Royal Institution, Albemarle Street, London, W.1, at 5 p.m. Mr. MacDonald will take as his subject "Science and the Community". The Norman Lockyer Lecture, on "Origins of Town Life in Britain: an Illustrated Review of Recent Evidence", will be given by Dr. R. E. Mortimer Wheeler in the Goldsmiths' Hall, Foster Lane, Cheapside, London, E.C.2, at 4 p.m. on Wednesday, November 24. Further information can be obtained from the Secretary, British Association, Burlington House, London, W.1.

THE Iron and Steel Institute and the Institute of Metals have arranged to hold their 1938 autumn meetings in the United States, opening in New York jointly with the corresponding American Institutes on October 3. Technical sessions will be held on

October 3 and 4, and from then until October 21 visits will be made to various centres of technical interest in the United States. Further information can be obtained from the Secretary, Iron and Steel Institute, 28, Victoria Street, London, S.W.1.

THE Federation of Progressive Societies announces a series of fourteen lectures being given in the Conway Hall, Red Lion Square, W.C.1, at 8 p.m. Among the subjects and lecturers are: November 3, eugenics and the class struggle, J. B. S. Haldane; November 10, sex and censorship, Norman Haire; January 5, 1938, the failure of intellectuals, Doris Russell; February 2, the cultural basis for unity, John MacMurray. Particulars may be obtained from the hon. secretary of the Society, 4 Fitzroy Street, London, W.1.

THE following appointments and promotions have recently been made in the Colonial Service: B. de L. Inniss, agricultural superintendent, Gold Coast; A. B. Lucy, agricultural officer, Malaya; A. F. Posnette, botanist, Agricultural Department, Gold Coast; D. H. Welch, agricultural officer, Nigeria; H. B. Burgess, assistant conservator of forests, Nigeria; J. H. Nelson Smith, assistant conservator of forests, British Honduras; P. R. Page, assistant conservator of forests, Nigeria; C. L. Turner, veterinary officer, Malaya; G. K. Argles, manager, Fruit and Vegetable Development Scheme, Jamaica; E. G. A. Benson (assistant agricultural superintendent), agricultural superintendent, British Guiana; D. L. Blun (director of agriculture, Cyprus), director of agriculture, Nyasaland; W. E. Freeman (late tobacco breeding officer, Mauritius), botanist, Agricultural Department, Nigeria; E. F. S. Shepherd (botanist and mycologist, Agricultural Department, Mauritius), plant pathologist, Gold Coast; J. P. Edwards (senior assistant conservator of forests), conservator of forests, Malaya; M. Crawford (Government veterinary surgeon), deputy director (animal husbandry and Government veterinary surgeon, Department of Agriculture, Ceylon; G. B. Simmins (veterinary research officer), senior veterinary research officer, Department of Agriculture and Fisheries, Palestine; M. A. Crane (chief draughtsman), research officer, Mechanical Engineering Department, Nigerian Railways; C. G. Fannin (district surveyor), chief surveyor, Kenya; J. H. Haleblan (assistant chemist), chemist, Department of Antiquities, Palestine; A. S. McKinnon (assistant livestock officer, Veterinary Department, Tanganyika), agricultural officer, Veterinary and Agricultural Department, Somaliland; J. H. Nield (computer), district surveyor, Kenya; J. G. Reece (first assistant surveyor), deputy surveyor and deputy sub-intendant, Trinidad; H. Smith (assistant mechanical engineer, Public Works and Electricity Department, Zanzibar), inspector of machinery, Mines Department, Gold Coast; J. A. R. Stoye (Government analyst, Mauritius), assistant Government analyst, Nigeria; W. G. W. Wilson (superintendent of workshops), chief mechanical engineer, Nigerian Railways.

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. 685.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Discovery of a Lower Molar of *Australopithecus*

ABOUT a year ago I announced the discovery of a new specimen of a fossil anthropoid from a cave at Sterkfontein, near Krugersdorp, Transvaal. The specimen consists of the nearly complete brain cast, most of the base of the skull, with both maxillæ in fair preservation. Of the teeth we have on the right side the second premolar and the three molars, and on the left side both premolars and the first and second molars. In addition we have the socket of the right canine, and those of the left canine and both incisors fairly well preserved. It is thus possible to make a satisfactory restoration of the whole upper dentition.

I referred the ape to a new species of *Australopithecus*; as though certainly allied to the Taungs ape it is evidently considerably later in time. Owing to the great importance of *Australopithecus* as a fossil anthropoid with teeth much more like those of man than those of any of the living anthropoids, and to its thus possibly being nearly related to the anthropoid from which the human stem arose, it seems necessary to get as much new light on this remarkable form as we can.

Explorations of the Sterkfontein cave and of other caves in the neighbourhood have resulted in a satisfactory knowledge of the animals that were contemporaneous with *Australopithecus transvaalensis*, and the fauna shows that the climatic conditions were probably not unlike those of to-day. A full account will be given elsewhere of the associated fauna. It seems to be of Upper or possibly Middle Pleistocene age.

On September 15 I was fortunate in discovering a beautifully preserved third lower molar of *Australopithecus*. As fossil anthropoids are better known by their lower molars than the upper, it was felt that we could scarcely decide the affinities of the ape until we got a lower jaw or at least a good lower molar. The tooth was quite isolated. It is from the same cave as the skull and from about the same level but from a spot about six yards from the other. It cannot, I think, belong to the same individual, but it is the tooth of a young adult, not improbably a male. The crown is slightly worn.

The tooth is very large, the greatest antero-posterior length of the crown being 17.7 mm. and the greatest breadth 15.2 mm. It is thus comparable in size with that of the gorilla and very much larger than the corresponding teeth in the chimpanzee or man. The crown pattern will be seen from Fig. 1 to be a modification of the well-known *Dryopithecus* pattern. There are three large cusps on the outer side, and three almost as well developed on the inner side. As will be noted, there are clear indications

of a rudimentary external cingulum such as we find in *Dryopithecus*, and in the small fossil anthropoids, *Bramapithecus* and *Sugrivapithecus*, recently discovered by Lewis in the Siwaliks. Indications of the cingulum are usually seen in the molars of the gorilla, but they are usually lost or only represented by pits in the chimpanzee and man. There is a well-marked anterior fovea—a characteristic generally present but not much developed in the gorilla. A fovea is often present in man, but is usually lost in the chimpanzee.

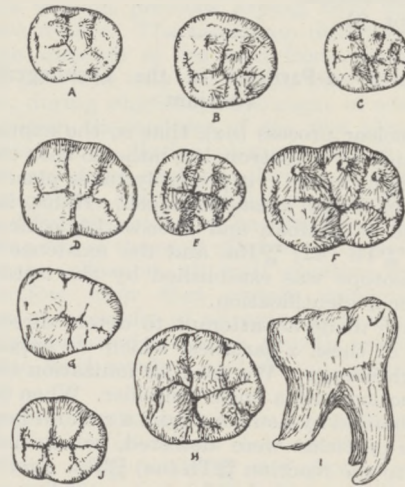


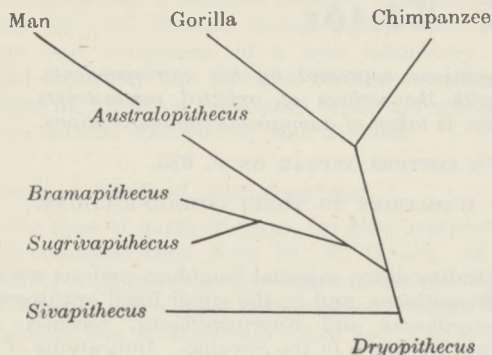
Fig. 1.

THE THIRD RIGHT LOWER MOLAR TOOTH IN *Australopithecus transvaalensis* BROOM, AND IN ALLIED ANTHROPOID APES AND MAN. ALL FIGURES NATURAL SIZE.

A. *Dryopithecus fontani* Lartat; B. *Dryopithecus darwini* Abel; C. *Dryopithecus rhenanus* (Pohlig); D. *Dryopithecus chinjiensis* Pilg. (=fide Lewis *Sivapithecus indicus*, Pilg.); E. Chimpanzee; F. Gorilla; G. *Bramapithecus punjabicus* Lewis; H. *Australopithecus transvaalensis* Broom (occlusal surface); I. *Australopithecus transvaalensis* Broom (outer view); J. Australian native woman. All figures except G, H and I are after Gregory, a number reversed.

From the illustrations it will be seen that the tooth in its crown pattern agrees more closely with that of an Australian native than it does with that of any of the known anthropoids. It may be regarded as a form evolved from that of *Dryopithecus*: the molar of man may be regarded as derived from that

of *Australopithecus*, but reduced in size and degenerate. The molars of the gorilla and chimpanzee are probably evolved from a pre-*Australopithecus* type.



All the available evidence would seem to indicate that the higher anthropoids and man may be related as shown in the accompanying diagram.

R. BROOM.

Transvaal Museum,
Pretoria,
South Africa.
Sept. 21.

Detection of α -Particles in the Disintegration of Thorium

THE nuclear process (α), that is, the expulsion of an α -particle by a neutron, has hitherto been observed only for light nuclei; it probably takes place also in the case of heavy, unstable nuclei. Hahn, Meitner¹ and Curie, v. Halban and Preiswerk² assumed the reaction ${}_{90}^{232}\text{Th} (\alpha) {}_{88}^{228}\text{Ra}$, and the existence of the radium isotope was established by the latter three by chemical identification.

We have made an attempt to detect directly the presence of these α -particles, which we expected to be of high energy. We used an ionization chamber in conjunction with a linear amplifier. When thorium was bombarded by neutrons from a radium-beryllium source, α -particles were detected, which must be ascribed to the reaction ${}_{90}^{232}\text{Th} (\alpha) {}_{88}^{228}\text{Ra}$. Preliminary measurements with absorbing screens have shown that these α -particles possess an energy greater than 9 million electron volts.

A full account of these experiments will appear in due course in *Helv. phys. Acta*.

A. BRAUN.
P. PREISWERK.
P. SCHERRER.

Physikalisches Institut,
Eidgenössische Technische Hochschule,
Zürich. Aug. 31.

¹ Hahn und Meitner, *Naturwiss.*, 23, 320 (1935).
² Curie, v. Halban and Preiswerk, *C.R.*, 200, 1841 and 2079 (1935); *J. Phys.*, 6, 361 (1935).

Production of Showers by Heavy Particles

Carlson and Oppenheimer¹ and Bhabha and Heitler² have proposed a very ingenious explanation of showers by a multiplicative production of photons, electrons and positrons. The greater part of the showers observed can in this way be regarded as originated by electrons, positrons or photons penetrating from the atmosphere. Such showers are absorbed if the layer of lead is sufficiently

thick. It is known, however, that at sea-level and especially under earth, the frequency of showers with increasing thickness of lead layer does not diminish but tends to a limit. We wish to point out that this phenomenon does not require a new concept of showers, but can be explained by irradiation with heavy particles, which easily penetrate through such layers of lead.

A more rigorous treatment of showers³ shows that a shower has a certain range given by the formula

$$L = 0.25 \frac{\hbar c}{e^2} \left(\frac{mc^2}{e^2} \right)^2 \frac{1}{ZN} \log \frac{E}{\epsilon}$$

where \hbar , c , e have the usual meaning; m is the electronic mass; N is the number of electrons per cm.³; $\bar{Z} = \frac{\sum N_z Z (Z+1)}{\sum N_z Z}$ (N_z is number of atoms with charge Ze); E is the energy of the incident particle and ϵ a critical energy of the order of magnitude $750/\bar{Z}$ million volt.

If we combine this formula with the well-known formula for radiation probability for a heavy particle, we get for the probability that a shower produced by a photon emitted by a heavy particle gets out of the layer of sufficient thickness:

$$W = 0.8 \left(\frac{m}{M} \right)^2 \left(\log \frac{E}{\epsilon} \right)^2 \log \frac{E}{(Mc^2)^{3/4} \epsilon^{1/4}};$$

where M is the mass of the heavy particle and E its energy, which is assumed $\gg Mc^2$. If we take for M the value of some tens of electronic mass proposed by Anderson and Neddermeyer⁴, we get a fair agreement with the observed order of magnitude.

Details of the calculations will be published elsewhere.

Physical Institute,
Academy of Sciences of the U.S.S.R.,
Moscow.
Sept. 1.

L. LANDAU.
G. RUMER.

The Zodiacal Light at a Total Solar Eclipse

AN interesting observation made by Mr. M. Honda in Hokkaido at the total solar eclipse of June 19, 1936, has just been reported and is well worth mention.

Seated in a lightproof bag, which covered his head also until totality had commenced, Mr. Honda observed the sky round the sun, with a large black disk blotting out an area of radius about three solar diameters with the sun at the centre. He saw and plotted the boundaries of the band of zodiacal light from close to the sun, where it had a width of 44°, along the ecliptic to a point about 40° away where it was cut off by clouds. To see the zodiacal light, on what is effectively a moonlit sky, is difficult, but the band must be very much brighter near the sun. Mr. Honda's observation is well worth repeating by other experienced zodiacal light observers at the next eclipse, and if possible some quantitative measure of the intensity of the band should be obtained along with measurements of coronal intensity.

F. J. M. STRATTON.

Solar Physics Observatory,
Cambridge.

Excretion of Nitrogen by Leguminous Plants

WITH reference to Prof. P. W. Wilson's communication upon this subject¹ I wish to make the following comments.

In our laboratory, where the excretion of nitrogen compounds from the leguminous root nodules has been for the first time definitely proved with a sterile culture system, hundreds of experiments have been carried out during the last ten years. In all experiments—both in sterile and in ordinary pot cultures—distinct excretion has practically always been detected, when suitable bacterial strains have been used for inoculation of red clover, white clover and pea, and the experimental conditions have been natural. Our experiments have not been restricted only to sand cultures, but similar experiments have also been carried out in clay and sandy loam soils, in kaolin medium, etc. The excretion of nitrogen compounds from the root nodules is therefore no incidental phenomenon which would appear only under certain artificial laboratory conditions. On the contrary, it occurs in experiments carried out under most natural conditions.

When Prof. Wilson could find no excretion in his numerous experiments during three years and now at last finds the phenomenon occurring in certain experiments, in others not, his experimental conditions must in some way differ from the natural ones. So far as is known to me, Prof. Wilson is using very coarse quartz sand as the substrate and the pot cultures are watered many times a day. According to our investigations the excretion depends greatly on the absorptive capacity of the medium. For example, with water cultures as well as with those containing glass beads, we have as a rule not been able to show any distinct excretion. Nor can any noticeable excretion be expected if the quartz sand particles are big.

From cultures grown on such media no conclusions can be drawn with regard to practical agriculture. Our experiments have been carried out partly in very fine quartz sand, which has a great absorptive capacity, partly in different soils. On the basis of these experiments, and particularly of those carried out in soil, it can be definitely concluded that the excretion is a phenomenon which must occur in the field and plays an important part in practical agriculture. The benefit to non-legumes in associated cultures with legumes, a fact which has been known in practical agriculture for thousands of years, has been explained through the excretion phenomenon. I refer to our publication concerning the associated cultures appearing in the October issue of the *Journal of Agricultural Science* and also to my paper presented before the Fourth Agricultural Grassland Congress at Aberystwyth in July this year.

The extent of excretion varies considerably even in parallel experiments and depends, as I have often emphasized, on many factors, of which so far only a part is known to us. Such factors are, for example, bacterial strain, amount of nodules, host plant, medium and nitrate content of the medium².

At least with the plants employed by us, the excretion can always be shown, and with our recent knowledge of the factors effecting the excretion. In associated cultures of lucerne and rye-grass, Thornton and Nicol (1934), in Rothamsted have detected distinct excretion. If some species of legumes (for

example, soy) should differ in this respect, it certainly does not mean that the excretion phenomenon has no importance in agriculture. However, I consider that, even with soy, thorough investigations must first be carried out using different bacterial strains in inoculating different species of soy and natural media, before anything definite can be stated.

ARTTURI I. VIRTANEN.

Biochemical Institute,
Helsinki.
Aug. 31.

¹ NATURE, 140, 154 (1937).

² See *J. Agr. Sci.*, July 1937.

A PREVIOUS communication¹ referred to experiments with inoculated soybeans (variety "Manchu") growing under normal conditions in sand culture, in which I was unable to detect any excretion of nitrogenous substances from the nodules into the rooting medium, as demonstrated by Virtanen² and his collaborators in other legumes, especially the pea. Further experiments, in which the sand from the culture pots was submitted to direct Kjeldahl analysis without previous drying, have also yielded negative results. The maximum difference between nitrogen contents of the sand from inoculated and control pots was only 2.5 mgm., after four months' growth, during which time 350 mgm. of nitrogen was fixed within the nodules of the five plants of the inoculated pot. Barley plants grown in the same pots as nodulated soybeans derived no benefit from the association, confirming the absence of excretion. Three different strains of bacillus have been tried, including two of the most efficient in fixation from the Wisconsin collection, all with negative results. It is therefore clear that certain measurements of fixation and transfer of nitrogen made in a previous investigation³ under similar growth conditions are complete in themselves and do not require amendment.

Negative results have also been obtained with broad bean (*Vicia Faba* L.) variety "Longpod", both from sand analyses and from examination of test plants grown with the nodulated beans. The fixation here amounted to 275 mgm. for two plants.

It is impossible to say at present whether these negative results arise from the absence of excretion from these particular legumes under any conditions, or from the lack in the present experiments of certain undefined conditions necessary for excretion to proceed. Ludwig and Allison⁴ and Wilson⁵ have also been unable to find excretion in a number of legumes. The plant cultures of the present experiments were not strictly sterile in the sense that some of Virtanen's were, but since the latter author finds excretion in both sterile and ordinary open cultures, it is clear that absence of complete sterility is not a reason for negative results. It is possible that differences in anatomical details of the outer nodule tissues may account for any variations in excretion between different legumes that may finally be established.

With the pea (*Pisum sativum* L.) variety "Gradus", we have obtained a maximum excretion of 7 mgm. nitrogen per pot of three plants, the fixation being 60 mgm. (bacillus strain Virtanen HX). Barley

plants associated with similar peas showed no measurable uptake of nitrogen, confirming that the excretion was small.

Mr. J. Boyes collaborated in some of this work.
G. BOND.

Dept. of Botany,
University,
Glasgow.
Sept. 10.

- ¹ Bond, *NATURE*, **139**, 675 (1937).
² Virtanen, *J. Soc. Chem. Ind.*, **54**, 1015 (1935).
³ Bond, *Ann. Bot.*, **50**, 559 (1936).
⁴ Ludwig and Allison, *J. Bact.*, **31**, 93 (1936).
⁵ Wilson, *NATURE*, **140**, 154 (1937).

Attitude and Concealing Coloration

I FOLLOWED with much interest and amusement a controversy in *NATURE* concerning the origin of species, which involved the meaning of protective coloration in insects. One correspondent asserted that insects placed themselves in special locations with which their concealment devices blended. I am submitting a further example of this.

We have in New Zealand a tree-lily or palm-lily, *Cordyline australis*, related to the dragon-trees, and known to us as the cabbage-tree. A looper caterpillar lives in and on its green erect crown, and the moth, *Venusia verriculata*, from this caterpillar lies concealed by day in the dead, strap-like leaves that hang like a rustling skirt around the trunk.



Fig. 1.
Venusia verriculata RESTING ON DEAD LEAF OF THE 'CABBAGE TREE'. APPROX. $\frac{2}{3}$ NATURAL SIZE

they match very well in colour.

This is, so far as I can find, the first time the actual movement, appearing strikingly purposive, has been observed, or even the live insect photographed more or less *in situ*.

Dominion Laboratory,
Scientific and Industrial
Research Department,
Wellington.
Aug. 5.

J. J. S. CORNES.

THE part played by living insects in adopting attitudes which increase the effect of the colour and pattern is often overlooked in discussing the relation of coloration of insects to natural selection. Mr. J. J. S. Cornes has given a striking new example from New Zealand of a phenomenon recorded by Mr. A. H. Hamm¹, for English moths when resting on the bark of trees. It was recorded that the vast majority of the individuals of the common winter moth, *Hybernia leucophaearia*, rest with the body horizontal, so that the lines of pattern on the wings are brought into parallelism with the dark shadows in the abundant vertical cracks of the bark on which they rest. If the wings were spread horizontally, as is so often the case with moths of this group, the main lines of the pattern would cut across the main lines of the background.

The same principle was shown to apply to the resting attitudes of other species in a later paper². It is quite obvious when one witnesses such a case that the insect is under the influence of a strong instinct and that until it has adopted the attitude described it is uneasy. The same thing has often been noted with the butterfly *Eronia cleodora* in Africa, of which the underside resembles the blotched green, yellow and brown appearance of a partially dead leaf³. Specimens disturbed from rest among vegetation have been seen to settle among the leaves on a plant which show the same mottled coloration rather than among healthy and entirely green leaves.

G. D. HALE CARPENTER.

Department of Entomology,
University Museum,
Oxford.

- ¹ *Proc. Ent. Soc. Lond.*, p. xv (March 19, 1902).
² *Trans. Ent. Soc. Lond.*, 483-85, Plate xxix (1906).
³ Longstaff, G. B., "Butterfly Hunting in Many Lands" (London, 1912), p. 194 and frontispiece.

Excretion of Vitamin C in Sweat

ON the Witwatersrand gold mines, where the Bantu mine labourers work under hot humid conditions, cases of scurvy and sub-scurvy occur with some frequency, despite the fact that the diet provided has been shown to contain adequate amounts of vitamin C (some 20-30 mgm. daily). The explanation given is that the high energy requirement increases utilization of the vitamin. However, on testing sweat samples collected from recruits undergoing a 'heat tolerance' test under conditions approaching those encountered underground (shovelling gravel at 97° F. dry and 96° F. wet bulb for one hour in a surface chamber), it was found that sweat reduced indophenol dye under conditions regarded as specific for the vitamin¹.

The vitamin C content of a series of samples varied between 0.5 mgm. and 1.1 mgm. ascorbic acid per 100 c.c. Since the average weight loss during the test is about $\frac{1}{4}$ lb., representing chiefly sweat loss, excretion of vitamin C by this route amounts to some 2 mgm. per hour. Further, examination of the urinary excretion of vitamin C both before and after the heat chamber shows no change. Hence severe exercise produces an increased elimination through the sweat mechanism.

We found² that the average urinary excretion of Bantu miners was 10 mgm. vitamin C daily and did not differ from boys resting. As Orenstein³ has shown that a miner may lose 2 $\frac{1}{2}$ -5 lb. weight after

an eight-hour shift underground, excretion of vitamin C through sweat must play an important part in vitamin C subnutrition in miners, who cannot afford a liberal diet (20–25 mgm. vitamin C daily has been regarded as the indispensable minimum to prevent subscorbutic symptoms under normal conditions⁴).

R. E. BERNSTEIN.

Department of Physiology,
University of the Witwatersrand,
Johannesburg.
Sept. 16.

¹ Emmerie, A., and van Eekelen, M., *Biochem. J.*, **28**, 268, 1153 (1934); **30**, 25 (1936).

² Bernstein, R. E., and Weiner, J. S., *S. Afr. J. Med. Sci.*, **2**, 37 (1937).

³ Orenstein, A. J., *Africa*, **9**, 218 (1936).

⁴ Heinemann, M., *Biochem. J.*, **30**, 2299 (1936).

Hexaco-ordination of Tellurium, Molybdenum and Tungsten

THE Raman spectra of telluric acid and several molybdates and tungstates have been examined in the crystalline state and in aqueous solutions, particular care being taken to record their *complete* Raman spectra. Some of the results are given below :

Telluric acid solution— $\Delta \nu$ 644(10), 619(1), 333(3).

Ammon. molybdate crystals—927(7), 881(4), 362(1), 223(2).

" " solution (ammoniacal)—895(5), 820(2), 326(3).

Potass. " " (alkaline)—891(10), 823(3), 319(8).

Sodium tungstate " (alkaline)—929(5), 834(1), 320(3).

Potass. tungstate " (")—924(4), 835(1), 320(3).

(Figures in parenthesis indicate relative intensities, estimated visually).

Points from Foregoing Letters

DR. R. BROOM reports the discovery of a molar tooth having the characteristics of *Australopithecus* in a cave at Sterkfontein, South Africa, a few yards from the recently found skull belonging to the same species. The author gives diagrams comparing this tooth with the third right lower molar in allied anthropoid apes and in man, and submits a diagram of a possible relationship between man and the higher anthropoids.

By bombarding thorium with neutrons from a radium beryllium source, A. Braun, Dr. P. Preiswerk and P. Scherrer have detected alpha particles of energy greater than nine million electron volts, which they ascribe to the transformation of thorium of mass 232 into radium of mass 239.

The frequency of ionizing showers at sea-level and under the earth does not diminish with increased thickness of protecting lead, but tends to a limiting value. Dr. L. Landau and G. Rumer suggest that this is due to heavy particles which penetrate easily through lead. They submit a formula for the probability that a shower produced by a photon emitted by a heavy particle gets out of a layer of sufficient thickness, and this, they state, gives fair agreement with observed data.

Commenting on a previous communication by Prof. Wilson on nitrogen excretion by white and red clover and pea, Prof. A. I. Virtanen states that his experiments were carried out in very fine sand and in various soils approximating to natural conditions. He explains Prof. Wilson's failure to confirm the excretion as possibly due to the use of coarse quartz sand, which lacks absorptive capacity. A number of other factors, such as bacterial strain, amount of

In contrast with the results for sulphates¹ and selenates² (and of solid ammonium molybdate), the total number of Raman lines in each of the spectrograms of aqueous solutions is *three*, and *not* four, which is the number of lines expected from a tetrahedral molecule. On the other hand, the relation $\nu_1^2 = \nu_2^2 + \frac{2}{3} \nu_3^2$, which is the relation between the frequencies of an octahedral molecule, is strikingly obeyed, the deviations (2 per cent for molybdate; 0.1 per cent for tungstate) being very much less than what has been observed in some accepted octahedral molecules like the hexafluorides of sulphur, selenium and tellurium³ (10–17 per cent). The intensity relations of the lines are also in agreement with an octahedral structure.

It is therefore concluded that, like telluric acid, the molybdates and tungstates, which are known from studies of the phase systems to exist at ordinary temperatures as dihydrates⁴, are octahedral units in aqueous solutions, two oxygen atoms being co-ordinated to the central atom from the two water molecules of hydration.

A detailed discussion of the subject will be published elsewhere.

JAGANNATH GUPTA.

University College of Science
and Technology,
92 Upper Circular Road,
Calcutta. Sept. 15.

¹ Nisi, *Jap. J. Phys.*, **7**, 3 (1932).

² Ganesan, *Proc. Ind. Acad. Sci.*, **1**, 156 (1934).

³ Yost, Steffens and Gross, *J. Chem. Phys.*, **2**, 311 (1934).

⁴ Funk, *Ber.*, **33**, 3700 (1900).

nodules, host plant, medium and nitrate content of the medium also affect the amount of nitrogen excreted. Dr. G. Bond now reports experiments with sand cultures of inoculated soybeans which failed to show that nitrogen is excreted from their root nodules. This may be due, he thinks, to lack of as yet undefined conditions necessary for excretion. A small excretion of nitrogen in the case of a pea culture was observed.

In connexion with the discussion on protective coloration in insects, J. J. S. Cornes submits a photograph of an Australian moth, *Venusia verriculata*, resting on a dead leaf of the palm-lily, *Cordyline australis*, with its wings so oriented that their brown parallel markings lie along the parallel veins of the dried palm leaf, which they match in colour. This position they always take up. Prof. G. D. Hale Carpenter recalls a similar phenomenon recorded by Mr. Hamm in the case of the common winter moth, *Hybernia leucophaea*, and another in the case of the African butterfly, *Eronia cleodora*.

The amount of vitamin C excreted in the sweat in the case of Bantu labourers working at a temperature of 96–97° F. in the Witwatersrand gold mines is 0.5–1.1 mgm. per 100 c.c., or about 2 milligrams per hour, according to R. E. Bernstein. This loss of vitamin C may account for the relative frequency of scurvy or sub-scurvy amongst those miners.

The Raman spectra of aqueous solutions of telluric acid and of several molybdates and tungstates show only three lines, and their characteristics indicate that these substances exist at ordinary temperature as dihydrates in octahedral units, two oxygen atoms being co-ordinated to the central atoms from the two water molecules of hydration.

Research Items

Pomo Culture

A FURTHER statistical study of cultural elements among the Indians of California by Mr. E. W. Gifford and Prof. A. L. Kroeber deals with the Pomo as a whole (*Univ. Calif. Pub. American Archaeol. and Ethnol.*, 37, 4). The Pomo form a nationality speaking recognized related languages, or dialects, and are mainly distinguished by directional terms, such as 'south', 'eastern', etc. They are divided into a number of small groups, which, at one time or another, have been called tribes, villages, village-communities, or tribelets. Each was completely autonomous and possessed a main settlement, or central village, ordinarily in some valley, which was the residence of the chief or chiefs. Here was also situated the earth-lodge or dance-house, around which all the community gatherings centred. There was no Pomo culture, except as an ethnological abstraction; but there was a series of highly similar, but never quite identical, Pomo cultures, each carried by one of the independent communities. The aim of the present study is to discover how far the elements of this series, within the framework of a nationality, varied and how they were related. The number of communities is estimated to have been seventy-five; but in all probability this figure is too high. The number may have been about fifty, with an average population of possibly two hundred. The data for statistical treatment comprised 15,000 comparable factual items. From their analysis it emerges that generally it would appear that there existed a high level of uniformity between adjacent minimal territorial entities. The generic picture of Pomo culture accords with a numerical finding of around ninety-five per cent of cultural uniformity ordinarily shared by strictly neighbouring communities. All this presupposes a population always narrowly localized, as well as ordinarily peaceful—as we know it to have been.

Radiation and Cell Division

THE work of Spear has shown that the first effect of small doses of gamma rays on chick fibroblasts in tissue culture is an inhibition of cell division due to an action on the early phases of this process. A paper by Tansley, Spear and Glücksmann (*Brit. J. Ophthalmol.*, June 1937, p. 273) has extended the observations to a mammalian tissue (rat retina) and has presented much additional evidence as to stage of cell division at which the effect occurs. This tissue was chosen because it is still undifferentiated, and actively dividing, for some days after birth, and because it is easily accessible to radiation. Exposure to a small dose causes a diminution in the number of cells in the prophase of division, which reaches a minimum in a little less than two hours. This is followed by a minimum, first of the number of cells in metaphase, and then of those in telophase. If the dose is very small, the counts then rise to maxima which may be greater than the normal value, probably because cells which would have divided during the inhibitory period are added to cells which would have divided in this later period. When the dose is increased, this maximum does not occur and the

proportion of degenerate cells increases. A further increase of dose delays the onset of degeneration. These observations confirm the view that the effect is on the very early stages of cell division, and elucidate an apparent anomaly in connexion with degeneration. If observations had been confined to twelve hours after exposure, an increase of dose would have appeared to diminish the amount of degeneration.

Control of Nematodes of Horses and Sheep

CONTINUING his studies of the control of bursate nematodes, I. W. Parnell has tested the lethal effects of ten of the more common nitrogenous artificial fertilizers upon the free-living stages of sclerostomes (*Canadian J. Res.*, 15, 127, July 1937). The three nitrogenous fertilizers which lost most ammonia when mixed with faeces were found to be most deadly—pure ammonia water has already been shown to be lethal. In general it was shown that the proportion of fertilizer to faeces necessary to effect sterilization would, in farming practice, be too high to be used if all faeces had to be treated. But in a well-built manure heap only the bottom and outer surfaces of the heap would have to be treated, for sclerostome larvæ are unable to survive the heat of fermentation, associated probably with lack of oxygen and harmful products of decomposition, in the centre of a manure heap.

Amphibia of Connecticut

IN order to help teachers and students, biologists in schools and colleges, and the plain naturalist, the State Geological and Natural History Survey has published a popular bulletin describing the Amphibia of Connecticut (Conn. State Geol. N. H. Survey, Bull. 57, 1937, pp. 50). The State harbours ten species of frogs and toads, nine species of salamanders and newts, and a few species have been introduced, including *Necturus maculosus*. The bulletin describes each species, indicates its distribution, and gives a short account of its habitat and habits. Identification is simplified by a key to characters and by twenty plates of uncoloured photographic reproductions.

Parasitic Copepods of the North Sea and Baltic

G. M. VAN OORDE-DE LINT and J. H. Schuurmans Stekhoven, jun., give a good account of the parasitic copepods in this most useful series ("Die Tierwelt der Nord- und Ostsee", 31, Teil X.c. Leipzig: Akademische Verlagsgesellschaft m.b.H., 1936). Fish parasites are specially dealt with, and a large number of these have been recorded from the area covered. Dr. Stekhoven has recently described several parasitic copepods from the Belgian coast (*I. Bull. Mus. Roy. d'Hist. Nat. Belgique*, 1936) and worked at the physiology of *Lepeophtherius*, *Acanthochondria* and *Lernæocera*: a large amount of work has also been done by other authors on this favourite group. The copepod family Calanidæ is the only one without parasitic species. Even the Harpacticidæ include, according to Sars, a species probably parasitic for part of its life on whales, although it is not recorded from the area. A useful register of species, 214 in all,

and their hosts, both vertebrate and invertebrate, occupies thirteen pages, showing the parts of the body parasitized. Of the invertebrate hosts the Mollusca, especially nudibranchs, are the most numerous, Crustacea coming second, and there are a few in or on annelids, echinoderms and tunicates. This section of "Die Tierwelt" will be very useful for reference to those working on the group. It is well and clearly written, and the illustrations are numerous and well chosen. The same part includes Decapoda (Nachträge und Berichtigungen) by H. Balss (X.h.3), and *Pantopoda* (2 Nachtrag) by H. Helfer (XI.a.3).

Ciliary Currents on Lamellibranch Gills

MR. ALASTAIR GRAHAM makes some interesting observations on the gill currents of certain members of the Tellinacea (*Proc. Roy. Soc. Edin.*, 57, Part 2, No. 8). He has noted previously that the outer gill of *Solecurtus scopula* is peculiar in the absence of a groove along the free edge which is usually present in lamellibranchs. He has also shown (1934) that *Solecurtus* is almost certainly related to the Tellinacea. In his new investigation he finds that the ciliary mechanisms of the outer gill agree with other members of the Tellinacea (*Gari*, *Scrobicularia*, *Tellina*) and thus a further argument is produced in favour of this relationship. In discussing the homologies of the outer gills of the Tellinacea, the author puts forward various views, the most favourable, which he appears inclined to support, being that the outer gill of *Solecurtus* is not homologous with the outer gill of other lamellibranchs, but is a new structure formed from the supra-axial extension of the outer lamella. There are, however, certain arguments against this view, and the question remains unsettled.

Effect of Moulds upon Tanning Liquors

SEVERAL trees growing in the Philippine Islands yield liquors suitable for tanning purposes. The betel nut, *Areca Catechu*, the black wattle, *Acacia decurrens*, kalumpit, *Terminalia edulis*, and kamachile, *Pithecolobium dulce*, are four of the most important trees. Tanning liquors prepared from them are, however, subject to attack by common mould fungi, and Messrs. Luz Baens and F. M. Yenke have investigated their action (*Philippine J. Sci.*, 61, No. 4, 417-428; Dec. 1936). They found that the activities of the fungi *Penicillium glaucum* and *Aspergillus niger* gradually reduced the tannin content of prepared solutions. A rise in the relative acidity of the liquid was usually accompanied by a large decrease in tannin content. Variations in susceptibility of the liquids to attack by the fungi appeared, for extracts of betel-nut kernel and black wattle bark were susceptible to *A. niger*, but somewhat resistant to *P. glaucum*, whilst kalumpit bark extract allowed *P. glaucum* to increase more than *A. niger*. Both moulds would find their way to the liquid when natural infection took place during practical tanning operations.

Oceanography of Davis Strait

AN important contribution to the oceanography of the north-west Atlantic is contained in the Scientific Results (Part II) of the Marion and General Greene Expeditions to Davis Strait and the Labrador Sea 1928-1931-1933-1934-1935 (Washington: U.S. Treasury Department, 1937. 75 cents). One of the most interesting of many conclusions reached is in

regard to the vertical distribution of water in the Labrador Sea. The intermediate water between 500 and 2,000 metres appears to be derived from the warm, saline West Greenland current. The bottom water is formed by the winter-time chilling of the surface, intermediate and deep water in the northern part of the Labrador basin in the area off-shore from rapid currents. In that area it seems that convection currents occur down to the bottom. On the other hand, in summer the bottom water is isolated from the cold surface water by the intermediate warmer water. Part of the bottom water escapes into the Atlantic basin eastward of long. 38° W., and part may enter round the southern end of Greenland. The report points out the necessity for mid-winter observations in these seas in order to test this theory of vertical movements of water within the Labrador Sea.

Soil Erosion in the United States

A WELL-ILLUSTRATED article by Mrs. E. Huxley on this topic in the *Geographical Magazine* of September reveals some striking facts regarding the devastation of natural resources by over-cultivation, especially in areas of poor soil and steep slopes. It is estimated that more than ten per cent of the total land area of the United States has lost more than three-quarters of its top-soil and that a further thirty per cent can be regarded as moderately eroded. In the Mississippi valley alone, 400,000,000 tons of good rich top-soil are swept annually into the Gulf of Mexico, and in that area twenty-five per cent of the cultivated land has been stripped down to the subsoil and rendered useless for cultivation. A reduced yield of crops is the first sign of soil erosion, and this is generally countered by the use of fertilizers, which are, however, only a temporary remedy. A change in agricultural practice is required, and this is being carried out in some areas. Terracing, strip cropping, embankments along contours and other devices are being used, but most important of all is the reversal from one-crop cultivation to crop rotation and mixed farming. This, of course, will reduce the output of cash crops and mean a greater production of livestock products. The tendency will be to put American agriculture on a basis of home food production rather than intensive export production.

Haboobs in the Sudan

A PAPER read at the Royal Meteorological Society on June 16 entitled "Haboobs and Instability in the Sudan", by J. S. Farquharson, dealt with the cause of disturbances that are distinct from sandstorms and sand-devils, although associated with increases of wind and an atmosphere unpleasantly charged with dust. Recent observations of sand-devils were described in NATURE of January 30, p. 201. Sandstorms, according to Bagnold, are clouds of flying sand that rarely extend more than two metres above the ground. The haboob is very much greater in vertical extent than this, contains much smaller particles and in general structure is very different from the slender column of the sand-devil. In this paper a detailed description of all the haboobs observed in 1936 brings out the main characteristics of this phenomenon. A sample of dust in a haboob at Khartoum was collected with the aid of a pilot balloon from a height of 50 feet above the ground and it was found that the greatest length of a particle was generally between 0.01 and 0.07 mm. The observed changes of wind, temperature, etc., seemed

to indicate clearly that the necessary wind is associated with a thunderstorm or at least with a cumulo-nimbus cloud and is of the nature of the outrushing squall of the thunderstorm. The evaporation of rain from such a cloud before it can reach the ground was often observed near Khartoum, this process being very favourable for the development of a high degree of instability, seeing that the descending air in which the rain is evaporating would warm up dynamically at only the saturated adiabatic lapse-rate, while the environment would have a dry adiabatic lapse-rate. The instability resulting in the cumulo-nimbus development appears to occur near the boundary between the south-west monsoon and the north-east trade winds, and this year was more often associated with an advance of the relatively cool air from the north than with a northward extension of the warmer monsoon wind. Photographs of some of the haboobs showed the advancing storm to have a wide lateral extension across the direction of its advance, giving it something of the nature of a line-squall.

Preparation of Germanium and Gallium

THE presence of small quantities of the rare metals germanium and gallium, in coals and flue dusts has been known for some time. Sir Gilbert Morgan and Dr. G. R. Davies (*Chemistry and Industry*, 56, 717; 1937) have recently made a systematic investigation of British coals and flue dusts and find that, with the exception of certain South Wales coals, all contained some germanium, although the ash from Kentish coal contained only a trace. All gas-works' dusts contained both germanium and gallium, irrespective of the coal used, and these flue dusts constitute a valuable potential source of germanium and gallium, so that by suitable and probably minor alterations in working conditions, a material could be obtained which would be much richer in these metals than anything hitherto examined. It was found that loss of germanium occurs when a coal is burnt, so that its presence in flue dusts is explained. The method used for the extraction of the germanium and gallium was the distillation of the volatile germanium tetrachloride by heating the material with hydrochloric acid in a still, and the extraction of gallium trichloride from the residue by means of ether. The authors calculate that very large quantities of germanium and gallium are annually dissipated into the atmosphere or discarded as useless dust by the combustion of coal. F. Sebba and W. Pugh (*J. Chem. Soc.*, 1371, 1373; 1937) also describe an improved method for the extraction of gallium and germanium from the mineral germanite. The usual method of acid extraction leads to a troublesome separation from copper, iron, lead and zinc, and the extraction of gallium is probably incomplete. The new method consists in digesting the finely powdered mineral with sodium hydroxide solution. In this way both the rare elements are concentrated in a single operation. The authors also describe the electro-deposition and purification of gallium. Conditions for the electro-deposition of quantities of the order of 10 gm. of the metal are specified.

Carbon-Carbon Bond Distances

L. Pauling and L. O. Brockway, in considering the dependence of interatomic distances on resonance, have assumed that the C-C single bond is characterized by the distance 1.54 Å., as in diamond, and

the shorter distances observed in several compounds have been attributed to partial double bond character resulting from resonance. It might, however, be questioned whether this interpretation is justified, as the single bond radius for aromatic carbon might well be different from that for aliphatic carbon. These authors have now (*J. Amer. Chem. Soc.*, 59, 1223; 1937) determined the configuration of thirteen hydrocarbons by the electron diffraction method and have arrived at the conclusion that the value assumed for the carbon double bond covalent radius, obtained by linear interpolation between the single bond and triple bond radii, is 0.02 Å. too large. They now give corrected values for covalent radii as follows:

Bond	C	N	O	F	Si	P	S	Cl
Single	0.77	0.70	0.66	0.64	1.17	1.10	1.04	0.99
Double	0.67	0.61	0.57	0.55	1.06	1.00	0.95	0.90
Triple	0.60	0.55	0.51	—	0.99	0.93	0.88	—

In the case of other atoms than the first four, it is supposed that the factors converting single to double and triple bond distances are somewhat different from 0.87 and 0.78 adopted in the above table. The curve drawn by the authors connecting interatomic distances and bond types is somewhat altered. It does not differ appreciably from the old one up to 50 per cent double bond character; in the region between 50 per cent and 100 per cent double bond character the new curve makes it possible to determine bond type, whilst the old one was useless because of its small slope. They also show that the curve may be represented by an equation based on a potential function for a resonating bond as given by the sum of two parabolas, representing single bond and double bond potential functions.

Bright Solar Eruptions and Radio Fadings in 1935-36

Messrs. H. W. Newton and H. J. Barton have produced a very comprehensive paper (*Mon. Not. Roy. Astro. Soc.*, 97, 8, June 1937) in which a comparison is made between sudden radio fadings and bright eruptions observed on the sun in hydrogen light or in that of ionized calcium. In 1936, when rapidly increasing solar activity took place, 29 close associations of radio fadings with bright solar eruptions were recorded, and in those cases where the origin of the solar eruptions was observed, the radio fadings took place 7 minutes before the observed time of the solar eruption. There is no doubt that the fadings are due to a solar agency, travelling with the approximate speed of light from a limited part of the sun's chromosphere. The data are insufficient at present to show any correlation between terrestrial magnetic effects and radio fadings, and, in addition, are insufficient to establish a tendency for fadings to recur in intervals of 27 or 54 days.

The Orbit of OΣ 79

MR. L. T. S. SYMS has published a paper with this title (*Mon. Not. Roy. Astro. Soc.*, 97, 8, June 1937). The preliminary orbit was computed by Russell's method, largely a graphical one, and then the method of Innes and van den Bos was applied for a more definitive orbit. The period of this binary is 89.20 years, the semi-axis major 0.53", and the inclination $\pm 51.6^\circ$. It is interesting to notice that the elements give a dynamical parallax of 0.021", as compared with the spectroscopic parallax 0.022" determined at Mt. Wilson and the trigonometrical parallax 0.046" \pm 0.006" found at Allegheny.

Universities and Education

THE discussion in Section G (Engineering) of the British Association at Nottingham on September 3 on the training of university graduates for the engineering industry, which was opened by Prof. F. G. Baily, was notable not only for the high level sustained, apart from one or two lapses, but also for some stimulating remarks on the functions and character of university training in general which merit the attention of a wider audience.

In his introductory paper, Prof. Baily reviewed the scope and subject-matter of the various courses at present followed, and urged that for most men the practical training should follow the college course. He does not consider that the theory of commerce or industry should be included in the three-year curriculum, but should preferably be studied after some practical experience has been acquired. It is also doubtful whether a fourth year of study repays all students for the time spent. Prolonged study of theory may be of slight benefit to students of medium capacity and of little use in several branches of employment. Prof. Baily also stressed the value of the sandwich system and the perspective which some manual training gives as well as the closer contact with the workmen. The latter, rather than the acquisition of manual skill, are the most valuable results of manual training.

Dr. W. Jackson, who presented a joint paper with Dr. A. P. M. Fleming, stressed the need for a more effective co-ordination of the resources of the universities and of industry. The task of educating and training for engineering careers those who will ultimately occupy positions of high technical and administrative responsibility is a joint responsibility between the universities and industry, and Dr. Fleming and Dr. Jackson pleaded for a broader interpretation of industry's share in this responsibility. They made the somewhat revolutionary suggestion that the large industrial organizations should accept the responsibility of training such men for the country as a whole, and that the smaller concerns should no longer recruit direct from the universities. The tendency to include industrial administration and an increasing amount of specialized technological information in university courses was again adversely criticized, Dr. Jackson pointing out that this overloading or undue specialization is detrimental to their educational value. Opportunities for independent reading and thinking, and the exercise of originality, may be unduly restricted, and too high a premium placed on memory and the ability to reproduce information in the exact form in which it has been communicated in the lecture. The undergraduate stage is much too early a stage at which to encourage intensive specialization.

Dr. Fleming and Dr. Jackson suggested that the universities might now reasonably expect the large industrial firms to undertake, both independently and in co-operation with adjacent technical colleges, the necessary systematic instruction in the specialized branches of engineering technology with which they are concerned. If facilities for combined practical and technological training could be made available on a wide scale, the opportunity for a liberal education at the university and the effectiveness of the overall training could be increased considerably. Moreover, if released from technological obligations, the universities could

do much to stimulate in the embryo engineer the development of broader interests and participation in wider fields of activity. If engineers are to make their full contribution to the solution of the complex problems of modern life, their interests cannot be limited to technical matters, and the opportunities for humane studies and for participation in the corporate life of the university are two of the most important attributes of a university education.

Finally, Dr. Fleming and his colleague, referring to the universities and industrial research, urged that men of outstanding ability should be given the opportunity to return for one or two years to an appropriate university, either at home or abroad, to learn more effectively the method and art of research and to enhance their fundamental scientific knowledge. A regular stream of such men from industry, endowed by adequate joint scholarship provision, would exercise a very stimulating effect on the research and teaching activities of the universities. In addition, the engineering departments of the universities have an excellent opportunity for co-operative research with the physics, chemistry and metallurgical departments on borderline subjects in which industry is keenly interested but which an industrial research laboratory may be unable to tackle. Industry should also afford facilities in its research laboratories for members of university staffs to carry out or supervise supplementary work beyond the scope of their financial resources, thus assisting them to keep in touch with outstanding industrial problems.

Many of the points made in these two papers were strongly endorsed in the discussion which followed. In a written communication describing the training of engineer recruits for the Post Office service, Sir George Lee referred to the stress laid on personality, judgment and character in candidates rather than on technical knowledge, and emphasized the importance of a wider cultural education with, if possible, two foreign languages. A general education which equips the engineer to take some part in everyday affairs is much to be preferred to the present over-specialized education.

Mr. S. V. Goodall, who dealt with the Admiralty system of recruitment and training for the Royal Corps of Naval Constructors, referred particularly to the Admiralty's efforts to obtain university graduates who have not had any experience in shipyard work but have attained a high standard in mathematics and naval construction.

Sir T. Hudson Beare, after emphasizing the value of instruction in design as affording a means for expressing creative ability, asserted that the fundamental task of the university is to turn out trained minds able to absorb knowledge readily later on in life when left to their own resources, and to take their proper place in the life of the nation. The only specialization at a university should be specialization in the fundamental principles of the science. Mr. H. A. Ward, of Messrs. Rolls-Royce, Ltd., described a recent experiment in the employment of university graduates which is giving promising results, and Prof. C. H. Bulleid endorsed a number of Prof. Baily's and Sir Hudson Beare's remarks regarding premature specialization and the place of university training. Prof. E. W. Marchant also strongly endorsed the value of a university training for an engineer,

stressing particularly the importance of association with other students, and paid tribute to the work done by Dr. Fleming to encourage the employment of university graduates in industry.

Other speakers in the discussion reiterated the importance of concentration upon fundamental principles and humanitarian studies in a university training, while in regard to research it was pointed out that the greater expensiveness of engineering research, as compared with research in the physical sciences, is often a great handicap to the universities in initiating such work. Prof. R. V. Southwell suggested that the time is ripe for a drastic revision of engineering curricula, and a further speaker urged an inquiry into the whole question of scientific education, with the view, among other things, of eliminating the overlapping which at present exists between the technical schools and colleges and the universities.

The educational functions of the university were also touched upon from a different aspect in discussions before Section L (Educational Science). Incidental reference was made to the part of the university in the discussion on education for the community on September 3, although Prof. A. M. Carr-Saunders did not present his paper on this subject. A special session on September 6 was, however, devoted to the educational function of the university. Sir Richard Livingstone, who opened the discussion, took as his main theme the need for a new type of adult education which the universities are pre-eminently qualified to impart.

If the university sends out graduates with a thorough mental training and a background, it has done what it can to prepare them for life. When, however, education ceases at the age of twenty-two or twenty-three years, in our swiftly changing world a man is very liable to lose intellectual energy by the time he is forty and fail to keep up with advancing knowledge. Sir Richard urged that everyone engaged in routine or practical work, especially if he occupies a directing or controlling position, needs periods of systematic study to refresh, re-equip and re-orientate his mind. There is no occupation or profession in which the resumption of systematic education in later life would not be profitable, and there are few who would not greatly profit by it. Already in medicine and in teaching, refresher or vacation courses are being arranged, and Sir Richard referred to experiments in the same direction in civil and local government service. The Commonwealth Fund awards three fellowships for study in the United States to civil servants to enable them to carry out inquiry or research on problems akin to those which come within the scope of the Department in which they are serving. A summer school in colonial administration has been organized by the University of Oxford with the encouragement and help of the Colonial Office and Colonial Governments, in which detailed problems of native administration are placed in a wide general and comparative setting. A third instance is the growing practice of granting officers leave for part-time study in such courses as the diploma course in public administration at Oxford.

This type of adult education, which enables the student to place his special subject against the background of modern civilization, can only be supplied by the universities, and an extension of the practice of seconding promising officials for systematic study at the university would do much to break down the dangers which routine continually threatens. Moreover, this practice would tend to remedy the serious

neglect of the social sciences. Bringing back to the university in this way the civil or municipal servant, the medical or other professional man and the business man, with the first-hand knowledge of social conditions which they possess, would not only add to the data on which the social sciences depend and stimulate the cross-fertilization of theory and practice which is such a fruitful source of advance, but also assist to prevent disastrous mistakes in the study of these sciences, which aim at directing the policy of Governments and the conduct of millions of human beings.

The functions of the universities in regard to the social sciences were discussed in still greater detail by Prof. M. Ginsberg, who condemned the divorce of the teaching of the social sciences from that of social philosophy. This separation is the more unfortunate because the problems of deepest interest to layman and student alike are those in which questions of value and questions of fact are closely interwoven, and to see them in their proper relation is of the most vital importance. The training at present provided in the universities is not well calculated to achieve this object, for students, while trained in marshalling and correlating facts, have no parallel experience in weighing values or in disentangling values in complex social situations. Social science has two functions to fulfil, both of special relevance and urgency at the present time. The first, or critical function, is concerned with the pre-suppositions or assumptions underlying common-sense and scientific thought about social phenomena and with the nature and validity of the methods employed in investigating them. It is urgently necessary that philosophy should attempt to provide a critical apparatus for scrutinizing and evaluating the methods and assumptions made by the social sciences, and particularly the fundamental conceptions from which a synthesis of the social sciences may proceed. A philosophical analysis of the conceptions of social change, which are in fact employed, for example, in the different social sciences, would greatly help in clarifying the present confusion. Similarly, the philosopher could do much to guard against confusions which may arise out of misunderstandings regarding the logical character of the laws and the relations between necessity, freedom and law. The relation between purely deductive studies and the more concrete or inductive handling of economic data also requires elucidation.

That function of social philosophy which is concerned with the problem of values is, however, of even greater importance to-day and Prof. Ginsberg considers that in economic questions the moral issues involved at present most urgently require clarification. In many cases our moral judgments of particular institutions would be transformed if we had fuller knowledge of the ends actually attained in relation to the ends they are intended to serve. The effective handling of social problems involves a synthesis, but not a fusion of social science and social philosophy, and co-operation is even more important in the teaching of political science and especially of international relations. The present neglect of philosophy is due partly to the little attention devoted to social problems by philosophers, and particularly to the failure to bring the teaching of ethics into relation with present needs. Prof. Ginsberg considers that great changes are required in the teaching of both social science and social philosophy if the universities are to make their rightful contribution towards the rational ordering of society.

National Smoke Abatement Society

ANNUAL CONFERENCE AT LEEDS

THE ninth Annual Conference of the National Smoke Abatement Society was held in the Philosophical Hall, Leeds, on October 1-2. The morning session on October 1 began with the annual meeting of the Society, during which Dr. H. A. Des Vœux delivered his presidential address, which was entitled "Idealism".

After reference to the high ideals of cleanliness, both personal and civic, possessed by the ancients, and to the lack of hygiene in the Middle Ages, Dr. Des Vœux passed on to consider present-day standards. He asked whether we can pretend to-day to have recovered the ancient Greek ideal of clean and open cities. We still tolerate slums in our midst; we are yet content to live in cities periodically blotted out by fog and permanently wasted by sulphur-bearing fumes. Were every citizen an idealist, the City Fathers would have the authority and could exercise the power to clean the atmosphere.

Prof. R. W. Whytlaw-Gray (University of Leeds) presided over the discussion on town planning and smoke abatement which followed, and referred to results of recent research on the nature of atmospheric pollution. All smokes are in the process of natural coagulation, and the form of the deposit from polluted air depends on the degree of coagulation. Measurement of the size-range distribution of the particles probably affords the best means of assessing the injurious nature of polluted air, and it seems that fine particles, for example, of radius less than $0.5\ \mu$, are mainly responsible for the harmful effects. Such particles ($0.3-0.1\ \mu$) often form 50 per cent by weight of the solid matter in Leeds air.

Papers on town planning and smoke abatement were then read by Mr. J. E. Acfield (city engineer and surveyor, Leeds) and Mr. C. Gandy, of Manchester (chairman of the Executive Committee of the Society). Mr. Acfield discussed the doubts which exist regarding the possibility of creating smokeless zones under existing planning powers. The sections of the Act relating to 'zoning' appear to mean that enforcement of restrictions on present users regarding the fuel to be used would involve payment of compensation, and asked what possibility there is of action being taken under these conditions. Speaking of the present position in Leeds, he said that in the case of 27 buildings of any magnitude erected in the central area since April 1, 1930, the type of fuel used for central heating is in 18 cases coke, 3 coal, 5 oil and 1 gas; and in all cases where the fuel for cooking is known it is gas, electricity or steam. If the Corporation had possessed powers to require the change, subject to compensation, it would probably have achieved little more and might have been at considerable cost to do so. In a light industrial zone adjoining a large rehousing area, however, the Corporation has insisted on smokeless methods of generating power. There are now 4,200 municipal houses equipped with coke-burning ranges, yet despite an adequate supply the quantity of coke used by the tenants is deplorably small (85 tons for the 12 months ending in June 1937).

Mr. Gandy said that the time has come to consider the smoke problem as an integral part of the task of the town planner. Present restrictions on smoke emission are practically confined to factory smoke; attention should now be directed to the control of non-industrial smoke. He put forward a strong plea that legislation should be established empowering local authorities to make by-laws or schemes under which the emission of smoke would be declared a statutory offence in certain areas selected for that purpose. He gave reasons why the central areas in many cities would probably prove most suitable for selection in the first instance.

The two papers provoked a lively discussion, in which the need for appointing specially qualified whole-time smoke inspectors was emphasized. Duties in this respect usually fall to the already overworked sanitary inspector. Whilst an educational campaign for the general public is obviously required, it is imperative that the local administrators should be the first to be made 'smoke-conscious'.

In the afternoon session, devoted to the discussion of the reports from the regional committees of the Society, opinions were divided regarding the necessity for further legislation to advance the cause of smoke abatement, but it was suggested more than once that the fullest use is not being made of existing powers.

On October 2, Mr. Arnold Marsh, general secretary of the Society, presented a report on behalf of the Executive Committee on "Education and Smoke Abatement". Prof. J. W. Cobb (University of Leeds) who presided, referred to the prime necessity of arousing the public conscience to the harm done by smoke. For this it is necessary to look to education all the time, to education of different grades, all seeking the same end: the efficient utilization of fuel for the generation of heat, light and power with the minimum of atmospheric pollution.

Mr. Marsh stressed that information on the value of a pure atmosphere should be given in schools. It need not form an additional subject, but appropriate aspects of it should be incorporated into the normal course of such subjects as hygiene, domestic economy and general or elementary science. He outlined the contents of booklets which might be distributed to teachers to provide the necessary information.

In the ensuing discussion, Dr. F. A. Mason, representing the Board of Education, said that the children must be made conscious that the veil of fog and murk which prevents their enjoying the welcome warmth and health-giving rays of the sun is not an act of Nature but of man's own handiwork. The Board of Education is quite prepared to favour the introduction of some instruction on the smoke evil.

The views of a science school-teacher were expressed by Mr. Pixton, who said that smoke abatement is an excellent subject for the school curriculum and offers scope for interesting and informative experiments. He urged that in pressing for the introduction of the subject into school courses, the co-operation of the teachers' unions should be secured.

A. L. ROBERTS.

Larvæ of Decapod Crustacea*

THE first contribution to the study of the decapod larvæ of the "Discovery" expedition deals with the Stenopidea, Amphionidæ and Phyllosoma. The whole collection is so large that the easiest and best way to treat it is by taking the groups separately irrespective of systematic order. The three sections chosen are of peculiar interest, and their elucidation has entailed an enormous amount of labour, eminently worth while.

Most of the plankton samples were taken far out to sea, and one of the features of the collection is the abundance of late larvæ, whilst early larvæ are comparatively scarce. For this reason, it is rarely possible to complete a life-history of any form. In Part 1, Stenopidea, the author was fortunate in obtaining larvæ hatched from the egg of *Stenopus hispidus* from Bermuda (previously somewhat inadequately described by Brooks and Herrick), which has enabled him to recognize later larvæ and to establish certain generic characters. Two further species (presumably) of *Stenopus* are described and six more belonging to the Stenopidea, and a key is given to the stenopid larvæ described.

Part 2, on the Amphionidæ, is of special interest, for *Amphion* is a form which has led to much controversy both as to its systematic position and as to whether it is a larval or adult animal. There can be now no doubt that the oldest specimens known are immature, and Dr. Gurney is almost certainly right in referring *Amphion* to the Caridea (as Korscheldt and Heider had previously suggested). Given that it is a carid, then he believes that the only known

genus to which it can be referred is *Amphionides*, three specimens of which were found in the "Discovery" material, from a depth of 2,500-2,700 metres. This most extraordinary decapod is so tender that in all instances known it is much damaged; but a construction of one of them certainly shows a distinct likeness to *Amphion*. Zimmer, who first described *Amphionides*, regarded it as a larva and observed that it closely resembles *Amphion*. Dr. Gurney remarks that he might have gone further and claimed it as an adolescent post-larval stage in the development of that crustacean, for, as he shows, *Amphionides* is certainly a post-larval form. All this is most interesting and suggestive.

Part 3 deals with the Phyllosomas, and here the work is remarkable, for no fewer than four hundred specimens have been examined and measured, and about a dozen forms recognized. No series, unfortunately, is complete, and no very early stages are present. Nevertheless, generic larval characters are described which distinguish *Palinurus*, *Panulirus*, *Jasus*, *Scyllarus* and *Scyllarides* and, probably, *Palinurellus*, *Thenus* and *Parribacus*. A very large amount of information is given in connexion with these Phyllosomas which will help enormously in future work.

This first section of the expedition's decapod larvæ promises well for future parts.

* Discovery Reports, vol. 12, pp. 377-440. Issued by the Discovery Committee, Colonial Office, London, on behalf of the Government of the Dependencies of the Falkland Islands. Larvæ of Decapod Crustacea. (1) Stenopidea. (2) Amphionidæ. (3) Phyllosoma. By Dr. Robert Gurney. (Cambridge: At the University Press, 1936.)

Forestry in Great Britain

THE progress of the afforestation work being carried out by the Forestry Commission in Great Britain for the year ending September 30, 1935, is detailed in the sixteenth annual report (London: H.M. Stationery Office, 1936). During the year, the programme of work was that laid down by Government at the time of the financial crisis of 1931. In January 1935, the Commissioners reported to Government that it was desirable to review the position generally and to extend the current five-year programme, so that the work might be organized to the best advantage.

The Commissioners consider that a steady development is preferable to a sudden large increase of work which might lead to waste. They suggested therefore: (1) that the acquisition of land and the supply of plants should be speeded up; (2) to work up the annual planting programme from 21,000 acres to 30,000 acres over the next four years; (3) to continue expanding the programme up to 45,000 acres per annum. Of interest are the remarks made upon Jubilee forests, unemployment training camps, national forest parks and home timber trade.

With the permission of the late King George V,

three forests have received Royal designations to commemorate the jubilee, namely, the King's Forest in Suffolk, the Coed-y-Brenin (the King's Forest) in Wales, and the Queen's Forest in the Cairngorms.

In co-operation with the Ministry of Labour, sites of training camps and work such as road-making, etc. have been provided. During the year there were in all thirteen permanent camps and fifteen summer camps, with accommodation for 5,000 men. The camps were distributed at different centres throughout Great Britain.

The question of the formation of national parks has been under consideration by various bodies and individuals for some years past. The Commissioners appointed a committee, under the chairmanship of Sir John Stirling-Maxwell, to consider a specific example. The Commissioners have already, as a result of their land purchases, a considerable area of unplantable land. The Committee took a Scottish example consisting of unplantable land in the Forests of Ardgartan, Glenfinart, Benmore and Glenbranter in the County of Argyll. This area, including the adjacent Ardgool Estate belonging to the Glasgow Corporation which the Corporation is willing to

bring into the scheme, extends to 100 square miles and has now been earmarked as a national park to be used for campers, the youth movement body, and so forth. Funds have been obtained to provide camping sites, alpine huts and for the acquisition of Ardgartan House and policies.

A record is being prepared of the exceptional May frosts of the year 1935, which did a serious amount of damage in different parts of the country. The chief frosts occurred between May 13 and 19. The record of the susceptibility of the numerous species, conifer and broad-leaved, given in the report corresponds with previous statistics in this matter.

During 1935, the question arose as to whether afforestation could be of use in assisting the Special Areas. As a result of investigations, it has been found that a certain amount of land could be purchased for forestry purposes within fifteen miles of certain Special Areas, and that, as a preliminary, 1,000 forest workers holdings could be established and a certain amount of work provided. Grants have been made by Government both to speed up the afforestation programme and to assist the schemes in connexion with the Special Areas.

The information on the 1934 seed crops is of interest. During that year, the Sitka spruce crop was only moderate in Canada and the United States, and therefore the Commissioners (and others) were unable to obtain their full requirements. Douglas fir was good and Japanese larch seed abundant in Japan. In Europe, Norway spruce, European larch and Corsican pine were not too plentiful. Oak seed was in fair quantities, but beech was scarce. Of home-collected seed, the supplies of the chief forest species were sufficient to abundant.

Of the net total area of land acquired by lease, feu and purchase in Great Britain to September 30, 498,146 acres were classified at the time of acquisition as plantable, and of this area 301,133 acres (60 per cent) were in England and Wales and 197,013 acres (40 per cent) in Scotland. In addition to the above-mentioned areas, Crown woodlands extending to about 120,000 acres (of which some 60,000 acres are plantable) have been transferred to the Forestry Commissioners. The total area of land in the Commissioners' control thus approximated to 929,000 acres.

The Commissioners' seventeenth report for the year ending September 30, 1936 (London: H.M. Stationery Office, 1937) recently issued, shows the progress made. The Argyll National Park was inaugurated and a camping ground, car park and buildings for the use of campers were formally opened at Ardgartan. The question of instituting a similar park in Wales is now under consideration. The Special Area afforestation scheme received the sanction of Government and the Commissioners were authorized, as a first instalment covering three years and largely as an experiment, to acquire and begin to plant 100,000 acres and to establish 500 holdings. These plans were made public in February 1936 and the remaining months of the year under report were concerned with the preparatory work—acquisition of land and staff and provision of the necessary trees for planting purposes. Steps were being taken to cultivate a larger area of nursery ground. By May 1937, says the report, some progress had been made.

Owing to the wet year there were fewer fires. The total area of land under the Commission amounted to 954,500 acres and the area planted to 296,452 acres.

Science News a Century Ago

The Franklin Institute

THE fifty-fifth quarterly meeting of the Franklin Institute, Philadelphia, was held on October 19, 1837, when the usual quarterly report of the managers was read. Although the period covered by the report had not been marked by any new undertakings, the several sub-divisions of scientific and practical subjects had been encouraged with all the means at the disposal of the Society.

The interesting investigations on the cause of explosions of steam boilers had been concluded and the Government and the community had been put in possession of the results of the experiments and of ample directions tending to prevent the occurrence of accidents. The final report of the committee on the value of water as a moving power was expected to be ready shortly. The experiments made under the authority of the Institute were of the most perfectly practical character, and the application of a sound theory, deduced from practical results, would be put at the command of those interested.

The committees on science and the arts had sedulously prosecuted inquiries desired by inventors and others; the department of instruction had arranged for regular courses in chemistry, natural philosophy and mechanics. In addition to the usual augmentation to the library, "about one hundred volumes have been received from our esteemed member, Professor Bache, President of the Girard College, now in Europe. These books have been purchased out of a fund placed in the hands of Dr. Bache by the subscriptions of the members, and have been selected by a mind distinguished by its discrimination and devoted to practical science. . . ."

Launch of S.S. *Liverpool*

ON October 18, 1837, the wooden paddle-wheel steamship *Liverpool* was launched in the Mersey. The largest vessel built at Liverpool up to that time, she was constructed for Sir John Tobin, but became the property of the Transatlantic Steam Ship Company. She was built by Humble and Milcrest, and was 235 ft. long, 35 ft. beam and about 1,150 tons. Her engine, made by Forrester and Co. at the Vauxhall Foundry, had two cylinders, 75 in. diameter and 7 ft. stroke, and was of 468 horse-power. She is said to have cost £45,000. The *Liverpool* was the fourth of the steam vessels by which, in 1838, regular steam communication was maintained with America. The *Sirius* and *Great Western* made their first passages in April 1838, and the *Royal William* first crossed in July 1838. The *Liverpool* sailed from Liverpool on October 22, 1838, had to put into Queenstown, and finally reached New York on November 23. Her return voyage began on December 6 and ended on December 21.

Civilization and Insanity

THE *Gazette medicale de Paris* of October 21, 1837, contains the following information: At a meeting of the Academy of Sciences on October 10, M. Brière de Boismont dealt with the different countries in which he had been able to obtain information as to the figures of insanity. "What we have shown," he said, "gives us the right to regard insanity as a product of civilization. We have seen it reach its greatest development in the most enlightened nations, diminish as we penetrate into despotic governments

or into recently emancipated countries and disappear almost entirely when our researches have taken in any savage people." M. Brière de Boismont then submitted tables showing the number of the insane in the principal European capitals with the population of each capital and the population of the different European countries and New York State, with the number of insane interned in each country.

Encouragement of Vaccination

AN editorial in the *Lancet* of October 21, 1837, contains the following information and suggestion: "At the last meeting of the Royal Academy of Medicine, Paris, there were distributed by order of the French Government for the encouragement of vaccination rewards of £60 to three medical men who had shown themselves most active in the propagation of that inestimable benefit during the course of the preceding year. Four gentlemen received handsome gold medals; and no less than a hundred persons were rewarded with silver medals. It would be highly desirable that our own Government should adopt some similar method of encouragement. Numerous accounts from correspondents inform us that small-pox prevails to a very great extent in some of the poorer districts, where we are sorry to say, vaccination seems to have been neglected in a deplorable manner".

University Events

BIRMINGHAM.—At its last meeting the Council of the University was informed that the vice-chancellor and principal (Sir Charles Grant Robertson) had placed his resignation in the hands of the pro-chancellor (Mr. Walter Barrow), so that in accordance with the statutes of the University it may be considered at a meeting of the Court of Governors, which will have before it also the nomination of Dr. Raymond Priestley, of Melbourne, as his successor.

OXFORD.—At Merton College Dr. G. M. B. Dobson has been elected to an official fellowship and Prof. R. Campbell Thompson, formerly research fellow, to a professorial fellowship.

At Balliol College Dr. Simon Flexner (George Eastman visiting professor) and Dr. J. A. Gunn (on appointment as director of the Nuffield Institute of Medical Research) have been elected to supernumerary fellowships. Dr. J. H. Burn has been elected to a professorial fellowship and J. St. L. Philpot, formerly tutorial fellow, to a senior research fellowship.

Dr. A. A. Bake, of the University of Utrecht, has been appointed to a senior research fellowship at Brasenose College for research on the religious songs and music of India. Dr. Bake is working under the guidance of Sir Rabindranath Tagore. He has already been engaged in research in India on the Sanskrit theory of music and the folk-music of India in 1925-29 and 1930-34.

READING.—Sir Samuel Hoare has been elected Chancellor of the University and will be installed on November 29.

ST. ANDREWS.—At a graduation ceremony on October 8 the honorary degree of LL.D. was conferred upon Dr. W. T. Calman, former president of the Linnean Society, and lately keeper of the Zoology Department of the British Museum (Natural History).

Societies and Academies

Paris

Academy of Sciences, August 9 (*C.R.*, 205, 345-380).

LOUIS DE BROGLIE: The quantification of the field in the theory of the photon.

PIERRE LEJAY: The general characters of the acceleration of gravity in the Levant. A map of the countries of the Levant under French mandate is given, showing the anomalies in the value of g .

CHARLES EDGAR WINN: Some reducibilities in the theory of charts.

LUBOMIR TCHAKALOFF: A problem of Laguerre and its generalizations.

RAYMOND JACQUESSON: The variations of the internal friction of solids under the influence of thermal and mechanical treatments. The influence of a traction.

SANTIAGO ANTUNEZ DE MAYOLO: The charge e of the electron and the materialization of the photon.

MME. IRÈNE MIHUL and CONSTANTIN MIHUL: The ionization of the lower part of the ionosphere. A theory is proposed based on the ionizing action of the sun varying with the latitude: this is regarded as explaining all the known facts.

JULES FARINEAU: The spectrographic study of the conductivity electrons in the alloys of magnesium and aluminium.

JEAN BERNAMONT and MICHEL MAGAT: A new method for separating isotopes.

ANDRÉ DEBIERNE and LADISLAS GOLDSTEIN: The new transformations produced at low temperatures (*frigidreactions*). Correction of an error of printing in note of August 2.

ALFRED REIS: The measurement of the angular domain of reflection of the X-rays in polycrystalline substances by a new statistical method.

JACQUES GILBERT: The indirect experimental verification of the logarithmic increase of wind velocity starting from the ground. The method is based on the quantity of hoar frost deposited on a vertical rod exposed to the wind.

MARCEL AVEL: Experiments on the role of the complex digestive tube plus non-cutaneous mesodermic tissues, in the regeneration of the head in worms.

LOUIS GALLIEN: The masculinizing action of testosterone propionate in the differentiation of sex in *Rana temporaria*.

ALBERT PEYRON, BERNARD LAFAY and GUY POUMEAU-DELILLE: The regression of the papillo-epithelioma of the rabbit (Shope's tumour) under the action of colchicine.

August 18 (*C.R.*, 205, 381-396).

MARTIN FERBER: The structure of the order of statistical series of the exponential type.

AUGUSTE GOSSERIES: Study of the hydrolysis of solutions of cobalt chloride.

V. M. MITCHOVITCH and G. STEFANOVITCH: The reduction of glycerides by the Bouveault and Blanc method.

ROGER GUY WERNER: Cryptogamy and phyto-geography.

EMILE F. TERROINE and MME. SIMONE SYNEPHIAS: The relative participation of the proteins and lipids in meeting the energy losses in starvation.

Mlle. DIGNA VAN STOLK and ROLAND LEROY: Folliculin and dihydrofolliculin in the urine of pregnant mares.

Rome

National Academy of the Lincei (*Atti*, 25, 75-100; 1937).

G. SANSONE: Cesaro's summability of the Laplace series.

B. FINZI: Propagation of movement in threads.

G. PICCARDI: Molecular spectra and spectroscopic analysis (6). Detection of samarium.

A. C. BLANC: *Hippopotamus* fauna and palaeolithic industries in the deposits of the littoral grottos of Monte Circeo. Grotto delle Capre (1). Grotto del Fossellone (2).

L. CALIFANO: Investigations on the glycolysis of the retina.

Atti, 25, 101-144; 1937.

G. ROVERETO: New tectonic synthesis of the western Alps.

R. CALAPSO: Systems of lines of a surface which are invariant with respect to a transformation for a *W* congruence.

I. POPA: Asymptotic transformations of oblique curves.

G. SESTINI: Translo-circulatory current in presence of an arc of circumference with an eccentric source.

O. ZANABONI: General proof of the principle of De Saint-Venant.

L. LABOCETTA: Potential energy and curvature in gravitational fields.

A. IANDELLI and E. BOTTI: Crystal structure of the compounds of the rare earths with the metalloids of the fifth group. Nitrides of lanthanum, cerium and praseodymium (2).

B. L. VANZETTI and P. DREYFUSS: Configuration of olivine and of iso-olivine.

F. CEDRANGOLO: Amilase activity of the adipose tissue.

A. CAVINATO: Valentinite from the Ballao mine.

Sydney

Royal Society of New South Wales, August 4.

T. G. ROOM: The virtual genus of a curve with a multiple point.

S. J. HAZLEWOOD, G. K. HUGHES, F. LIONS and others: Pyrroles derived from acetylacetone. The Paal-Knorr synthesis of pyrroles from amines and 1:4-diketones has been studied for acetylacetone, and 37 new N-substituted 2:5-dimethyl pyrroles described. Pyrroles could not be obtained from *o*-nitraniline, tribromaniline, methyl anthranilate or *o*-aminobenzamide. On the other hand, anthranilic acid reacts readily to form N-*o*-carboxyphenyl-2:5-dimethyl pyrrole. Methyl anthranilate also fails to form pyrroles with ethyl phenacylacetate and with phenacyllaevulinic acid.

G. K. HUGHES and F. LIONS: Derivatives of higher catechol ethers. Attempts to sulphonate catechol di-*n*-butyl ether led to dealkylation. Hence, some reactions of catechol di-*n*-butyl ether and catechol di-*n*-amyl ether have been studied in comparison with veratrole. The higher ethers and derivatives appear to behave normally except in presence of sulphuric acid or chlorosulphonic acid.

K. J. BALDICK and F. LIONS: Derivatives of 6:7-dimethoxybenzoparathiazine. Treatment of 1-sulphydryl-3:4-dimethoxybenzene in alkaline solution with chloroacetic acid gives 3:4-dimethoxyphenylthioglycollic acid, which nitrates in cold glacial acetic acid to 2-nitro-4:5-dimethoxyphenylthioglycollic acid (I), but in the hot is converted into 2-nitro-4:5-dimethoxyphenylsulphoxide acetic acid (II). Both I and II can be oxidized to 2-nitro-4:5-dimethoxyphenylsulphone acetic acid (III). Reduction with tin and hydrochloric acid of I gives 3-ketodihydro-6:7-dimethoxybenzoparathiazine and of II gives 3-ketodihydro-6:7-dimethoxybenzoparasulphazone.

Tokyo

Imperial Academy (*Proc.*, 8, No. 7, July 1937).

GEMMYO ONO: Subhakara-simha's *Rta-samgraha*. "Compendium of Truth" introduced into China by the Indian priest Subhakara-simha (716-735).

TADAO DOI: Researches in the Japanese language made by the Jesuit missionaries in the sixteenth and seventeenth centuries. Grammatical and lexicographical works showing the development of the language.

AKITSUGU KAWAGUCHI: Theory of connexions in a Kawaguchi space of higher order.

UNAI MINAMI: An extension of the Phragmén-Lindelöf's theorem.

SEIJI IRIE: A theorem of Beurling.

JUICHI OBATA and RYUJI KOBAYASHI: A direct-reading pitch recorder and its applications to music and speech. Apart from recording simultaneously the intensity of sound and pitch variation in music and speech, it is suggested that the apparatus described can be used for industrial purposes, such as determining the number of revolutions of a rotating machine.

HANTARO NAGAOKA and TSUNETO IKEBE: Magnetic variation during an explosion of Asamayama, and its mechanism. During the eruption of the volcano, magnetic disturbance, mechanism of explosion, tilts and role of water were studied.

NAOMI MIYABE: Results of re-levelling in Kyūsyū, Japan. During re-levelling, details of the chronic deformation which is taking place were examined.

TSUNYUKI KIMURA: An improvement on cyanin synthesis (mixed solvent process) and the reaction of orthothioformic ester. Several new trinucleo carbocyanins were synthesized by the mutual actions of orthothioformic ester with cycloammonium quaternary salts.

FUMIO HIRATA: Rigidity and constitution of a thermo-reversible gel.

YASUO TAZAWA: Splitting of glyceryl glutamine acid anhydride by means of crystalline trypsin.

ICHIRO IITAKA: A new equilibrium diagram for the system Fe-C (see *NATURE*, 140, 462; 1937).

SANSHI IMAI: An edible Mongolian fungus, 'pai-mo-ku'. This proved to be a new species of the genus *Tricholoma*, and the name *T. mongolicum* Imai, sp. nov. is proposed.

YO K. OKADA and YOSHIKI MIKAMI: Inductive effect of tissues other than retina on the presumptive lens epithelium.

Forthcoming Events

Monday, October 18

ROYAL COLLEGE OF PHYSICIANS OF LONDON, at 4.—Sir Arthur Hurst: Harveian Oration.

ROYAL GEOGRAPHICAL SOCIETY (in the Connaught Rooms), at 7.45.—Annual General Meeting.

Thursday, October 21

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—Sir George Lee: Presidential Address.

Friday, October 22

BRITISH ASSOCIATION (at the Royal Institution), at 5.—The Right Hon. J. Ramsay MacDonald, F.R.S.: "Science and the Community" (Radford Mather Lecture).

PHYSICAL SOCIETY, at 5.15.—Guthrie Lecture.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—Sir John Thornycroft: Presidential Address.

Appointments Vacant

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

JUNIOR SCIENTIFIC OFFICER at the Forest Products Research Laboratory, Princes Risborough—The Establishment Officer, Department of Scientific and Industrial Research, 16 Old Queen Street, London, S.W.1 (October 20).

TECHNICAL OFFICER and ASSISTANT (grade III) for work in illuminating engineering at the Air Defence Experimental Establishment, Biggin Hill, Kent—The Superintendent (October 22).

PERMANENT ASSISTANT (male—grade III, metallurgy) in the Admiralty Technical Pool—The Secretary of the Admiralty (C.E. Branch) (quote C.E. 7851137) (October 23).

RESEARCH OFFICER (grade III) in the Agricultural Economics Research Institute, University of Oxford—The Secretary of the Committee for Rural Economy, School of Rural Economy, Oxford (November 1).

DIRECTOR of the Institute for Research in Agricultural Engineering, University of Oxford—The Secretary of the Committee for Rural Economy, School of Rural Economy, Oxford (November 15).

TWO ASSISTANTS in the British East African Meteorological Service—The Director of Recruitment (Colonial Service), 2 Richmond Terrace, S.W.1.

JUNIOR ASSISTANT for abstracting and library work at the Imperial Bureau of Fruit Production, East Malling, Kent—The Deputy Director.

Official Publications Received

Great Britain and Ireland

Technical Publications of the International Tin Research and Development Council. Series A, No. 59: Variation in Thickness of the Tin Coating of Tinplate, and its Effect on Porosity. By W. E. Hoare. Pp. ii+22. (London: International Tin Research and Development Council.) Free. [309]

University of Leeds: Department of Leather Industries. Report of the Advisory Committee on the Work of the Department during the Sessions 1935-36 and 1936-37. Pp. 8. (Leeds: The University.) [110]

Colonial Office. A Summary of Legislation relating to the Introduction of Plants into the Colonial Dependencies of the British Empire as at the end of December 1936. (Colonial No. 141.) Pp. 65. (London: H.M. Stationery Office.) 1s. net. [410]

Institution of Mechanical Engineers. General Discussion on Lubrication and Lubricants. Group 1: Journal and Thrust Bearings. Pp. 300. 2s. 6d. Group 2: Engine Lubrication. Pp. 216. 2s. 6d. Group 3: Industrial Applications. Pp. 162. 2s. 6d. Group 4: Properties and Testing. Pp. 226. 2s. 6d. (London: Institution of Mechanical Engineers.) [410]

Other Countries

League of Nations. Report of the Committee for the Study of the Problem of Raw Materials. (Official No.: A.27.1937.II.B.). Pp. 62. (Geneva: League of Nations; London: George Allen and Unwin, Ltd.) 2s. [289]

Bulletin of the National Research Council. No. 100: An Experimental Study of the Problem of Mitogenetic Radiation. By Alexander Hollaender and Walter D. Claus. Pp. 96. (Washington, D.C.: National Research Council.) 1 dollar. [289]

Veröffentlichungen des Geophysikalischen Instituts der Universität Leipzig. Zweite Serie: Spezialarbeiten aus dem Geophysikalischen Institut und Observatorium. Band 8, Heft 2: Thermische Untersuchungen in Waldteichen. Von Johannes Herzog. Pp. 77-132. Band 8, Heft 3: Die Strömungen der Atmosphäre über Teneriffa. Von Fritz Müller. Pp. 133-180. Band 8, Heft 4: Beiträge zum Ozonproblem; Die Rolle des Ozons im Wärmehaushalt der Stratosphäre. Von Rudolf Penndorf. Pp. 181-286. Band 8, Heft 5: Messungen mit dem Bergmannschen Sichtmesser. Von Rudolf Strange. Pp. 287-346. Band 9, Heft 1: Stratosphärische Steuerung und Wellensteuerung. Von Karl Schmiedel. Pp. 102. Band 9, Heft 2: Skagerrak-Zyklogen; Analysen der Wetterlagen vom 25-27 März 1930 und vom 2-4 März 1931. Von Hans Georg Macht. Pp. 103-218. Band 10, Anhang 1: Untersuchungen über die von Maschinen, Fahrzeugen und Wind hervorgerufenen Boden- und Gebäudeerschütterungen nach Registrierungen eines Benioff-Vertikal-Seismographen. Von Gerhard Fritzsche. Pp. 82. (Leipzig: Geophysikalisches Institut der Universität.) [289]

Proceedings of the American Academy of Arts and Sciences. Vol. 72, No. 1: Postulates for Assertion, Conjunction, Negation and Equality. By Edward V. Huntington. Pp. 44. 50 cents. Vol. 72, No. 2: Polymorphic Transitions of 35 Substances to 50,000 Kg/Cm². By P. W. Bridgman. Pp. 45-136. 1.45 dollars. (Boston, Mass.: American Academy of Arts and Sciences.) [289]

U.S. Department of the Interior: Office of Education. Bulletin, 1937, No. 7: Student Health Services in Institutions of Higher Education. By Dr. James Frederick Rogers. Pp. v+61. 10 cents. Leaflet No. 34: State Library Agencies as Sources of Pictorial Material for Social Studies. By Effie G. Bathurst, Elias Katz and Edith A. Lathrop. Pp. 9. 5 cents. Pamphlet No. 72: Status of Rural-School Supervision in the United States in 1935-36. By W. H. Gaumnitz. Pp. iii+20. 10 cents. Pamphlet No. 75: Safety and Health of the School Child; a Self-Survey of School Conditions and Activities. By Dr. James Frederick Rogers. Pp. 29. 10 cents. (Washington, D.C.: Government Printing Office.) [289]

U.S. Department of Agriculture. Miscellaneous Publication No. 251: A History of Agricultural Experimentation and Research in the United States, 1607-1925; including a History of the United States Department of Agriculture. By Alfred Charles True. Pp. vi+321. (Washington, D.C.: Government Printing Office.) 25 cents. [289]

Proceedings of the United States National Museum. Vol. 84, No. 3021: Observations on the Birds of West Virginia. By Alexander Wetmore. Pp. 401-442. (Washington, D.C.: Government Printing Office.) [289]

Smithsonian Miscellaneous Collections. Vol. 96, No. 4: Indian Sites below the Falls of the Rappahannock, Virginia. By David I. Bushnell, Jr. (Publication 3441.) Pp. v+65+21 plates. (Washington D.C.: Smithsonian Institution.) [289]

Carnegie Institution of Washington. Principles and Methods of Tree-Ring Analysis. By Waldo S. Glock. (Publication No. 486.) Pp. viii+100+14 plates. (Washington, D.C.: Carnegie Institution.) [110]

Report of the Aeronautical Research Institute, Tōkyō Imperial University. No. 154: Notes on the Lift and Moment of a Plane Aerofoil which touches the Ground with its Trailing Edge. By Susumu Tomotika and Isao Imai. Pp. 519-571. (Tōkyō: Kōgyō Toshō Kabushiki Kaisha.) 60 sen. [410]

Journal of the Indian Institute of Science. Vol. 20A, Part 1: (contributions to the Study of Spike Disease of Sandal (*Santalum album* Linn.). Part 17: Some Factors relating to the Abnormal Accumulation of Carbohydrates in Diseased Tissues. By A. V. Varadaraja Iyengar. Pp. 14. (Bangalore: Indian Institute of Science.) 1.2 rupees. [410]

University of Illinois: Engineering Experiment Station. Bulletin No. 292: Tests of Steel Columns, Thin Cylindrical Shells, Laced Channels, Angles. By Prof. Wilbur M. Wilson. Pp. 40. 50 cents. Bulletin No. 293: The Combined Effect of Corrosion and Stress Concentration at Holes and Fillets in Steel Specimens subjected to Reversed Torsional Stresses. By Thomas J. Dolan. Pp. 40. 50 cents. Bulletin No. 294: Tests of Strength Properties of Chilled Car Wheels. By Prof. E. Richart, Rex L. Brown and Paul G. Jones. Pp. 68. 85 cents. Bulletin No. 295: Tests of Thin Hemispherical Shells subjected to Internal Hydrostatic Pressure. By Prof. Wilbur M. Wilson and Joseph Marlin. Pp. 20. 30 cents. (Urbana, Ill.: University of Illinois.) [410]

Egyptian Government: Ministry of Public Works. Annual Report for the Year 1929-1930. English Version. Part 1. Pp. v+138+13 plates. (Cairo: Government Press.) P.T. 50. [410]

Catalogues, etc.

Electric Heat-Treatment Furnaces. Pp. 6. (London: Wild-Barfield Electric Furnaces, Ltd.)

The Hammond Organ, Model E. Pp. 4. (London: Boosey and Hawkes, Ltd.)

Black Light Equipment. Pp. 4. (Cincinnati, Ohio: Science Laboratories, Inc.)

A Pamphlet on Cambridge CO₂ Apparatus for the Steam Raiser. (Folder No. 60.) Pp. 6. (London: Cambridge Instrument Co., Ltd.)

Standard Meteorological Instruments. (List M.3.) Pp. 136. (London: Negretti and Zambra.)

Laboratory Balances and related Weighing Apparatus. (Catalogue No. 15B, Section 2.) Pp. vi+66. (London: Griffin and Tatlock, Ltd.)

Galvanometers. (Galvo 36.) Pp. 12. (Delft: P. J. Kipp and Zonen; London: W. Edwards and Co.)

Watson's Microscope Record. No. 42, September. Pp. 24. (London: W. Watson and Sons, Ltd.)

Important Books in the History of Science. (Catalogue 45.) Pp. 60+8 plates. (London: E. P. Goldschmidt and Co., Ltd.)