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Scientific Aspects of Housing Problems

THE fundamental scientific problems of the building industry which underlie the housing question were touched upon by Dr. Stradling in a lecture on "Physics in the Building Industry" at the end of 1933, and again by Sir Harry McGowan in the Messel Memorial Lecture to the Society of Chemical Industry at Cardiff. They have also been indicated by Prof. Julian Huxley in his "Scientific Research and Social Problems" and in much greater detail, so far as the United States of America are concerned, by Mr. A. F. Bemis in "The Economics of Shelter", the second of three volumes in a series "The Evolving House".

Nothing corresponding with the latter study has hitherto appeared in Great Britain, but a report entitled "Housing England", which has now been produced by the Industries Group of Political and Economic Planning (PEP), 16 Queen Anne's Gate, S.W.1, ably fills this gap and is an important contribution to the discussion of the housing question which deserves close consideration by the scientific worker. If studied in conjunction with the housing statistics of the Census of 1931 just available, it will help to create a more scientific, more critical and more constructive attitude towards the problems of housing and of the building industry.

Although a comparatively small section of the report is devoted to actual research problems, this attitude supplies its outstanding characteristic. It recognises from the start that any sound solution of the housing problem must provide for reconstruction of the building and building materials industry, overhaul of building regulations and the setting up of national standards. The discussion accordingly ranges over wide fields of industrial and technical as well as of economic and social questions.

The core of the present housing problem in Great Britain is that of supplying suitable accommodation at rents within the means of the lower-paid workers of the community. The final report of the National Housing Committee stated that this represented the provision during the next ten years of at least a further million houses to let at rents of not more than 10*s*. per week. The present report reaches essentially the same conclusion, estimating that a minimum of 200,000 new houses a year is required for the next seven years, of which half must be available at rents averaging 10*s*. per week.

Leaving on one side the discussion of the political and financial aspects of this question, which the report suggests might be dealt with by means of a national housing company and a national building company, attention is directed to the unjustifiable variations in building costs throughout the country of the more or less standard three-bedroom non-parlour house. Technical and economic research on a comprehensive scale is essential for the attack on building costs. While such a research programme is properly the function of the building industry as a whole, the industry has not yet developed a collective organisation capable of undertaking the work. Accordingly the report regards it as essential that the Government should initiate a centralised housing research organisation to co-ordinate existing efforts so far as possible through existing organisations.

This is one of the most important recommendations of the report, and the section entitled "Research and Statistics" on which it is based, will be read with close interest by all scientific workers. At present even market research in the building industry is remarkably casual and incomplete, and largely in the hands of advertising agents. Vital information on proprietary and non-proprietary materials is unobtainable or obtained with difficulty owing to the law of libel. Lack of knowledge about building regulations, which vary from district to district, hampers the operations of building concerns outside their own immediate area. The possibilities of economies dependent upon improved management technique, such as the Taylor or the Bedaux systems, and the whole field of industrial psychology, have scarcely been considered or explored by the building industry. Much of the existing scientific work is not applied so quickly as it should be because its results either do not receive adequate publicity or are published in unsuitable form.

At the present time, there appears to be almost unlimited scope for the improvement of the facilities for the exchange and co-ordination of information on building progress, building technique, trade names and catalogues, co-operation between libraries and the like. Such work inevitably tends, moreover, to overcome one of the difficulties in the way of introducing new methods and the obstacles which the lack of scientific personnel presents to the practical application of research. One of the functions of such a central authority might well be the co-ordination of information on training facilities, the type of instruction required, openings, etc.

This economic and statistical research is intimately related with the technical research work discussed in the same section of the report. The scarcity of men with a scientific training on the contracting side of the industry is in extraordinary contrast with the executive branches of engineering or even cotton, and presents a very serious obstacle to progress. The expenditure on research by the industry itself is noticeably smaller in proportion to Government expenditure than in other trades, but the wide scope of the industry is one of the reasons why scientific research has made so little headway. In addition, research of fundamental importance to the industry is being carried out by other industries, though rather from the point of view of the manufacturer than from that of the consumer. Special stress is laid upon the necessity for adequate research from the latter point of view, on the need for full-scale experiments and on the importance of adequate financial support for the Building Research Station.

The most important criticisms advanced of existing research organisations are the lack of direct co-operation in direction, and their inability in a non-scientifically minded industry to get the results of their work accepted by the industry. The danger of research financed by or carried out mainly for proprietary material interests is also stressed, as is the need for an authority which would facilitate experiment with new systems of construction.

One of the chief obstacles to such experiment lies in the chaotic legislative position affecting building and the building industry, particularly the restrictive and antiquated regulations which, in effect, limit the rate of introduction of new materials and new methods. Despite the attention directed to this important factor by the first report of the Council for Research on Housing Construction ("Slum Clearance and Rehousing", P. S. King and Son, Ltd., Great Smith Street, S.W.1; 1934), which asserted that the diversity and obsolescence of building regulations is a principal obstacle to progress and recommended the amendment and more enlightened administration of the system, as well as a more flexible system of by-laws, insufficient attention has yet been given to this factor.

Examples quoted in the report of obstacles to the introduction of improved lead piping, fire-proofing practice and the like indicate the absurdity of the

present position. Here, as elsewhere, there is to be found a plethora of evidence that the statement quoted by Mr. Bemis from a leading American engineering publication is equally valid in Great Britain: "The average house to-day is a shoddy affair, of high first cost, and soon reduced to a condition requiring constant maintenance; it is built as it was a great many years ago, by hand methods, with every piece cut in the field by men whose horizon is limited to the locality in which they live, whose training makes them impervious to the adaptation of new methods, whose financial capacity does not permit of modern research or study . . . and who themselves are the victims of profiteering material dealers."

If the report produced by Political and Economic Planning reveals very clearly the immense difficulties in the way of a really scientific housing policy, and in placing building and the building industry on a satisfactory scientific basis, it is far from being a depressing document. Its lucid and constructive criticism and pertinent recommendations do not merely point the way forward and assist in the clarification of public opinion on this important matter. They also reveal the wide field which here confronts the scientific worker, both as such and as a citizen, to secure that public policy and action are determined by definitely ascertained facts and not by archaic tradition or prejudice.

Reviews

Early East Africans

The Stone Age Races of Kenya. By Dr. L. S. B. Leakey. With Appendices by T. W. P. Lawrence, Sir Grafton Elliot-Smith, Sir F. Colyer, L. S. B. Leakey. Pp. xii+150+82 plates. (London: Oxford University Press, 1935.) 38*s*. net.

DR. LEAKEY led his first archæological expedition to East Africa in 1926, his second in 1928, and his third in 1931. In this imposing memoir, he gives an account of the human remains found on all three expeditions. Rich as were the discoveries made in the first and second expeditions, they were thrown completely in the shade by the outstanding importance of those made during the third expedition.

Dr. Leakey's third expedition began by a visit to the site of the discovery of Oldoway man in Tanganyika Territory. In the Oldoway district the examination of the grave site was a minor matter, for it was in this area that Dr. Leakey discovered a sequence of deposits bearing evidence of the presence of man in East Africa from the earliest Pleistocene times onwards, and by early Pleistocene Dr. Leakey means what most geologists call late Pliocene. He speaks of the 'culture' represented by the implements in the oldest deposit as Oldowan—a crude and very early form of hand-axe. Overlying deposits reveal this early type of stone axe in the process of being transformed into the true Chellean and later into the Acheulean form of *coup-de-poing*.

In Tanganyika, Dr. Leakey found nothing of the men responsible for the early hand-axe industry, but early in 1932 he moved his expedition to that part of Kenya Colony which extends to Kavirondo Bay, on the eastern shore of Lake Victoria, and had his search crowned with success almost immediately. The land into which he came was made up, just as at Oldoway, of deposits laid down in the Early and Middle Pleistocene periods; only the fauna at Kanam—the site of the most important discovery—was rather of an earlier date than the oldest at Oldoway. There were the same crude stone implements in the basal deposits at Kanam as at Oldoway.

Very soon after its arrival on the eastern shore of Lake Victoria, the expedition had the fortune to find at Kanam a fossil fragment near the base of the Pleistocene deposits. This fragment represents the front part of the lower jaw of one of the earliest human beings known to us. Never, perhaps, was a more puzzling piece placed in the hands of a student of fossil man. That it is human and that it is very ancient there can be no doubt. But by a very strange coincidence, the chin of this representative of early humanity was the seat of a bony tumour of an exceedingly rare kind. The tumour, which grew from the deep aspect of the lower jaw, just behind the chin, has spread over and obscured the normal features of this region. Enough remains, however, to make quite certain that in dimensions and in its features, the chin region of this early being was shaped as in primitive types of living humanity—such as the aborigines of Australia. Dr. Leakey describes the Kanam man as having "a very pronounced mental prominence". Far from being "very pronounced" the Kanam "mental prominence" or chin represents a low or early stage of chin development.

Dr. Leakey does not hesitate to infer that the rest of the Kanam man will prove to be in keeping with the fragment of his jaw, and regards him as the ancestor of modern races of mankind—*Homo*

sapiens. This may prove to be the case, but it may not. The fragment of lower jaw, which is of the same age as *Pithecanthropus*, and which Dr. Dubois attributes to *Pithecanthropus*, has a human chin region; if Dr. Dubois had merely found this fragment, he would have presumed that *Pithecanthropus* was an early representative of *Homo sapiens*, as indeed it may prove to be. The lower jaw of some of the Peking fossil men (*Sinanthropus*) show an incipient development of the human chin. If Sir Arthur Smith Woodward had been given only the chin region of Piltdown man, he would certainly have inferred that a Pleistocene anthropoid ape had been discovered in England. Kanam man, when Dr. Leakey discovers him, may be quite unlike his anticipation, for we can place no great reliance on the chin as a clue to the structure of the rest of the body.

Dr. Leakey does not consider the Kanam fragment in connexion with the most important of all fossil Africans known to us, namely, Rhodesian man. The size and shape of the Kanam premolar teeth, the flatness of their worn surface and the massiveness of the chin region (Dr. Leakey estimates that the height of the symphyseal region was 42 mm.) indicate just such a lower jaw as might be postulated for Rhodesian man.

It is said that Dr. Dubois went to Java in 1888 to find the 'missing link'; he found *Pithecanthropus*. Dr. Leakey, in March 1932, went to the Kavironda country to find the fossil ancestor of modern man. He not only discovered the fossil fragment of Kanam man but also at a neighbouring site—Kanjera—found fossil fragments of four other skulls. The Kanjera people, however, are later than the Kanam man. They fall at that phase of the Mid-Pleistocene when hand-axes had reached their full Chellean development. Two of the Kanjera skulls have been reconstructed by Dr. Leakey. They represent big-headed and big-brained people. Their heads were long and narrow. Dr. Leakey claims that the Kanjera people are by far the earliest representative of true modern man that has been discovered so far. That is so, but there are certain very important characters of these fossil skulls which Dr. Leakey passes over without mention and yet which, in the opinion of the reviewer, are of the utmost importance for racial recognition. These points are the flatness of the glabellar and interorbital regions at the root of the nose, and the form of the external angular processes of the forehead. These are features of the Kanjera skulls and are characters of the Negro race. So, too, are their 'infantile' traits, on which Dr. Leakey rightly lays emphasis. More than in any race, the Negro tends to retain fœtal and infantile stages in development and growth, as we see in the tendency of this race to throw dwarf forms—such as the Bushman and Congo pygmies. Far from being marked by "generalised characters" as Dr. Leakey assumes, the Kanjera people are already endowed with features which definitely assign them to the African or Negro stock. Indeed, Dr. Leakey's discovery is one of the utmost importance to anthropologists, for it reveals for the first time the differentiation of a modern race of humanity in Mid-Pleistocene times. The great enigma, the origin of the modern races of mankind, is brought a big step towards solution. We are to find that "parallel or independent evolution" is to play a large part in the differentiation of the modern races of mankind.

The other races discovered by Dr. Leakey, representing the inhabitants of East Africa in Late Pleistocene and in the Early Post-Pleistocene times, need not detain us long. A large part of the present work is devoted to them. One is impressed by the prevalence in all these periods by a tall, long-headed, big-brained, heavy-faced type of man. It is a type which can still be recognised amongst the native peoples of East Africa and in the upper watershed of the Nile. It is a Hamitic or Negroid type, certainly not a pure Negro form. Measurements of their bones and drawings of their skulls are given to an extent which will satisfy the most exacting of readers.

Beyond a doubt the discoveries which Dr. Leakey has made, and to which the book under review is devoted, take a place among the major events in the calendar of all anthropologists. No one can now discuss the rise of humanity and the evolution of early 'cultures' without taking Dr. Leakey's discoveries in East Africa into consideration. Nor has the work of anyone been given a finer setting than the Oxford University Press has given to "The Stone Age Races of Kenya". That makes it all the more regrettable that many of the plates show crude draughtsmanship and much of the text evidence of hurried composition.

ARTHUR KEITH.

The R.S.P.C.A.

A Century of Work for Animals: the History of the R.S.P.C.A., 1824–1934. By Edward G. Fairholme and Wellesley Pain. Second edition. Pp. xx+308+8 plates. (London: John Murray, 1934.) 2*s.* 6*d.*

THE century's work of the Royal Society for the Prevention of Cruelty to Animals was published in 1924, and now a second edition carries that history on through the succeeding decade. Both this and the analogous Society in respect to children have done notable work in directing the attention of the public to cruelty in whatever form they found it. They have used the

law courts, the decisions of which attract the public and are educative in themselves. The times too have been favourable, for education became compulsory in the latter half of last century and has been increasingly conducted by men of broad outlook and knowledge. With the spread of scientific knowledge, it is difficult to conceive of avoidable cruelty now being countenanced by educated men, since all such would naturally be imbued with the ideas of evolution and with the close relationship, even ancestral, that this implies between man and beast.

The successive 'ages' of amphibians, reptiles and mammals were established, with the implied replacement of older forms by descendants better adapted to cope with the difficulties of life. Often the establishment of a new age was a cruel process, for Nature's unalterable laws are often cruel. This, however, is no longer the age of mammals but the age of man, and this age has not been established without cruelty not only to mammals but also to less intelligent races of man. Now man is becoming highly mechanised. With civilisation his whole life is artificial. However, with this there would seem to be a development of a humane instinct for Nature, seen practically in the growth of Nature reserves and national parks. Unfortunately, scarcely one of these can be left to itself, since a few animals and plants in each soon dominate to the exclusion of weaker types. Man has to rule, but fortunately the instincts for civilisation and kindness seem firmly coupled.

From the history before us we gain the impression that the Society's activity has been largely directed to securing penalties for inhumanity and inventing more humane methods of necessary slaughter, together with such propaganda as was desirable to secure these and to make detestable the needless destruction of wild creatures. To-day, any case of inhumanity excites detestation, and such cases can be increasingly left to the community. In the present story no chapter deals with future work; yet the Society must be aware that it cannot rest on its laurels and still flourish. Is not there a wide field before it in encouraging the study both of the feeding and of the diseases of domestic animals, thereby ultimately alleviating their lives? Is not the development of veterinary science to a position akin to that of medicine increasingly to be desired? How far can Government-managed laboratories be expected to concentrate on our pets? Assuredly the funds would be forthcoming if the Society would establish its own research institute in the interests of such 'low priced' beasts.

Furthermore, while for forty years we have ceased to mutilate our dogs for the show bench, are any of our methods for the minor beasts causing them pain? What are our aims when we breed these in captivity? Are we breeding for stamina and health and intelligence, three factors which apparently mean happiness to their possessors? Or is our aim merely to secure the money of lovers of the bizarre, forgetting that monstrous developments in any form are frequently accompanied by loss of stamina and brain? Not to consider the nature of any pet is cruel and inhumane, and surely a pet must not be regarded as the inane doll of its owner.

The Society's position as to vivisection is that it "deprecates all experiments on animals which cause pain". This is exactly the position of scientific men of all shades of thought, but they recognise that their first duty is to alleviate the sufferings of their children, even if they require very occasionally to learn how to do so at the expense of animals. In other words, they follow the law of Nature which to-day has assigned pride of place to man. To judge by its précis of evidence before the Royal Commission of 1907, the Society was scarcely fair. It did not distinguish between painless inoculations and experimental operations, or between those of Governmental and private, usually university or hospital, laboratories. Without any new Act of Parliament, so far as we can judge, every change asked for by the Society or the Commission has been effected administratively. There is an unbribable inspectorate of the highest class, the most rigid control and a universal employment of anæsthetics. No operations are possible except for definite and approved ends; and to crown all, there is the universal opinion of the scientific world deprecating cruelty and any attempt to evade the Act. Indeed, the British faculty for compromise would appear to have reconciled desirable sentiment with practical necessities, and the Society would do well to recognise this.

Bessel Functions for Engineers

Bessel Functions for Engineers. By Dr. N. W. McLachlan. (Oxford Engineering Science Series.) Pp. xii+192. (Oxford: Clarendon Press; London: Oxford University Press, 1934.) 15*s.* net.

THE value of Dr. McLachlan's book to engineer users of Bessel functions will depend on the kind of engineer who refers to it. Probably the electrical or acoustical engineer will be well pleased and all other kinds relatively disappointed. The preface makes the contents quite clear, but had the book been called "Bessel Functions for Wireless Engineers" a more correct impression of its contents would have been given.

A general indication of the problems selected

for consideration by the author will show the scope of the book; he deals with loud-speaker horns, electrical transmission lines, alternating current density and skin effect in wires, electric furnaces of eddy current type, etc. Another group of subjects covers the vibration of stretched membranes, the lateral vibrations of a conical bar and the 'virtual mass' added to a body when accelerating through a fluid. On these subjects the book is adequately self-contained.

The general pattern of the chapters is a beginning of theory and an ending of examples. The latter are very numerous—some six hundred in all. The author's statement that the book has been used with success for a course of lectures to practising engineers can readily be accepted as true, but the question still remains as to what the author meant by the expression "for engineers". Probably Dr. McLachlan had in mind the textbook by G. N. Watson as one suitable for mathematicians rather than engineers since a considerable analytical skill is required to extract working formulæ from that treatise. On the other hand, there is the book by Gray, Mathews and MacRobert, and we should hesitate to describe that as unsuitable for engineers; in fact, almost the whole of the theoretical part of Dr. McLachlan's book is to be found in the same form in MacRobert's, but in the latter there is additional matter with engineering applications. Such extra matter covers the addition theorems and the contour integrals which Dr. McLachlan deliberately leaves out. Such integrals are not obtrusive in MacRobert's work and the general arrangement of the theoretical part in that work may be preferred to that of the new volume. It may be that familiarity with the older work has produced a bias in its favour.

It is pleasing to find the author stressing his belief that "it is rather hazardous to solve practical problems with a book in one hand and a pen in the other without a proper knowledge of the processes involved"; and within its admitted limitations the whole book satisfies the criterion laid down by giving adequate discussion of the theory behind the applications.

The book ends with certain tables of Bessel functions comparable in value to the tables in Jahnke and Emde and much less accurate than those of Watson and MacRobert. Perhaps a textbook on Bessel functions is no longer a suitable place for it, but a comprehensive collection—not limited to four significant figures—would be welcomed by some engineers. Lack of even a moderately complete set of tables seems to detract appreciably from the practical value of Dr. McLachlan's book. L. B.

Short Notices

Neuroanatomy: a Guide for the Study of the Form and Internal Structure of the Brain and Spinal Cord. By Prof. J. H. Globus. Sixth edition, revised and enlarged. Pp. xv+240 (53 plates). (London: Baillière, Tindall and Cox, 1934.) 16*s.*

TEXTBOOKS of neuroanatomy are rather apt to become redundant. "Neuroanatomy" by Prof. J. H. Globus was first published in 1915, and we now have the sixth edition. This edition has a method of dissection, and we can rest assured that any student who follows these dissections carefully and discusses the questions asked at the end of each 'assignment' will have a knowledge of the anatomy of the nervous system which will be enduring and at the same time exhaustive.

The book is divided into two parts, the first dealing with the description of the various parts of the brain together with the directions for dissection, etc. The second part consists of the plates, fifty-three in number: these can be detached and after completion by the student replaced in the book by adhesive paper. There are thirty-six figures in part one, all of which are original. The descriptions are extremely lucid and well done, and we congratulate the author on making what is really a very dry and difficult subject to most students into a fascinating and most interesting study.

There is an excellent index.

Nervous Breakdown: its Cause and Cure. By Dr. W. B. Wolfe. Pp. xv+260. (London: George Routledge and Sons, Ltd., 1934.) 7*s.* 6*d.* net.

THE question of the nervous breakdown is always with us, and few people realise the amount of time and money lost to the nation each year by people who have personal problems to solve and difficulties to meet that are too much for them. How many people lose heart in the struggle in unhappy homes with individuals they have learnt to hate and end it all in the river or what is nowadays much more comfortable—the gas stove. It is so easy, such a relief from torment. Fifteen people commit suicide in England every day. How many try but do not succeed and how many consider it, and say they have not the pluck to do it? To all these struggling individuals this book is addressed, and there is no doubt that it will be a great help, but how many are likely to read it? Few, we fear.

The author has shown himself a deep student of human nature and its weaknesses. How many of us are striving to save our 'face'! In his "plain words to parents" there is much worldly wisdom. To learn a funny story and tell it until you make someone laugh is good advice, but does not mean carrying *Punch* under your arm every day as one man used to do until he became an unsufferable bore!

(1) *The Selection of Colour Workers : being a Research into the Practical Methods of measuring the ability to discriminate Fine Shades of Colour.* Begun by A. M. Hudson Davies and A. Stephenson. Completed and described by W. O'D. Pierce. Edited and with a Preface and a Chapter by Charles S. Myers. Pp. xi+134. 5*s*. net.

(2) *The Case for Vocational Guidance : Three Lectures given under the Heath Clark Bequest to the National Institute of Industrial Psychology.* By Angus Macrae. Pp. vii+92. 3*s*. 6*d*. net.

(London : Sir Isaac Pitman and Sons, Ltd., 1934.)

BOTH these books well exemplify the pioneer research work which is being carried out under the auspices of the National Institute of Industrial Psychology.

(1) The first arose out of a request by a firm of colour printers for a test which would enable them to make selections from their employees for the more responsible positions in the firm. From this beginning there followed a prolonged psychological inquiry, resulting in the practical test of colour discrimination here described by members of the staff of the Institute. The test has already been proved to have high value in the selection of competent colour workers.

(2) The second book is general in character, and relates to the great problem of vocational guidance for boys and girls leaving school. As the author sadly remarks, many young people in these days are less concerned with the difficulty of choosing suitable work than with the difficulty of finding work at all. Even so, there are many even now who have some choice in the matter, and this short book by Mr. Macrae puts the case for systematic guidance in making that choice wisely. He does not enter upon the details of the technique of the methods employed by the vocational psychologist. He points the way, and supplies bibliographical information for those readers who wish to pursue the subject further. In so doing he has performed a useful service.

Anleitung zu optischen Untersuchungen mit dem Polarisationsmikroskop. Von F. Rinne und M. Berek. Pp. viii+279. (Leipzig : Max Jänecke, 1934.) 11.60 gold marks.

THIS book appears after the death, on March 12, 1933, of one of the authors, Prof. F. Rinne. The task of completing the work and seeing the manuscript through the press fell to the lot of Prof. Berek of Wetzlar, who was taking part in the revision of an earlier book, "Einführung in die kristallographisches Formenlehre", by Prof. Rinne, with the idea of strengthening the optical treatment of the subject.

The name of Prof. Berek will, of course, be a guarantee that the optical aspect of the subject is well and adequately discussed, and although doubtless some initial study of physical optics would be necessary for a beginner before taking up the volume (the introductory sections are brief in character), the book appears to be a very useful and systematic review of the application of microscopy to the qualitative and quantitative investigation and identification of crystalline substances.

Some of the later sections, on luminescence and on the application of the microphotometer for the measurement of absorption, may be mentioned as bringing the matter well up to date, and Prof. Berek's association with the firm of Leitz will naturally indicate good descriptions of modern resources in apparatus. The book is profusely illustrated with diagrams and photographs.

L. C. M.

Venereal Disease : its Prevention, Symptoms and Treatment. By Hugh Wansey Bayly. Fifth edition. Pp. xv+260+3 plates. (London : Chapman and Hall, Ltd., 1934.) 10*s*. 6*d*. net.

THE first edition of Dr. Bayly's "Venereal Disease" appeared in 1919. This is the fifth edition, and it is an improvement on the other editions. The author very wisely, we think, points out that a number of competent judges consider that there is a definite increase in the prevalence of neurosyphilis, and not a reduction, as so many hoped there would be. Probably the wish was father to the thought. It is probable that the ideal treatment for general paralysis is tryparsamide followed by malaria or some other pyrexial treatment and then tryparsamide again. The last word on the various fever and arsenical treatments of general paralysis has by no means been said, and in twenty years' time we may find all these present treatments scrapped. From the descriptions given, it is rather difficult to see how a differential diagnosis between cerebral syphilis and general paralysis can be made.

The book is extremely well laid out and the illustrations and directions for treatment are very good. The book is also not too long and diffuse, and is one that we recommend.

Handbuch der Spektroscopie. Von Prof. H. Kayser und Prof. H. Konen. Band 7. Dritte und letzte Lieferung. Pp. 751–1473+xiv. (Leipzig : S. Hirzel, 1934.) 80 gold marks.

THE colossal task of bringing Kayser's standard "Handbuch der Spektroscopie" up to date, which has been undertaken with the assistance of Prof. Konen and other collaborators, is carried forward another stage by the appearance of this, the third and concluding part of vol. 7. The publication contains data, complete to July 10, 1933, for the fourteen elements (as usual, in alphabetical order of chemical symbols) from Il to Nb, and the fact that, on the average, fifty pages are required for each element indicates to some extent the imperative need of the practising spectroscopist for such a collection as this. With this part are included also an index and an introductory note to the seventh volume.

The general plan and characteristics of the work are so well known that comment is unnecessary : it is sufficient to say that in every respect this issue appears to conform with previous ones. The publishers announce that vol. 7, containing 1473 pages and dealing with the elements from argon to niobium, can now be obtained complete at a cost of 132.20 gold marks (bound, 141 gold marks).

Ecology and Rubber-Growing

BROADLY speaking, there are two ways of 'growing' plants useful to man. The first and most obvious is to treat the plant as an agricultural crop, that is, to clear the ground of existing vegetation, prepare it by digging, ploughing, or other treatment, and then to sow or plant the crop, which is kept 'clean weeded'. The second is employed where large tracts of natural vegetation are useful as a whole, or contain useful species, as with pasture grasslands or forest. Here the primary attention required is to see that the regime of exploitation, by the grazing of stock or by felling, is not such as to impoverish the vegetation as a whole, or to favour useless at the expense of useful species. Besides regulating the regime, active interference to these ends is sometimes required.

There are, of course, many crops which are managed by some intermediate method. Thus the primary crop may be sown or planted in the first instance, but other plants may be introduced or allowed to come naturally into the spaces between the crop plants because they are useful in assisting the growth of the main crop plant or in protecting the soil surface. A well-known example is the planting of 'nurse' trees or shrubs, which are eventually removed, between the seedlings or saplings of a young plantation. In all such cases we begin to approach the conditions of natural vegetation, in which more than one species grow in association and the different species present act and react on one another, either favourably, or unfavourably by direct competition for light, food or water. The study of such interactions under the given conditions of habitat is the most important part of what is called plant ecology.

The history of the great rubber-growing industry of the eastern tropics provides an interesting example of a change from the first towards the second of the two methods of treatment. When the first seedlings of *Hevea brasiliensis* were planted commercially in Malaya towards the end of last century, and for several years afterwards, when extremely remunerative results were being obtained, the universal practice, or at any rate the universal ideal, was to keep the plantation 'clean-weeded', and with the cheap labour obtainable this was quite possible on the more successful estates. But after a time it became increasingly clear that the practice was not everywhere desirable. Especially on sloping ground, the bare soil was exposed to erosion by the torrential rains and great damage was done : the soil also deteriorated by the direct action of sun and rain : it often became compact and hard, a result to which the constant trampling of the coolies contributed ; and the absence of humus led to its impoverishment in essential mineral food stuffs. Consequently the trees began to suffer and their supply of latex to fall off. 'Clean weeding' began to lose its prestige ; and this process was notably aided because, when the slump followed the boom, it was no longer so easy to find the necessary labour. 'Ground cover' began to be planted, at first leguminous plants, which, besides protecting the soil, were expected to increase its combined nitrogen. The legumes, however, were not very successful, largely because their growth under the rubber trees was unsatisfactory.

Then it occurred to someone to try the effect of allowing the natural 'weeds' of the forest to enter and colonise the plantations, which, of course, they had always been trying to do. The results were in many cases beneficial, and the practice became generally adopted. Now, in certain circles, the pendulum has swung to the other extreme, and it is even suggested that a rubber plantation should be treated like a self-regenerating natural forest, with its complex 'stories' of vegetation, and the rubber trees allowed to provide their own successors by sowing their own seed spontaneously ! This extreme 'forestry method' of rubber cultivation is far from being generally supported. It is not, for example, the policy of the Rubber Research Institute, though the necessity of 'ground cover' in most cases is recognised. It is obviously true that much more experience is required before we can decide on the relative advantages of such a method of renewing plantations as compared with the established planting and 'budding'.

In a pamphlet recently published, Mr. Haines* gives, on the whole, a very fair and interesting review of the situation. He is in favour of what may be described as 'controlled natural ground cover'. Wild plants are allowed to come in, but discriminatingly, and when they become too luxuriant they are to be 'slashed' or otherwise kept down. Different species play different parts under different conditions, and it is impossible to lay down hard and fast rules that some of the natural colonists are 'good' and others 'bad'. All this is just what the ecologist would expect.

One remark of the author (p. 8) is very curious. "Practical planters are . . . advised to *study competition* as evidenced in the development in their fields, and to let Latin names and fine botanical distinctions take second place. Accurate

* Rubber Research Institute of Malaya. Planting Manual No. 6 : The Uses and Control of Natural Undergrowth on Rubber Estates. By W. B. Haines. Pp. iii+23+20 plates. (Kuala Lumpur : Rubber Research Institute of Malaya, 1934.) 1 dollar.

naming of plants must always be helpful in assembling and disseminating information, but a very general classification on obvious features like the rate of growth, habit of growth, both above and below ground, texture of tissues and similar factors is quite adequate for the purpose in hand." But how on earth is a "practical planter", or anyone else, to "study competition" when he does not know the names of the competing species? Also how will a "very general classification" of the kind described help him here? It is obvious enough that it does not matter what language the names belong to—Latin, English or Malay—(though the scientific names have well-known advantages), provided the same name is always used for the same species and for that species alone; but names in some language are quite indispensable. The planter *must* learn the names of the important species on his estate (or give them names of his own) before he can advance a single step in studying competition or increasing his knowledge in any way of what is going on in his plantations, once he lets in the native plants. Naturally, it is not necessary for him to acquire an exhaustive knowledge of the whole flora. When he has learned to distinguish the important species, then he can most usefully pay attention to their characters and behaviour under different conditions.

This, of course, is nothing but ecology, and we very much regret to see that, though Mr. Haines himself admits (p. 1) that "many of the problems which arise regarding natural covers are ecological", Mr. B. J. Eaton in his foreword summarises "the advantages of natural covers" solely in relation to their effect on soil, and writes that "for a study of this aspect of the problem the employment of a Forester or of a Plant Ecologist, as has been suggested in some quarters, is not essential". Well, the rubber industry may survive without such appointments, but that the whole problem is essentially ecological there can be no shadow of doubt. The soil problems as such, though an extremely important part of the whole, by no means exhaust the matter, as Mr. Haines is clearly aware, witness his constant stress on competition.

The general recognition of the fundamental importance of the ecological approach wherever we have to deal with communities of organisms living together is gradually coming, though it is distressingly slow. The ecologist is trained to consider the *whole* set of phenomena presented by such communities, and to discover which are of decisive and which of subordinate importance. Only when such knowledge has been acquired in any given case can the problem of rational treatment be successfully attacked. There are now young ecologists available—as there were not ten years ago—who have had this training, and it remains for the competent authorities to see that their services are employed in tackling the innumerable problems that await rational solution.

Specialists who have had a narrower training and very naturally think that 'there's nothing like leather', very often fail to come to grips with the larger aspects of their problems because they envisage them solely from one side. Ecologists can sometimes indicate the best solutions as soon as their survey of the field is completed, but very often experiment and specialised work are necessary after the general survey is completed. This is the proper sphere of the specialist, be he plant physiologist, mycologist, entomologist, pedologist or soil chemist. Ecologists have now been successfully engaged in the solution of the most various practical problems in New Zealand, in South Africa, in the United States, and elsewhere, but the fields ripe for their work are innumerable, and the proper management of the modern rubber plantation is clearly one of them. A. G. T.

Economy of Transport Overseas

MERCANTILE vessels can be divided into three main classes—passenger ships, combined passenger and cargo ships and purely cargo ships. Of these it is the first class which receives the greatest attention in the public Press; although the commerce of the world is carried on principally by tramps and freighters, these are seldom in the public eye. Generally speaking, unlike the steam locomotive, which was first used for mineral traffic before its potentialities for passenger traffic had been realised, the steam boat was regarded chiefly as a passenger carrying vessel.

The idea that steam vessels might prove of use for freight carrying, however, was not altogether absent from the minds of the pioneers, and a century and a half ago the oft-forgotten but deserving American inventor John Fitch wrote, "Here is an estimate which I beg leave to make. It takes thirty men to take a boat of thirty tons burthen from New Orleans to the Illinois. Now, I say, if I could be enabled to complete the experiment, I would obligate myself to make a boat of sixty tons burthen which, with engines and all complete, would cost $2,000. As that could work double the time of the men at the oars, it could go half the time, and transport 120 tons in the same time that the other would thirty tons. At the rate now charged this would pay for

itself and clear $10,000 whilst one boat could make one trip—and larger boats could be made to greater advantage".

Fitch was a man of wide vision who did not live to see his dreams come true. He has, however, as great a claim as anyone to be regarded as the father of the steam passenger boat and the steam cargo boat. But while conceding this, it is true that both in the United States and in Europe, when steamboats came into use, it was passenger traffic which was regarded as the principal source of revenue.

The traffic which, perhaps, led to the construction of the first cargo steamers in Europe was the cattle trade between Ireland and England, and just a century ago the *Glasgow Chronicle* referred to the Clyde-built steamer *Irishman* plying between Drogheda and Liverpool, which was capable of carrying 2,000 head of cattle, and was fitted with stalls for horses and horned cattle and pens for pigs, etc., on deck and in the hold. There was certainly need for improvement in this trade, for Joshua Field in his "Diary" of a visit to Liverpool in 1821 said that during a storm in the Irish Sea in September, "6 or 8 Brigs full of horned cattle and pigs were out in it and I believe all came in during the following day having lost more or less of the cattle killed in the hold and pigs either killed on deck or washed overboard. One of them lost 60 pigs overboard and one 70 and the captain. They came in mostly on their beam ends, the cattle dead and alive being on one side".

Another traffic which gave rise to steam cargo vessels was the carriage of coal from the Tyne to the Thames. In 1844, a Tyneside shipbuilder built an iron screw collier with a deadweight capacity of 340 tons, while eight years later Sir Charles Palmer at Jarrow built the larger *John Bowes*, carrying 650 tons. The *John Bowes* could make the voyage from Newcastle to London and back in five days and thus "she accomplished an amount of work it would have taken two average-sized sailing-colliers a month to perform". To the success of the *John Bowes* may, to some extent, be attributed the subsequent rapid development of iron shipbuilding on the north-east coast, a district famous for its construction of tramps and freighters. Similar vessels are to-day built in many yards all over the world and from these yards come not only ships ready to carry any form of general merchandise but also others especially designed for the transport of fruit, meat, grain, coal, ore, oil and other commodities. The greater part of the world's mercantile marine is indeed composed mainly of these cargo ships, of which little is heard.

It has been considered worth while to give this brief sketch of the early history of cargo ships because it was with tramps and freighters that Mr. L. St. L. Pendred was concerned in the most valuable part of his Thomas Lowe Gray Lecture delivered to the Institution of Mechanical Engineers on November 30 (see NATURE, Dec. 8, p. 875). The title of his lecture, "A Survey of Ships and Engines", left him free to touch upon many aspects of shipbuilding and marine engineering; and in the earlier part he pointed out some of the landmarks in steamship history up to the time when improvements in both ships and engines had enabled cargoes to be carried long distances more economically by steam than by sail.

Having got thus far, Mr. Pendred devoted himself exclusively to cargo steamers. He had been at some pains to obtain from authoritative sources particulars of ships of the last fifty or sixty years, and his lecture contains two tables, prepared, one by Mr. T. W. Crozier, for many years manager of the Blyth and Tyne Shipbuilding Co., and another by Mr. Summers Hunter, giving particulars of merchant steamers engined between 1867 and 1934 by the North-Eastern Marine Engineering Co. With the aid of these tables, Mr. Pendred had prepared a series of curves connecting coal consumption, steam pressures, speed, etc. The progress of tramps, however, he summarised as follows. In 1887 a typical tramp was 285 ft. long, with a displacement of 4,840 tons. The working pressure was 160 lb. per sq. in. and the speed $9\frac{3}{4}$ knots. In 1896 the length had risen to 325 ft. and the displacement to 7,075 tons. By 1911 the displacement had risen to 10,000 tons, by 1924 to 11,500 tons and by 1928 to 12,380 tons. Boiler pressures had risen to 200 lb. per sq. in. or more, and speeds to 13 knots or more. Size has much to do with economy of transport, and Fitch was quite right when he said that "larger boats could be made to greater advantage".

In conclusion, Mr. Pendred said, "Further economy in cargo ships must be and will be sought. May it not best be found by extension of the known and approved, by higher propeller speeds, higher pressures, higher temperatures, higher piston speeds, better materials making for lighter structures, better under-water form? These will carry the steam engine forward until, its work well done, it surrenders its place to the internal combustion engine, or to some other prime mover which still lies in the womb of time".

Carriage by sea is the cheapest of all forms of transport, and the reduction in cost during the last century has been remarkable. Even thirty years ago, Sir William White said: "When small vessels were used to transport grain from America the freight was 9*s*. 6*d*. per quarter; now it is 9*d*. per quarter from New York in the large cargo-carriers".

Jubilee of the City and Guilds (Engineering) College, London

ON Monday next, February 4, the City and Guilds College, affectionately known to many besides its students as the 'Central', is to celebrate the jubilee of its foundation, the present building having been opened in 1884. It is too near the achievement for us properly to assess the value of the work done in founding and establishing London's and the Empire's premier school of engineering, but it is more than probable that a century hence the historian will regard the movement which led to the establishment of the colleges at Finsbury and South Kensington as outstanding in importance and in the results it produced.

From the first, the 'Central' has been characterised by its originality and independence; never were four colleagues so outstanding in this respect as its original professors, Armstrong and Ayrton promoted from Finsbury a year after the establishment of their new building there, Unwin from Coopers Hill and Henrici from University College, London. In principle they were in agreement, and each knew they had problems to solve; but each set to work to develop his own department to the best of his ability, and the College developed on these individual lines though also as a whole, and became great perhaps as a consequence.

A strong effort was made to make the chemistry course a part of the curriculum of the engineer and to insist on the chemist passing through a comprehensive course in mathematics, physics and the elements of engineering. It proved, however, that as a whole the engineers did not want to learn chemistry, chiefly perhaps because the subject never appealed to their mentality, since the tendency of the engineer is to construct and not to think or seek hidden meanings. It is of significance in this connexion that scarcely half a dozen of the Centralian engineers have distinguished themselves in chemical engineering, whereas the Centralian chemists, owing in part to their engineering training, have been uniformly successful as pioneers in developing the newer industries. It is still a fact that chemists have to learn engineering and become chemical engineers in order to take part in the enormous developments in chemical industry, and the lack of such trained engineers in Britain as compared with their superabundance in Germany and America has been definitely a handicap.

There is no need to record here how the College has passed from success to success; after the first few years, it was always full with students carefully selected by an entrance examination which grew increasingly exacting. The rapidly developing electrical industry was manned each year by new batches of Centralians imbued with Ayrton's zeal and enthusiasm, and civil and mechanical engineering positions at home and abroad were increasingly filled by Centralians loyal to the Unwin thoroughness. Time, alas, brought changes in the professoriate; Mather succeeded Ayrton, Klugh followed Henrici, Dalby came from Finsbury on Unwin's retirement, whilst the Chemical Department was closed when the 'Central' was merged with the Imperial College of Science and Technology, leading to the retirement of Armstrong, who is the only survivor of the four great original founders.

So far, the early development of the College has been emphasised and the birth of its traditions, which few will be unwise enough to minimise. For the new student tradition must mean much; it is up to him to be worthy of it: as Kipling says, "Of one muster all of us, . . . keen in his vocation"; whilst, in consequence of the tradition to produce highly trained, reflective, inventive graduates, employers have sought to obtain the 'Central' men as they graduated.

Perhaps the first break in the old order came with the inclusion of the 'Central' as a school of the University of London in the Faculty of Engineering in 1899 and the attachment of the University examination and degree in engineering to the diploma of A.C.G.I.

To-day the City and Guilds College has its own governing committee, or delegacy, within the organisation of the Imperial College. Its courses are essentially engineering; the number of departments has expanded. There is more specialism, and a number of eminent and devoted professors are giving of their best to training the men so urgently needed for Britain to hold its own in the intense struggle for industrial supremacy. In some ways the requirements are other, more specialised than fifty years ago; in other ways, the need is still the same for men of broad outlook, trained to think and create rather than to memorise and to imitate. The influence of the great teacher, of the man of genius, independence and vigour, is still as great on the student in his most impressionable age, and the College will be wise to select and retain such, be they young or old, whatever may be the cost. Countless biographies of successful men testify to this influence of their teachers on them, prevailing throughout their lives.

The 'Central' has done a great work; it has been well and unselfishly served in the past; it will do so much in the future.

E. F. A.

Manufacture of 'Colloidal' Fuel

SINCE 1879, numerous attempts have been made to produce a suitable mechanical mixture of coal and oil that would be capable of retaining the coal particles in suspension for a sufficiently long period and at such temperatures as would be likely to obtain in normal working conditions, where such fuels could be used.

Fairly successful attempts were made in 1918 on the U.S. patrol ship *Gem*, using a blend of 67·8 per cent oil and 31·2 per cent coal dust. More recently, great prominence has been given to this question as a result of experiments made on the Cunarder, S.S. *Scythia*, using a mixture of 60 per cent of oil and 40 per cent fine coal.

Despite these tests, progress in the development of a 'colloidal' fuel has been very slow. This is due to two causes :—first, the difficulty experienced in keeping the mixture in a stable condition where it had to be stored for any lengthy period before use ; and secondly, the high cost of pulverising dry coal to a sufficient degree of fineness to make a suitable and stable liquid emulsion.

The former difficulty can be readily appreciated when it is realised that the specific gravities of coal and oil are 1·3 and 0·9 respectively. Various attempts have been made to keep the coal particles in suspension by the addition of fixateurs (such as rosin, paraffin wax, etc.) or by the addition of 'peptising' fluids which tend to increase flotation by splitting up the particles of coal into still smaller particles. While the fixateurs have been more or less successful in increasing the period of suspension, the cost of peptising fluids makes their general use prohibitive.

From the results of a demonstration given by Messrs. Wyndhams Liquid Coal Co., Ltd., at their Cardiff works on January 23, it would seem that their engineer, Mr. Stephen Wyndham, has recently made great progress in overcoming both of the difficulties referred to. In his new plant, he has eliminated the costly process of dry coal pulverisation by mixing the fine coal as received from the colliery with an equal amount of heavy oil and then passing the coal-oil mixture through a series of rolls until a fineness of 99 per cent through a 200 I.M.M. mesh is obtained for the coal particles. This degree of fineness together with the aeration of the mixture which takes place in passing it through the mixer and between the mixer and the successive series of rolls, seems to give a very stable mixture which will retain the coal particles in suspension for at least four months under normal working conditions.

The plant is very simple in construction and no chemical processes are involved. The class of coal used is that known as 'duff' (namely, coal less than $\frac{3}{16}$ in. in diameter) and is fed from an overhead hopper through a worm screw into the rotating mixture where it meets an oil spray, forming a paste of coal and oil. The predetermined quantities of coal and oil forming this paste are automatically regulated in their entry to the mixer, which is fitted with a spiral worm cast on the inside and passing from top to bottom of its 6 ft. length. Although only 18 in. in diameter, it is capable, when working continuously for six days a week, of producing 100 tons of colloidal fuel.

The paste passing from the mixer is pumped to a pair of rolls 8/1000 in. apart, rotating in opposite directions at variable speeds of 3 to 1. It is then pumped to the second set of rolls, which are 4/1000 in. apart, and so on down to the fourth or sixth set, according to the degree of fineness required to produce stability for any particular class of coal.

The cost of one 100 ton per week plant is approximately £1,000. Very little manual labour is required to operate it and the maintenance charges ought to be low, as the principle of wet milling is used throughout the process.

In burning the oil underneath a steam boiler, the fuel is pre-heated to about 250° F., at a pressure of 15–20 lb. per square inch, and the air is maintained at a pressure of 2 lb. In the demonstration test, this gave a clear smokeless flame, without a trace of coking at the burner tip.

It would appear that we are at last within sight of the solution of a problem which has taxed the ingenuity of engineers for at least half a century.

Obituary

Sir E. A. Wallis Budge

IN the course of the year 1934, Egyptology had to record a heavier loss of life amongst its leaders than has occurred in any other single year of its century odd of history. Five of the seven who died were Englishmen ; the last was Sir Wallis Budge, for more than thirty years keeper of Egyptian and Assyrian antiquities in the British Museum, and one of the two most widely known Egyptologists that Great Britain has produced. The characteristics that gave him the unique position which he held in the public mind were no ordinary gifts, and are perhaps not to be found combined in our own generation.

Ernest Alfred Wallis Budge was born in 1857 of a Cornish Quaker family, to which no doubt he owed that abiding interest in the study of religions which

was the mainspring of so much of his work. In the man himself, assisted perhaps by the not easy circumstances of his early years, lay a 'power of work' which quite transcended mere industry and was his outstanding characteristic and the envy of those who served him. As a boy, it attracted the attention of his superiors and eventually won him the backing of W. E. Gladstone. At Cambridge, it brought him University prizes and an unusually wide and thorough knowledge of Semitic languages with which to start his official career in the British Museum.

The bare record of Budge's exceptionally early promotion to the full responsibility of keepership, followed by nearly two columns of "Publications", are still to be read in the current "Who's Who". But no mention is made there of the period during his assistantship, when, after the retirement of Renouf, the responsibility for the Department was his, without the privileges of the appropriate office. In two fat volumes, "By Nile and Tigris" (published 1920), parts at least of the adventurous life at home and abroad, which lay behind those dates and titles, are to be found. It is a story of vital and impressive contacts with the great pioneers of Egyptian and Assyrian studies, and of lasting gratitude to early masters; of missions on the Trustees' behalf to Egypt and Mesopotamia, covering a period of nearly thirty years; of the famous action for slander—*Rassam v. Budge*, of which the extensive account from the issue of NATURE for August 10, 1893, emphasises the national interest at stake and more than vindicates Budge's part in the case. This unofficial account of a scholar–civil servant's official career was as near as its author could permit himself to come to an autobiography; but we may guess that it tells only half the tale, and no one who reads it can escape the regret that we shall never know the rest.

Neither the long tenure of his office nor his massive learning could by themselves have made Budge the public figure that he was; though both contributed to his fame. It was the vigour and quality of his personality that endeared him and 'made his name to live' on the lips of as many thousands as there were individuals who came to blows with him professionally. But no man of his virility could fail to make enemies; nor could one of his positiveness easily escape criticism, some of it deserved. His worst enemies would not deny that he was possessed of prodigious learning; but inaccuracy in its setting forth rendered him liable to endless attack. That charge was not always a just one. His most important scientific work, which naturally was that most criticised by his colleagues, was the edition of texts, generally of considerable length, in many languages—Assyrian, Egyptian (Hieroglyphic and Hieratic), Coptic, Ethiopic, Syriac. It was a principle with him that in editing ancient authors his business was simply to present their text in a printed form which would be accessible to modern scholars. The correction of mistakes in the text, if indeed they were mistakes, was a secondary and later task with which he was not concerned. As a result, he sometimes received the censure which should have been addressed to the original scribe of the manuscript in question. There was something to be said on both sides of the argument, but however strong the attack, Budge's claim to be accounted among the great Oriental scholars of the last fifty years will grow rather than fail as personal considerations automatically die, leaving the impressive series of his editions of primary texts to speak for themselves.

Then again, the extraordinary number and size of the books which Budge turned out, the majority necessarily of a popular or semi-popular nature—while a matter of pride to himself—was often counted against his reputation. But in truth, it was a part of his greatness that he knew how to do what no other Egyptologist in Great Britain could do by writing, namely, to bring his subject within the reach of the ordinary reading public. Nor were his books a mere popularisation of that side of Egyptian studies which might be supposed to have a natural attraction for the man in the street. Any teacher of the subject, and still more any museum official familiar with the endless stream of inquiry on matters Egyptian which pours through the British Museum, is well aware that almost all stock questions relating to the history, customs or antiquities of Ancient Egypt can be most expeditiously answered by referring the inquirer to one or another of Budge's handbooks. The secret of his success lay, of course, in his Museum experience. Budge was above all things a devoted public servant, and after he had retired from the Museum and until the last, he remained as jealous for the authority and privileges of the Trustees, the representatives of the public, as he had been loyal to their interests during his service.

The tradition of scholarly research and authoritative learning in the subjects with which they dealt stood high among the officials of the British Museum when Budge entered it, but he was one of the first to bring that wealth of knowledge within the reach of the general public, even though, for various reasons, some of the methods he used would not now be considered good museum technique, or even effective for the purpose he sought. But it was of paramount importance that he should have been so fully conscious that the antiquities under his charge were the property of the nation, and that it was therefore his duty, first to take proper care of these antiquities, and secondly to make them as much available to the nation as was possible. He had his own clear ideas as to the manner in which both purposes should be achieved; and both brought him into conflict with authority. But he knew that in principle he was right, and he was proud to think that his knighthood was the reward not of his contribution to scholarship, nor of his success as a populariser of a branch of learning, but to the faithful performance of his stewardship. It was from his determination to serve the public that he learned what they wanted—or at least, what they thought they wanted—and gave it to them so successfully in his books and in the galleries under his charge. S. R. K. GLANVILLE.

SIR MAURICE CRAIG

PSYCHIATRY has suffered a grievous loss by the death on January 6 of Sir Maurice Craig, consulting physician in psychological medicine to Guy's Hospital, and consulting neurologist to the Ministry of Pensions. Born in 1866, he received his education at Bedford Grammar School and Caius College, Cambridge. He was early interested in mental disorders, and was one of the many distinguished men who have gained the Gaskell Gold Medal of the Royal Medico-Psychological Association.

For more than fifteen years, Craig was a resident physician at Bethlem Royal Hospital, years in which he gained a very wide experience in psychiatry, and in the teaching of the subject to students. From 1907 Craig confined himself to consulting work, and built up a very extensive practice. He delivered the Bradshaw Lecture at the Royal College of Physicians on "Mental Symptoms in Physical Disease" in 1922, and the Maudsley Lecture on "Some Aspects of Education and Training in Relation to Mental Disorder" in the same year. In addition to numerous articles in medical journals, Craig published a book on "Nerve Exhaustion" which was much discussed on its appearance. In 1905 the first edition of his well-known textbook on psychological medicine appeared; after exhausting three editions, the book was revised and rewritten in co-operation with Dr. Thomas Beaton and republished as the fourth edition in 1926.

During the War, Craig was a valued adviser on the care and treatment of nervous and mental disorders among officers and soldiers, and afterwards became consulting neurologist to the Ministry of Pensions, and a member of the War Office Committee on shell shock. He received the C.B.E. in 1919, and the honour of knighthood in 1921.

Sir Maurice Craig developed a profound interest in the early evidences of mental disease, and throughout his teaching life insisted on the importance of early symptoms. During the years of his consulting work, he became increasingly concerned in what are known as the psychoneuroses and neuroses. He was an enthusiastic and hard-working chairman of the medical committee of the Cassel Hospital at Penshurst, and chairman of the National Council for Mental Hygiene up to the time of his death.

Sir Maurice Craig enjoyed a very wide esteem and popularity among his professional brethren. He was made a governor of the Royal Hospitals of Bethlem and Bridewell; he became the president of the Section of Psychiatry, Royal Society of Medicine, and president of the Section for Mental Diseases at the centenary meeting of the British Medical Association in 1932. He was a vice-president of the International Committee for Mental Hygiene. His many appointments reflect his scientific interests, and his universal popularity.

It is impossible to write of Sir Maurice Craig without remembering his charm of manner, his delightful presence and popularity. He was ever ready to help and encourage a younger colleague, and was tireless in his devotion to his patients. Yet he could be quite fearless and outspoken in debate or criticism. His contribution to psychiatry may be summarised by his constant insistence on the importance of early symptoms in every form of mental disease, and the urgent need of early treatment; by his leadership in making psychiatry a part of general medicine, and freeing it as far as possible from legal restrictions; by the stimulus he has given to improving the education of medical students, practitioners and the general public in matters of mental health and hygiene. Lastly, Craig has focused a keen scientific inquiry on the place taken by fatigue in the etiology of mental disease. His death will be deplored by a very wide circle of scientific men.

THE REV. S. A. MCDOWALL

THE death on January 13 of the Rev. S. A. McDowall, chaplain and senior science master at Winchester College, will be felt as a deep personal loss by many Wykehamists and a wide circle of friends.

Stewart McDowall went up to Trinity College, Cambridge, from St. Paul's School and obtained first classes in both parts of the Natural Sciences Tripos. He became a demonstrator in the Biological Laboratory and assistant superintendent of the Museum of Zoology at Cambridge. In 1905 he joined the staff of the Christian College at Madras as temporary professor of zoology, and a year later was appointed an assistant master at Winchester College. In 1908 he was ordained, and in 1915 became one of the College chaplains. In the same year he published the first of a number of works on science, philosophy and religion. "Evolution and the Spiritual Life" was the first expression of his beliefs that evolution was the method by which God had chosen progressively to create free beings, and that science had great gifts to bring to the service of the Christian world.

McDowall was a select preacher at Oxford 1916, at Cambridge 1920, and Hulsean lecturer 1923–24. "Evolution and the Doctrine of the Trinity" appeared in 1919, and the Hulsean Lectures were published as "Evolution, Knowledge and Revelation". Meanwhile, he had been appointed senior science master at Winchester College in 1918, and since that time had much to do with the development of the science teaching both of science specialists and of a general science course which is taken by the whole of the upper part of the school.

McDowall held vigorously the view that every citizen should have sufficient training to appreciate the scientific problems which only the highly specialised technician can be expected to solve, and that all should have some acquaintance with the history of man's growing control over his environment, particularly as it has been attained by scientific methods. During the last year of a boy's school life, he aimed at introducing to him the facts and theories of modern biology in their bearing on the life of a civilised community. His views on this subject were incorporated in his last book, "Biology and Mankind", published in 1931.

For many years McDowall was curator of the College museum and president of the Natural History Society, of which the biennial reports show the

wide range of interests which he inspired in his young friends. To his psychological knowledge and insight, and to his sympathy with differing minds, Dr. William Brown has borne eloquent witness in *The Times*. He was a man of great personal charm and a brilliant conversationalist. His intellectual and æsthetic interests were very wide and led him to seek new experiences and to encourage others to share them. Successive generations of Wykehamists testify to the way in which he stimulated the development of their minds by his own enthusiasm for life.

Mr. Kenneth F. Armstrong

THE death of Kenneth Armstrong on January 3, at twenty-five years of age, while on a visit to the Austrian Tyrol with another young and promising Oxford graduate, John Howard, who was an old schoolfellow, is a grievous tragedy. While ski-ing, they encountered an avalanche which seems to have swept Howard to his death, and it appears that Armstrong, in his endeavour to recover his companion, fell into a ravine, being killed as the result of crashing on a rock.

Armstrong was the son of Dr. E. F. Armstrong and the grandson of Prof. H. E. Armstrong. His death is a personal shock to everyone who knew him, and it is regrettable that chemistry should be deprived of the contribution to its progress so clearly destined to come from his labours. There can be no doubt that, had he lived, he would have done full credit to his scientific ancestry.

Armstrong received his early education at Oundle School, whence he went to Magdalen College, Oxford, in 1927, having been awarded a demyship there. He gained a first class in the Honour School of Chemistry at Oxford in 1931. After graduating, he was awarded a Julia Henry scholarship and proceeded to Harvard University and commenced work on chlorophyll problems with Prof. J. B. Conant. In the two years spent there, he made a valuable advance in this difficult field, and part of the work has been published in the *Journal of the American Chemical Society*. Armstrong's extensive knowledge of this subject enabled him to contribute a lucid article on present-day knowledge of chlorophyll to *Chemistry and Industry*.

Soon after his return to Oxford in 1933, Armstrong was elected to a Harmsworth senior scholarship at Merton College and was quickly at work on several problems of his own choice. Among these were : the nature of the colouring matter of the red moth ; the identity of the glucoside in the Japanese laurel (*Aucubine*) ; and the configuration of the cyclic polyalcohols, particularly quebrachol. Recently, in collaboration with Prof. R. Robinson, some work on the oxidation effects of selenium dioxide was published. Armstrong recently collaborated with his father in producing a new edition of the well-known books on the simple carbohydrates and the glycosides.

His friends will ever remember with respect and admiration Armstrong's unfailing kindliness on all occasions. His lamented death deprives the Oxford school of organic chemistry of one of the most notable of the younger generation of research students.

Dr. Eleanor Hull

WE regret to record the death of Miss Eleanor Henrietta Hull, folklorist and Erse scholar, which took place at the age of seventy-five years, on January 14, at Wimbledon.

Miss Hull was the daughter of Prof. Edward Hull, and was educated at Alexandra College and the Royal College of Science, Dublin. She studied Celtic and allied subjects under Pedersen, Kuno Meyer and R. Flower. An enthusiast for the study of Irish history and letters, she added sound scholarship to the movement for the revival of Erse and the rekindling of pride in Irish tradition. Apart from her own literary work, this took practical form in the foundation in 1899, with the assistance of Prof. York Powell, of the Irish Texts Society. As honorary secretary of the Society she enlisted the services of the foremost Erse scholars of the day, and was largely responsible for the publication of a number of valuable and important early Irish manuscripts. Miss Hull was at one time secretary of the Royal Asiatic Society. She had served as president of the Irish Literary Society of London and was a member of the Council of the Folklore Society.

Among her contributions to Irish studies her work on the Cuchulain Saga (1898) will always hold first place ; but as a folklorist her "Folklore of the British Isles" (1928), in bringing some sort of system and order to the treatment of a mass of somewhat chaotic material, runs it close. Among other works worthy of note were her "Pagan Ireland and Early Christian Ireland" (1904), "A Text-Book of Irish Literature" (1906–7), "Cuchulain, the Hound of Ulster" (1909), and a "History of Ireland and Her People" (1926, 1931) in two volumes.

WE regret to announce the death of Arthur Lionel Pedder, on December 15, at the age of sixty-six years. He was mathematical tutor at Magdalen College, Oxford, from 1891 until 1925. He went to the College as a demy in 1886, and was elected fellow in 1894. Pedder was a very good teacher and was remembered with gratitude and affection by his pupils. He was one of the old-fashioned people who valued the educational training given by the curriculum and examinations of the old mathematical school as one of the best preparations for after-life ; and was quite out of sympathy with the new system which, in his opinion, was of little or no use, except for those who intended to be professional mathematicians.

WE regret to announce the following deaths :

Mr. F. J. Blight, fellow of the Royal Society of Edinburgh and formerly chairman and managing director of Messrs. Charles Griffin and Co., Ltd., publishers of many scientific and technical works, on January 27, aged seventy-six years.

Dr. Michael Grabham, author of numerous books and papers on the natural history of Madeira, where he had lived for some seventy years, on January 28, aged ninety-five years.

News and Views

Prof. Arthur H. Compton

THE Guthrie lecture of the Physical Society is being delivered this year at the Imperial College of Science and Technology, South Kensington, on February 1, by Prof. Arthur H. Compton, of the University of Chicago. Prof. Compton, who is at present Eastman visiting professor at the University of Oxford, is perhaps best known for his discoveries of the laws of interaction between radiation and free electrons, and for the associated effect, called after him, which results in a modification in the quality of a beam of monochromatic radiation such as X-rays on passing through matter. It was for these discoveries that he was awarded the Nobel Prize for physics in 1927. He is also one of the leading authorities on X-rays and the author of one of the finest books on this subject. In recent years, Prof. Compton has turned his attention mainly to the investigation of the cosmic rays, those mysterious and exceedingly penetrating radiations which come into the earth's atmosphere from outside. In this connexion he has organised twelve expeditions, with the collaboration of about a hundred physicists, which have made a cosmic ray survey of the globe. He also initiated, and was scientific director of, the balloon flight of Settle and Fordney in November 1933 for investigating conditions in the upper atmosphere, which achieved what still remains the official world's record altitude of 11·8 miles.

Prof. Arthur Lapworth, F.R.S.

PROF. ARTHUR LAPWORTH, who is Sir Samuel Hall professor of chemistry at the University of Manchester and director of the chemical laboratories, is retiring in September next. Prof. Lapworth joined the staff of the University of Manchester in 1909 as senior lecturer in chemistry, on vacating his lectureship at Goldsmiths' College, London. He was appointed professor of organic chemistry in 1913, and Sir Samuel Hall professor and director of the laboratories in 1922. He was appointed pro-vice-chancellor in February 1933, and it is a disappointment to the University that his health has not allowed him to exercise the functions of this office during the last few months. During his time at Manchester, Prof. Lapworth has published work in a number of branches of pure organic and physical organic chemistry; he will be remembered for his investigation of the terpenes, his work on certain natural products carried out in association with the Oil and Fats Committee of the Food Investigation Board, and especially for his studies on reaction mechanism and molecular reactivity, which led to the initiation of the now famous 'electronic' theory of organic reactions. He has been awarded honorary degrees by the Universities of Birmingham and St. Andrews, and received the Davy Medal of the Royal Society in 1931. His retirement will be a source of deep regret to his many colleagues and students.

Centenary of Friedrich Winnecke, 1835–97

ON February 5 occurs the centenary of the birth of the distinguished German astronomer, Friedrich August Theodor Winnecke, who at the early age of twenty-eight years was elected an associate of the Royal Astronomical Society, and was for a time the vice-director of Pulkova Observatory. The son of a pastor, Winnecke was born in a village in Hanover, and after leaving school studied at Göttingen and Berlin, coming under the influence of both Gauss and Encke. At the age of twenty-one years he became an assistant at Bonn to Argelander, who was then engaged on his great star maps. A visit by Wilhelm Struve to Bonn led to Winnecke in 1858 becoming a member of the staff at Pulkova, where he worked under both Wilhelm and Otto Struve, until in 1865 he was overtaken by severe mental illness. During those years he had observed the comets of 1856 and 1862, watched in Spain the total solar eclipse of 1860, made notable observations on Mars and compiled the first Pulkova General Catalogue of Stars. When he regained his health, he settled at Carlsruhe, and after the conclusion of the Franco-German war was appointed to the chair of astronomy at Strasbourg and charged with the task of erecting an observatory. He spent some ten years there, when to the great loss of astronomical science he was attacked by melancholia and from that time until his death at Bonn on December 2, 1897, the cloud which settled on his mind never lifted. He had been a frequent contributor to German, English and Russian astronomical publications, and was widely known as a great teacher of practical astronomy.

Anniversary of Prof. F. Haber's Death

TUESDAY, January 29, was the anniversary of the death in Switzerland of Prof. Fritz Haber, and a memorial ceremony at which certain of his distinguished German scientific friends were to speak had been arranged by the Kaiser Wilhelm-Gesellschaft in co-operation with the German Chemical Society and the German Physical Society. It was to have been held in the Harnackhaus, than which no more appropriate surroundings could have been found, and a pleasant impression had been made among Haber's friends that these three great German scientific societies were prepared to honour so soon the memory of one of their greatest members, though he had been among those men of science who had given up their positions through the political changes in Germany. The Prussian Minister of Education, however, in a letter dated January 17, addressed to the rectors and teaching staff of the universities, has expressed surprise and disapproval of this proposed memorial. According to this circular, Prof. Haber was dismissed on October 1, 1933, on account of a proposal which could only be regarded as showing his opposition to the measures taken by the National-Socialistic State. The ceremony seemed to the

Minister to constitute a challenge to the State, particularly since such memorials were to be held in honour only of the 'very greatest' Germans. The circular consequently concludes by forbidding all officials and all other members of staffs or institutions under the Ministry from attending the ceremony. It is difficult for scientific workers outside Germany to understand why a Minister of State should prohibit the commemoration of the great services rendered to that country and to the world by Haber, or what must be the feelings of the members of the societies concerned with the organisation of the proposed ceremony. Chemists and physicists throughout the scientific world acknowledge Haber's work as epoch-making, and Germany should be proud to cherish his memory. Truly in his case the Prussian Minister of Education now makes it clear that, officially, "A prophet is not without honour, save in his own country and in his own house".

Intensive Farming and Security of Tenure

THE Metropolitan Water Board is promoting a Bill in the present session of Parliament to acquire the Holly Lodge Farm, Walton-on-Thames, owned by Mr. A. F. Secrett, for the purpose of making a storage reservoir. Mr. Secrett is well known in the horticultural world as one of the leading growers of vegetable produce for market. He has been particularly prominent in developing the growing of early vegetables, winter saladings, etc., hitherto almost wholly supplied by French and other continental growers, and by his willingness to impart his knowledge of the management of these special crops, he has contributed more than anyone else to provide the home market with these products. The farm consists of 187 acres, of which 165 are now in intensive cultivation. One acre is under glass, three acres are under frames for early lettuce, etc. The seakale beds, traversed by an underground hot-water system, extend to about $\frac{1}{8}$ acre. The whole farm has been redrained so as to lower the winter water table 4–6 ft. below the surface. The irrigation system, with its own well and pumps, covers 125 acres, requiring $2\frac{1}{2}$ miles of pipes. No other agricultural enterprise in Great Britain of this magnitude can show an equal intensity of cultivation; for example, a capitalisation of £81 per acre (exclusive of land), an output of £142 per acre, a wage bill of £62 per acre. No less than 10,000 tons of dung have been brought on to the farm for this year. It is noteworthy that Mr. Secrett, as a pioneer in his special business, has always been willing to instruct others; at the present time he has taken on fourteen young men to gain experience of his methods. They pay no premium and receive the ordinary wages; once each week Mr. Secrett lectures to them and explains his procedure.

THE destruction of this business could not adequately be met by even the high compensation which Mr. Secrett might obtain. The site is a special one selected by Mr. Secrett after long search; it would be extremely difficult, indeed it might be impossible, to obtain an equivalent piece of land, which even then would require some years to equip and bring to a similar pitch of fertility. Doubtless very careful consideration has been given to the selection of this site for a reservoir, but it is difficult to suppose that no alternative exists. Mr. Secrett's farm stands pre-eminent as an example of the productive enterprise which the Government's agricultural policy is trying to foster, and of exceptional employment upon the land; under nothing short of absolute necessity should it be allowed to be submerged. Had the farm been a factory employing a hundred workmen and engaged in some new process, the Metropolitan Water Board would have thought twice about disturbing it. Yet it is a simple matter to rebuild a factory compared with the difficulty of finding a site and the time required to bring it into condition in order to replace the outfit represented by Holly Lodge Farm.

Aboriginal Reserves in Australia

THE attention of the public in Australia has again been directed to the urgent problem of the aborigines and their reserves. On this occasion the method employed to secure its consideration has been unique. According to a dispatch from the Melbourne correspondent of *The Times*, which appeared in the issue of January 24, a deputation of ten full-blooded aborigines waited upon Mr. Paterson, the Minister of the Interior, to urge, among other matters, the establishment of a Federal Department of Native Affairs, under a sympathetic administrator such as Sir Hubert Murray, the present Lieut.-Governor of Papua, and the institution of an advisory council, which would include social, anthropological, medical and educational experts. The spokesman of the deputation directed attention to the serious economic situation now arising among the aborigines. He pointed out that they are being driven into barren wastes in which it is impossible for them to live. He also pledged the aborigines as Commonwealth citizens, believing that the British Empire stands for justice, order and freedom, to maintain their heritage handed down to them by the Creator, but suggesting in what followed that present conditions were not favourable to that end. This is a somewhat surprising, but none the less significant, indication of recent developments in the movement for the improvement of the lot of the aborigines. It is probable, and, in fact, certain that the Australian public generally is not very fully informed of conditions of life among the aborigines. The mere size of the reserves has tended to obscure the relation to the area requisite for subsistence to the mode of subsistence. It is not realised that a considerable range of land is needed for the support of even small groups of food gatherers such as those found among the Australian aborigines. The formation of a Department of Aboriginal Affairs, of which the consideration is promised by Mr. Paterson at the next conference of Premiers, would ensure a more carefully reasoned control of aboriginal territory in relation to their needs and mode of life.

Ancient Greece and Modern Civilisation

IN his Friday evening discourse delivered at the Royal Institution on January 25, Sir Richard Livingstone discussed the relation of modern civilisation to ancient Greece. Starting in a world where men believed that Zeus made thunder and that the sun and moon were gods, the Greeks originated science. Their actual scientific and philosophic achievement was remarkable (witness Aristarchus's discovery of the heliocentric system, the anticipation of modern thought in Anaximander's notion that men originate from animals of a different species, and Democritus's atomic thory). But even more remarkable is the grasp on the ideal of science shown in such sayings as: "Thought is the supreme excellence of men and wisdom consists in saying what is true and acting according to Nature, listening to her" (Heraclitus), and "It is a sin that Reason should be the subject or servant of anyone; its place is to be ruler of all" (Plato). Further, they grasped the idea of a civilisation based on the development of the useful arts. This appears in the myth of Prometheus as expounded by Aeschylus, in the "Antigone" and in many other passages in Greek literature. In this sense the Greeks were the creators of the characteristic spirit of modern civilisation. They grasped the ideal of science as completely as any of their successors. We have carried scientific discovery and technology to heights of which they never dreamed. But they formed a clearer and perhaps higher conception than we of the life which men should lead against the background of material civilisation. They can correct our civilisation not only by the example of an existence, of which Goethe said that of all men the Greeks had dreamed the dream of life best, but also by reminding us that life is essentially a human problem and that ethics and political science are as fascinating as, and even more important than, physical science.

Radio Research

A DISCOVERY of great theoretical and practical significance in radio transmission was made last year. Listeners to foreign stations have, for some time past, noted that their reception was sometimes marred by a faint background of sound apparently made by a high-power long-wave station. At first, lack of selectivity in the receiver and possibly cross modulation were suspected. According to Prof. E. V. Appleton, in a paper in the *Electrician* of January 25, the interference is due to a cross modulation effect in one of the ionised layers in the atmosphere. The effect was first noticed in connexion with the powerful Luxembourg station, so it is generally called the Luxembourg effect. Recently amateurs belonging to the Radio Research League have shown that the phenomenon is also produced by the high-power stations at Droitwich and Athlone. Apparently a long-wave station of this type can impress the waves it produces on the ionised layer in its vicinity. If waves of another wave-length are reflected there, they acquire the modulation in question during the process of reflection. The present tendency of increasing the power of long-wave senders makes this phenomenon of practical importance. It brings about a type of interference over which the radio engineer has no control. Prof. Appleton comments also on the propagation of ultra-short waves (less than 8 metres). They are of importance because of their possible use in television. Apparently there is no acceptable evidence that 'round the world' communication will ever be possible with such short wave-lengths. The lowest possible wave-length appears to be determined by the finite value of the electrification in the upper atmosphere.

International Comparison of Radio Frequency Standards

THE technique of modern radio communication demands a very high degree of precision in the control and measurement of frequency. Considerable attention is therefore devoted by the more important national administrations to the development and maintenance of accurate frequency standards. In Great Britain one of the standards installed at the National Physical Laboratory provides a frequency of 1,000 cycles per second, the stability of which is better than one part in ten million. In order that this standard may be compared with those of other countries, the derived alternating current is used to modulate the carrier wave of a radio transmitting station. At the distant receiving station the modulation is extracted from the arriving signal and its frequency is compared with that of the local standard. In this manner frequency comparison measurements may be carried out simultaneously in different countries. Under the auspices of the Union Radio Scientifique Internationale, and with the co-operation of the British Broadcasting Corporation, such an international frequency comparison will be carried out during the night of March 12–13 next. On this occasion, the output from the frequency standard at the N.P.L. will be employed to modulate waves from the Droitwich, Scottish National and Scottish Regional stations of the B.B.C., simultaneously with the frequency of 1,000 cycles per second, for a period of about an hour and a half. The object of using several stations is to enable observations to be made on two or three carrier frequencies simultaneously, so that the effect of fading phenomena on frequency stability may be studied. On the same night a special emission of a constant frequency of five million cycles per second will be made from the U.S. Bureau of Standards, Washington, of sufficient intensity for satisfactory reception in Europe. Persons and organisations desirous of making use of any of these emissions may obtain further details from Dr. E. H. Rayner, president of Commission I of the U.R.S.I., at the National Physical Laboratory, Teddington, Middlesex.

Protection of Wild Animals in India

IT is a welcome sign for the welfare of the wild fauna of India that the editor of the *Indian Forester* (November 1934) should support whole-heartedly F. W. Champion's appeal in the *Journal of the Bombay Natural History Society* of April. Forestry

officers possess great power of determining the fate of the inhabitants of the areas under their control, and while complaints have been made here and there of excessive shooting on the part of the officers themselves, in most areas their influence tells for the preservation of forest animals. Fluctuations in numbers must be expected, and in the United Provinces, while tigers appear to have increased in numbers, marked decreases seem to have taken place amongst nilgai, kakar, wild dog and black buck. The decreases are attributed to serious floods and rinderpest epidemics, and these may be temporary; but the decrease of wild dogs is due to the large reward paid for their destruction. It is unfortunate that the author speaks with two voices about the relative abundance of game at the present day.

Gradual Decrease of Game in Reserved Forests

In the earlier part of his article, Mr. Champion gives as his definite conclusion that "taken as a whole the head of game shot recently has generally shown no marked decrease, except in the mountain reserved forests, where control is not so easy", and again "the impression of senior forest officers is that . . . the game in the United Provinces Reserved Forests as a whole has not markedly decreased during the last 25 years, except in the high hill forests". But before concluding his article he reconsiders the matter, and the result is by no means so encouraging: "I am not so certain as I was that the head of game inside the United Provinces Reserved Forests is not decreasing. . . . Although still a good place for animals in 1931, I would estimate that there had been at least a 25 per cent decrease in nearly all species during the previous decade." The decrease he puts down to the ease with which shooting can now be prosecuted owing to motor cars, and the destruction of game in areas outside the forests, which results in a smaller influx into the forests, and along with this the greater damage done to animals straying from the forests. Although the position in the reserved forests is not so serious as in outlying areas, it appears to have definitely deteriorated, and in view of this it is unfortunate that the earlier misleading statement was not deleted or modified before the article appeared in print.

Electrical Control of Road Traffic by Vehicle Actuation

The control of road traffic by means of vehicle-actuated signals is making rapid progress. In a paper read to the Institution of Electrical Engineers on January 24 by Mr. T. P. Preist, the relative merits of the control of road traffic by traffic officers and by time-controlled signals are discussed. The great advantage of using traffic officers is that they are able to take advantage of any useful break in a heavy stream of traffic and so reduce the time interference to a minimum. A drawback is that they are not conspicuous; this could be reduced by mounting them on a raised platform or crow's nest, but even this is not always effective, and a driver in the rear has to deduce the signals from the movements of the vehicles ahead. They also favour unduly horse-drawn vehicles and stragglers. With automatic lamps the signals are highly visible and control the traffic of vehicles before officers could see them from the cross-roads. On the other hand, the system is quite inflexible and may lead to much waste of time. Although railway practice has provided much valuable information to designers of road traffic control, there is a great difference between the fixed path of the railway train and the haphazard paths of the road vehicle. Mr. Preist pointed out a useful analogy between the road traffic problem and the problems that arise in telephony. Both arts have to select and control particular paths from the total available and ensure the orderly passage of the chance traffic arriving on those paths. In telephony the 'traffic' is concerned more with areas than with intersections, and future progress of road traffic control will probably lie in this direction.

Recent Acquisitions at the Natural History Museum

Among the recent acquisitions at the British Museum (Natural History) is a collection of 910 Coleoptera comprising 197 named species of Carabidæ (Trechinæ) and 257 species of Silphidæ (Bathysciinæ and Catopinæ) received from Dr. R. Jeannel, director of the Museum d'Histoire Naturelle of Paris. The main interest of these two groups of beetles is that they include the beetles that inhabit the extensive limestone caverns both of Europe and America. In the course of the ages that have elapsed since their ancestors left the free air and sunlight, various modifications for a cavernicolous habit have been evolved; thus, they have completely lost their eyes, their colour is an almost uniform reddish yellow, their legs have tended to lengthen while their wings have tended to disappear, and in some groups have been entirely lost, and their long isolation as separate colonies has brought about the evolution of distinct species in each different system of caverns. The Department of Mineralogy has received by exchange a portion (4,036 gm.) of a new meteoric stone from Lake Labyrinth in South Australia. A large series of specimens from the Libyan Desert has been collected by Dr. L. J. Spencer, keeper of minerals, while on the expedition of the Survey of Egypt to the Sand Sea in December. The object of the expedition was to investigate the origin of the lumps of pure silica-glass found on the surface in the stony or gravel 'streets' between the high (300 ft.) north-south dunes near the border of Italian Cyrenaica. Wind-worn pieces of clear glass were found in abundance over an area of 200 km. × 40 km., the largest lump weighing 16 lb. Many of the pieces had been broken by primitive man and were associated with hundreds of thousands of flakes of glass and quartzite. Querns and grinding stones were frequently found, and at one spot sixty fine palæolithic axes of quartzite, 8–10 in. long, were found. The region must at one time have supported a large population, but now not a living animal or plant is to be seen. Unfortunately, the glass could not be traced to any source. Another kind of silica-glass was found in the form of lightning-tubes or fulgurites, made by

the fusion of the sand when the dunes were struck by lightning. These are paper-thin tubes $\frac{1}{8}$ in. to one inch in diameter and penetrating downwards to the depth of eight feet or more.

THE Department of Botany has been presented with the remainder of W. Barton's herbarium excepting the genus *Rosa*. The present consignment is of about 12,000 sheets with carefully mounted and well-arranged plants, the whole in an excellent condition. The herbarium includes that of H. J. Riddelsdell and Mrs. Foord Kelsey. It is chiefly British, but includes some Alpine collections. The 20,000 sheets make an extremely valuable addition to the collections. Mr. N. Douglas Simpson has presented about 500 flowering plants from the Anglo-Egyptian Sudan. These form a most useful gift as they supplement the collection made by J. E. Dandy, assistant keeper in the Department, on his recent expedition. A collection of 750 flowering plants by H. H. Slater from Iceland, Nova Zembla, Kolquiev, has been purchased; it fills some gaps in the Department's extensive series of northern plants. Seven note-books which formerly belonged to Edward Forster (1765–1849) have been purchased from the Saffron Walden Museum. They contain a good deal of information about the plants he collected, and can now be again associated with his herbarium which has been in the Department of Botany since 1849. Robert Brown purchased it at the sale of Forster's books and herbarium, and it formed the nucleus of the British Herbarium.

Cambridge University Botanic Garden

CONSIDERABLE publicity has been given in the Press to the will of the late Mr. R. R. Cory, who was, in his lifetime, a generous benefactor of the Botanic Garden in Cambridge. He bequeathed the residue of his estate to the University for the benefit of the Garden, with the provision that the income from £30,000 of the residue should be used for certain specific purposes. This has led to the impression that the Garden would now be provided with an adequate income. Prof. A. C. Seward, professor of botany in the University of Cambridge, informs us, however, that "because of annuities created by Mr. Cory's will, the University should not expect any income for the Garden from his estate for many years to come. This means that the help hitherto given by the 'Friends of the Botanic Garden', by the promoters of the Somerset Employment Fund and by others interested in the Garden will be as urgently needed and as gratefully received as in the past."

Fireball of January 3, 1935

MR. A. KING, 53 Victoria Road, Ashby, Scunthorpe, Lincs, sends us the following particulars of this object: At 9h. 24½m. in the evening of January 3 a fireball, which was nearly as bright as the full moon, shot across south-west England. There were about sixty observations, ranging in place from Peterborough to 10 miles south of Falmouth. From the best of these the following path was deduced: Began, 55 miles high over English Channel, 23 miles south of Christchurch; mean deviation, 3·0 miles. Ended, 20 miles high over 4m. south-east of Wotton-under-Edge, Glos.; mean deviation, 1·8 miles. Length of visible track, 92 miles; speed, 13 miles per sec. Radiant, 76°–15°, altitude, 22·6°. The fireball exhibited remarkable colour changes during its flight, and drew out a red tail. A double detonation was heard at Dursley; at Crewkerne the object was seen to split into two halves towards the end of the path, which would seem to account, on the assumption that each piece set up its own shock-wave, for the Dursley observation. The velocity, allowing for air-resistance, was of the parabolic order. Assuming parabolic speed, the application of the correction for zenith attraction brought the radiant-position to 77°–20° and yielded the orbit: ι, 20·5°; π, 139·2°; Ω, 102·6°; q, 0·8865. The theoretical parabolic speed was 14½ miles per second.

Bibliography in Entomology

THE annual meeting of the Royal Entomological Society of London was held on January 16. In his presidential address, Dr. S. A. Neave took as his subject the development of bibliographical work relating to entomology. After dealing briefly with the growth of bibliographical compilations on the subject, Dr. Neave described the organisation responsible for the production of the monthly issues of the *Review of Applied Entomology*. His own very close connexion with the founding and growth of this periodical enabled him to give to his audience an intimate explanation of the manner in which the literature is surveyed and abstracted: the details of editorial duties and the work of preparing the elaborate indexes which are so prominent a feature in each completed volume. This well-known publication enjoys a world-wide circulation, and aims at keeping workers posted, by means of summaries, in the vast literature pertaining to the agricultural, medical and veterinary aspects of entomology.

Vocational Guidance in the United States

THE vocational guidance scheme which has been in operation in Great Britain for twenty-one years was recently reviewed at the request of the Minister of Labour by a committee of the juvenile employment councils. On the other side of the Atlantic also the 'coming of age' of vocational guidance as a function of the State has been recognised, and the very wide implications of the 'new deal' in this regard are discussed by the associate professor of education and sociology in the University of Pittsburgh in an article in *School Life* of September. It is pointed out that, in the past, vocational guidance has to a large extent been stultified by the gross inequalities in occupational rewards—inequalities which it is one of the purposes of the 'new deal' to reduce. Further, it has been a matter of national pride that everyone has the right to aspire as high as he will, regardless not only of social position and antecedents but also of apparent qualifications of intellect and character, and however obvious it may be to a vocational adviser

that his aspirations are incommensurate with his abilities. Now for the first time the view is tenable that society will not tolerate the waste involved in maintaining this conception, already largely illusory, of the individual's right to freedom of choice of occupation. A guidance far more positive and compelling than hitherto will obviously enhance the importance of the agencies responsible for it and, moreover, all teachers, supervisors and curriculum-makers will be increasingly preoccupied with their function of exploring and testing their pupils' capabilities.

Burden Mental Research Trust

AT a meeting held recently in London, the committee of administration had before it reports of the first year's working of the Burden Mental Research Trust, which Mrs. R. G. Burden endowed a short time ago with £10,000. The investigations contemplated by the Committee are being carried out by Dr. J. A. Fraser Roberts, assisted by Dr. R. M. Norman and Dr. Ruth Griffiths. An extensive survey of the mentally normal as well as the mentally abnormal has been initiated, and when the Trust eventually publishes its final report, it is hoped and expected that much valuable information will be forthcoming as to the nature of the transmission of mental abilities and disabilities. The Trust has also arranged for the co-operation of other distinguished investigators from different parts of Great Britain, one of whom—Dr. Shepherd Dawson of Glasgow—has already complied with the request of the Committee.

Vital Statistics for 1934

THE provisional figures of the vital statistics for the year 1934 have been issued by the General Register Office, Somerset House. They are as follows: for England and Wales: live births, 14·8, and deaths (crude rate), 11·8 per 1,000 resident population, and infant mortality rate (deaths under 1 year per 1,000 registered live births), 59. The birth rate shows an increase of 0·4 per 1,000 above the low record of 1933, and is noteworthy as being the only increase recorded since 1920, except in 1928, when there was a slight improvement of 0·1 following an exceptional fall in the previous year. The crude death rate is 0·5 below that for 1933, and only 0·4 above the lowest recorded in 1930. The infant mortality rate is 5 per 1,000 below that for 1933, and is the lowest recorded, the previous lowest being 60 for 1930.

Scientific Exhibition at Bombay

THE staff and students of the Royal Institute of Science, Bombay, held a most successful Scientific Exhibition on December 13–18, 1934, in aid of the Bombay hospitals. In a country like India which possesses few scientific museums, such exhibitions have great educational value, and the example of the Bombay Science Institute might well be followed elsewhere. About a thousand pounds were realised for the hospital fund. It may be remembered that similar exhibitions were organised in London several years ago in connexion with the King Edward's Hospital Fund and were very successful.

Solid and Liquid Gases in Science and Industry

THE low temperature exhibition, which is being arranged by the Science Museum, has already been mentioned in these columns; we now learn from the director of the Museum, Col. E. E. B. Mackintosh, that the opening date has been postponed until March 1936 in order to give a longer time for the preparation of the exhibits. The exhibition will remain open until the end of May and will therefore immediately precede the Seventh International Congress of Refrigeration to be held in Holland in May 1936. Promises of several interesting exhibits have already been received and the committee, under the chairmanship of Mr. H. T. Tizard, has made considerable progress with the arrangements. The other members of the committee are Dr. Ezer Griffiths, Prof. P. Kapitza, Prof. F. A. Lindemann, Prof. J. C. McLennan, Lord Melchett, Mr. C. C. Paterson, Dr. J. D. Pollock, Prof. F. Simon, Prof. M. W. Travers and Mr. R. S. Whipple, while the Museum officer responsible for carrying out the arrangements is Mr. T. C. Crawhall, who was also responsible for the Refrigeration Exhibition recently held in the Science Museum.

Standardisation of Hospital Equipment

A COPY of a report made by a Committee set up in 1931 by the Public Health Congress Council, 13 Victoria Street, London, S.W.1, to explore possibilities of standardisation of hospital equipment in Great Britain has been forwarded to county and county borough councils by the Ministry of Health (Circular 1410). It is concluded that some 30 per cent of the total maintenance costs of hospitals is incurred in respect of goods that can be readily standardised, without affecting the efficient working of institutions or interfering with the requirements of their professional staffs. It is shown that by standardisation and bulk purchasing, economies of 10–30 per cent may be effected. Standardisation is applicable to hospital furniture and textiles, crockery, cutlery, surgical materials and rubber goods, office requisites and many other articles; examples are given of economies that can be effected in this way, and reports of committees that have considered the subject in Germany and in New York are given in appendixes.

New Map of Hispanic America

IN 1920 the American Geographical Society began the compilation of a map of South America from existing sources. The available material is considerable, but so far no general map had been produced in any sense representative of the existing information. The Society now announces the publication of fifty of the hundred and two sheets which together will cover America from Mexico to Tierra del Fuego. Already large blocks including most of Chile and much of Brazil are ready. The scale is 1 : 1,000,000 and the style is in conformity with the International Map of the World on that scale. The Society also announces

the publication of a catalogue of the maps of Hispanic America in four volumes, giving a complete list with critical notes of all the source material used in the compilation of the map.

Announcements

IT is announced in *The Times* of January 25 that the Loder Cup, awarded for "meritorious service in the cultivation and preservation of New Zealand flora", has been awarded to Lord Bledisloe who, during his term of office as Governor-General of New Zealand, has done much for the protection of forests and encouraged the cultivation of the native flora.

LORD HIRST OF WITTON has been elected an honorary member of the Institution of Electrical Engineers. The thirteenth award of the Faraday Medal of the Institution has been made to Dr. F. B. Jewett, president of the Bell Telephone Laboratories, New York. The Faraday Medal is awarded not more frequently than once a year, either for notable scientific or industrial achievement in electrical engineering or for conspicuous service rendered to the advancement of electrical science, without restriction as regards nationality, country of residence, or membership of the Institution.

"IN order to bring to the notice of those interested in the applications of physics to the development of industry, to assist those engaged in industrial research and generally to promote the application of physics to industry" the Institute of Physics is arranging conferences on industrial physics. A conference on "Vacuum Devices in Research and Industry" will be held in Manchester on March 28–30, under the presidency of Prof. W. L. Bragg. Membership of the conference is open to all interested, and there is no fee. At the University there will be an exhibition of instruments, apparatus and books. Further information can be obtained from the Secretary, Institute of Physics, 1 Lowther Gardens, Exhibition Road, London, S.W.7.

THE Faraday Society will hold a general discussion on "The Structure of Metallic Coatings, Films and Surfaces" at the Imperial College of Science and Technology, London, S.W.7, on March 29–30. An introductory paper will be read by Dr. C. H. Desch. The discussion will be divided into two parts. Part 1 will be on "Electron Diffraction Methods". Prof. G. P. Thomson will read a paper on "An Apparatus for Electron Diffraction at High Voltages"; Prof. G. I. Finch is to deal with "Electron Diffraction and Surface Structure"; and papers by several foreign visitors will follow. The second part of the discussion will be on "The Structure of Metallic Coatings". Prof. E. N. da C. Andrade will read a paper on "The Crystallisation of Thin Metal Films", and papers by distinguished workers at home and abroad are promised. Further information can be obtained from the Secretary, Faraday Society, 13 South Square, Gray's Inn, W.C.1.

THE Institute of Chemistry will celebrate its charter jubilee this year. The Institute was founded in 1877, and incorporated by Royal Charter in June 1885. Arrangements are being made for a banquet to be held on July 9 and a reception on the following evening.

A DAVID ANDERSON-BERRY Gold Medal, together with a sum of money amounting to about £100, will be awarded in July 1935 by the Royal Society of Edinburgh to the person, who, in the opinion of the Council, has recently produced the best work on the nature of X-rays in their therapeutical effect on human diseases. A similar award will be made every three years.

THE Dobree collection of European Noctue which has been in the Museum at Hull for many years, and a catalogue of which (Pp. xv+156. 1*s.*) was issued in 1909, contained a certain number of type specimens. In the interests of students of entomology, it seemed desirable that these types should be in the national collection, and arrangements have been made whereby they are now in the British Museum (Natural History) at South Kensington, which has supplied suitable specimens to take their places at Hull.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—An engineer at the Fuel Research Station, East Greenwich—The Establishment Officer, Department of Scientific and Industrial Research, 16 Old Queen Street, Westminster, S.W.1 (Feb. 6). A borough electrical engineer for Middlesborough—The Town Clerk, Municipal Buildings, Middlesborough (Feb. 11). A physiological chemist at the Imperial Institute of Agricultural Research, Bangalore—The High Commissioner for India, General Department, India House, Aldwych, London, W.C.2 (Feb. 15). An assistant in the Essex Museum of Natural History—The Principal, West Ham Municipal College, Romford Road, E.15 (Feb. 15). Assistant electrical engineers in the Admiralty Service—The Secretary to the Admiralty (C.E. Branch), Whitehall, London, S.W.1 (Feb. 16). Assistants in clinical pathology, morbid anatomy, bacteriology and pathological chemistry in the British Postgraduate Medical School, Ducane Road, Hammersmith, W.12—The Dean (Feb. 18). A lecturer in biology at Whiteland's College, Putney, London, S.W.15—The Secretary (Feb. 20). A lecturer in chemistry in the Leicester College of Technology—The Registrar (Feb. 22). A professor of chemistry in University College, Exeter—The Registrar. A lecturer in natural history in the Froebel Educational Institute, Grove House, Roehampton Lane, S.W.15—The Principal. A Cargill professor of applied physics in the University of Glasgow—The Secretary to the University Court. A Gardiner professor of physiological chemistry in the University of Glasgow—The Secretary of the University Court. An assistant research engineer at the B.B.C.—The Chief Engineer, Broadcasting House, London, W.1. A temporary assistant lecturer in mechanical engineering at the Gloucester Technical College—The Principal.

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. 189.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Origin of the Cosmic Rays

FROM the properties of the kinematic world-models which I have been investigating during the past two and a half years, it can be shown that any unimpeded free particle, at large in inter-galactic space, undergoes acceleration as reckoned by an observer located on any arbitrary nebula, and attains the speed of light at some finite epoch in the experience of that observer. It then decelerates. It can also be shown that at any arbitrary epoch, in any arbitrary domain of inter-galactic space, there will occur some particles possessing velocities arbitrarily close to that of light. If such a particle, of atomic dimensions, happens to undergo a collision during this phase of its trajectory, it will give rise to effects similar to those observed in cosmic ray experiments. I therefore identify the primary agency responsible for cosmic rays with high-speed particles accelerated to the vicinity of the speed of light by the gravitational pull of the rest of the universe[1]. The arguments required are purely kinematical, and involve no appeal to any specific theory of gravitation, or any arbitrary hypotheses.

This identification is compatible with the corpuscular character assigned to the primary agency by many authorities. The identification accounts for the observed isotropy; and it provides the origin of the high energies, predicting indeed that there is no upper limit to the energy of a single 'ray'. The energy is drawn from the infinite energy associated with the infinitely many particles constituting the universe. Lastly, the identification removes the old impasse to which other theories of the origin of cosmic radiation have appeared to lead: that if the primary rays were born in the interiors of stars, it is difficult to see how they could ever get out; yet if they were born as a result of multiple collisions in inter-galactic space, it is difficult to see how the inter-galactic density of matter could be high enough.

A full account of these investigations will appear shortly in a volume to be published by the Clarendon Press. The results were first described at Dr. N. V. Sidgwick's colloquium at Oxford on February 19, 1934, and have been discussed in numerous lectures elsewhere.

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Oxford.
Jan. 11.

[1] cf. Bothe and Kolhörster, *Z. Phys.*, **56**, 777; 1929.

'Extra' Rings and Bands in Electron Diffraction Patterns

SO-CALLED 'extra' or forbidden rings have been observed from time to time in electron diffraction patterns, and their origin has been attributed to half-order diffractions or impurities. Cases in which more than one such ring have occurred in a single pattern have been rare. We have obtained patterns from platinum, gold, silver, cobalt, nickel, chromium, iron, tin, graphite and zinc oxide exhibiting not only up to as many as 14 'extra' rings, but also remarkable circular bands with well-defined heads.

The main facts relating to these rings and bands, so far as they have been ascertained, are as follows: (1) The method of production of the specimen is immaterial, but the crystals must be orientated; (2) specimens of similar thickness and method of preparation show much less background if the crystals are orientated than when randomly disposed; (3) for a given orientation the 'extra' ring and band pattern is characteristic of the crystal lattice; for

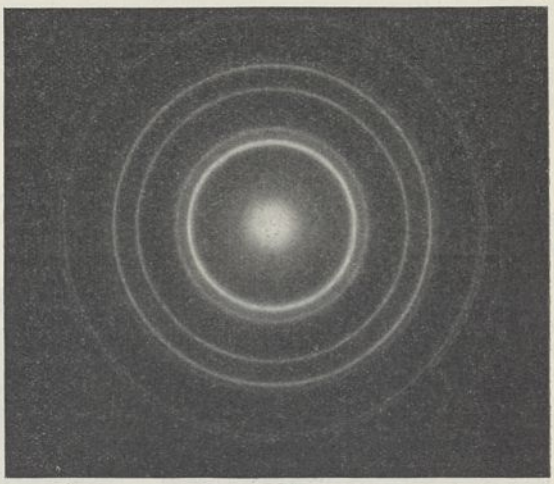

FIG. 1.

example, all body-centred cubic polycrystalline films with (111) face orientation yield 'extra' rings in the same relative positions; (4) no 'extra' spots have been observed in single crystal patterns; (5) with a suitable film, the thickness being rather critical, a pattern consisting almost wholly of 'extra' rings can be obtained; finally, (6) one head of each band coincides with a normal ring or with the central spot, while the other consists of an 'extra' ring. Fact (1) excludes impurity as a contributory factor, and (5) suggests that secondary scattering plays no material rôle in the formation of 'extra' rings; indeed, it can be shown that a primarily diffracted ray, hkl, on undergoing a second scattering, $h'k'l'$ in the same crystal will give diffracted rays falling on normal pattern rings.

It seems to us that the 'extra' rings and bands owe their origin to the external crystal shape, that is, to the boundary faces through which the electron beam leaves the crystals. For example, the pattern, Fig. 1, was obtained from a face-centred cubic polycrystalline silver film orientated with 110 planes normal to the beam, that is, equivalent to a single crystal rotating about an axis in the beam parallel to a cube-face diagonal. Four distinct 'extra' rings lie within the very intense 111 ring, and two conspicuous bands are

visible, one between the central spot and the first 'extra' ring and the other between the 200 and the outermost 'extra' ring just inside the 111. The first, third and fourth 'extra' rings correspond to diffraction of the primary beam by plane gratings consisting of the atoms in the (111) exit faces, while the second and also the fourth correspond to diffraction by (120) exit planes. As the electron wave-fronts pass down the inclined exit faces, the third Laue condition and the structure amplitude restrictions relax and finally disappear, with the result that one intense band is swept out between the 200 and the fourth 'extra' ring and another between the central spot and the first 'extra' ring. A similar explanation has been found to account for the other bands and 'extra' rings so far observed.

The value of the 'extra' rings and bands in crystal structure analysis is evident. We have here for the first time a possible means for identifying the actual crystal faces in crystals of sub-microscopic dimensions.

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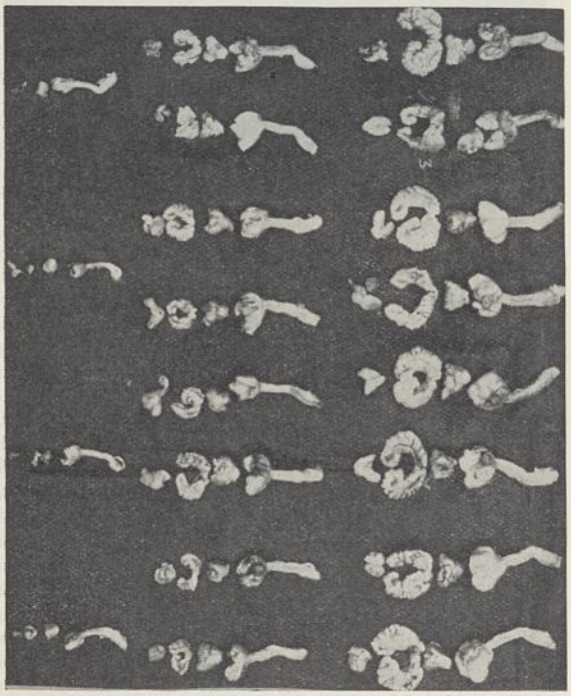
Differences between Male Hormone Extracts from Urine and from Testes

THE identity of the male hormone, extracted respectively from urine and from testes, has been assumed but never proved since the original isolation



A B C

FIG. 1. Prostate, seminal vesicles, periurethral tissue and penes of rats: A, controls; B, treated with urinary extract; C, treated with testis extract.

of active substances from these two sources. We[1] and also other authors[2,3] have pointed out various chemical and biological differences. The following experiment shows a more definitive differentiation.

Twenty-one male rats were castrated when 3–3½ weeks old; and at the age of 6–6½ months, when the average weight was about 260 gm., were divided into three groups. The first group of five animals was untreated. The second group of eight animals received injections of male hormone extracted from urine; the third group of eight animals, injections of male hormone extracted from testicles.

The extracts were administered during four periods of six days, the dosage being increased at each phase. The preparations had been standardised on capons. During the first six days, 2 × 0·5 comb units (C.U.) daily were given; during the second six days, 2 × 1 C.U.; during the third six days 2 × 2 C.U.; and during the fourth six days 2 × 4 C.U. When the animals were killed on the day after the last injection, they showed extraordinary differences in the size of the seminal vesicles (Fig. 1). The average weight of the seminal vesicles was 8 mgm. in the controls, 113 mgm. in the group treated with urinary extract and 538 mgm. in the group treated with testicular extract. The difference in size of the prostate of the injected animals was much less (6 mgm., 66 mgm., 105 mgm.). The histological findings are to be published later.

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Dec. 24.

[1] Laqueur, C. S., and Münch, *Ber. ges. Physiol.*, **61**, 3/4; 1931.
[2] Gallagher, T. F., and Koch, F. C., *Endocrinology*, **18**, No. 1, 107; 1934.
[3] Matsuzaki, K., *Jap. J. Med. Sci.*, **7**, No. 1; 1934.
[4] Freud, J., and Laqueur, E., *Acta Brevia Neerl.*, **4**, 100; 1934.
[5] Freud, J., *Acta Brevia Neerl.*, **4**, 81; 1934.

Excretion of Nitrogenous Compounds from the Root Nodules of Leguminous Plants

THE activities of the nodule, and particularly the excretion of nitrogenous compounds from the nodule into the medium, are largely dependent upon the supply of air to the roots. The quantity of excreted nitrogenous compounds is the greater the larger the culture flask. This fact has been clearly demonstrated by our experiments with sterile cultures of inoculated peas in quartz sand. The results also showed that the rate of excretion is proportionally highest at an early stage of development of the plants when the nodules are still quite young. Hence it can be concluded that the passage of the nitrogen compounds into the sand actually is due to excretion and not to a decomposition of the nodule proteins.

We have previously shown[1] that nitrogen compounds, found in sand after growth of inoculated leguminous plants under sterile conditions, consist mainly of amino-acids. Since these compounds cannot be breakdown products of nodule proteins it is reasonable to assume that the fixation of nitrogen takes place at the surface of the bacterial cells in the nodule, and that nitrogen compounds thus formed are partly utilised by the host plant and partly diffused into the soil. This view receives additional support from the fact that the proteoclastic action of leguminous bacteria and nodules is very slight.

Excretion of nitrogenous compounds from root nodules is not attributable to a mechanical wounding of the root hairs through sharp-edged sand particles, since the same phenomenon was found to

take place also in agar cultures if the access of air to the nodules and roots is facilitated by allowing the agar to shrink. Consequently, the excretion is a natural process which is closely dependent on the air-content of the medium.

Recently we have found[2] that pea and clover nodule bacteria effect a butyric fermentation of glucose, whereby hydrogen is also produced. This finding will probably help us to gain a clearer conception of the mechanism of nitrogen fixation. All attempts to effect a fixation of nitrogen by free-living nodule bacteria have so far led to negative results. This is probably due to the fact that ordinary sugar compounds are very poorly utilised by these bacteria. It seems, therefore, natural to assume that the nodule bacteria receive from their host plant some particularly suitable sugar compound which is readily utilised, and provides the energy required for nitrogen fixation. Theoretically it would thus be possible to effect a fixation of nitrogen by free-living nodule bacteria as soon as the chemical nature of the specific carbohydrate is ascertained.

Further details will be published in the *Journal of Agricultural Science*.

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[1] Virtanen, A. I., v. Hausen, S., and Karström, H., *Biochem. Z.*, **258**, 106; 1933. NATURE, **131**, 534, April 15, 1933.
[2] Virtanen, A. I., Norlund, M., and Hollo, E., *Biochem. J.*, **28**, 796; 1934.

Synthetic Compound with Vitamin B_2 Activity

ACCORDING to a note[1] in NATURE on a lecture recently given by me, synthetic 6.7-dimethyl-9-1-araboflavin, $C_{17}H_{20}N_4O_6$, possesses similar growth-promoting activity to that of lactoflavine (vitamin B_2). The statement, that a catalytically active compound results by combination with the colloidal carrier of the 'yellow enzyme' of O. Warburg and W. Christian is incorrect, both for the natural and synthetic pigment, in so far as experiments *in vitro* are concerned. According to the *in vitro* experiments described by H. Theorell[2], phosphoric acid plays an important rôle in the combination. *In vivo*, on the other hand, a combination of both pigments with phosphoric acid and protein to form yellow enzymes apparently takes place. *In this sense only*[3] does the synthesis of a compound with vitamin B_2 activity represent also the first synthesis of the active group of an enzyme.

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Jan. 9.

[1] NATURE, **134**, 966; 1934.
[2] *Biochem. Z.*, **275**, 37, 344; 1934.
[3] For the original German text, see *Ber.*, **67**, 2084; 1934. **68**, 166; 1935.

Formulæ and Equations in Nuclear Chemistry

THE question which Prof. Lowry raises on p. 36 of NATURE of January 5 is one which has perforce exercised my mind in the last few days, since I am at present revising the final page-proofs of the report of the International Conference on Physics. He refers to the different positions in which the numerals indicating the mass and atomic number of a nucleus are placed by different writers. Thus, we have ^4_2He, $_2He^4$ and He_2^4. He points out that if the last form is used, there is a difficulty in showing the number of atoms in a molecule in the customary English fashion (for example, Cl_2) whilst both the second and third forms introduce a difficulty for the French chemist, who is in the habit of writing Cl^2 for a molecule of chlorine.

As a matter of fact, the ideal symbolism would leave space not only for this numerical indication, but also for a sign to denote the state of ionisation. The two requirements together completely rule out both the second and third forms above, leaving only the first as suitable for general adoption.

From a logical point of view, if the symbol refers to a nucleus and not to a complete atom, the lower numeral is unnecessary. If a nucleus has subscript 2, it is helium, and conversely. Thus, the simplest method would be to write ^4He, ^6Li or ^7Li. The only objection is the ugliness of the juxtaposed large and small figures in such an equation as $2^1H_2 + {}^{16}O_2 = 2^1H_2{}^{16}O$.

If we were bold enough, we should adopt a logical scheme, and save the printer much trouble, by giving up the letter instead of the subscript. An atom would be represented by a number or numbers in a bracket: (1, 1) and (1, 2) for ordinary and heavy hydrogen, (2, 4) for helium, (3) to mean either isotope of lithium, and so on.

The above reaction would then be written

$$2\,(1,\,1)_2 + (8,\,16)_2 = 2\,[(1,\,1)_2(8,\,16)].$$

It is easy with this notation to show states of ionisation: $(17, 35)^- + (19, 39)^+ = [(19, 39)\,(17, 35)]$ or $(17)^- + (19)^+ = [(19)\,(17)]$ would replace the familiar $Cl^- + K^+ = KCl$.

If it is decided to retain the use of letters, I would plead for the use of H to signify all the isotopes of hydrogen. When H is restricted to mean ^1_1H, we have the additional symbols ^2D and ^3T (with perhaps ^4Q to follow) to remember, and there is no symbol available to mean hydrogen in general. One is certainly needed for this purpose, and the need is illustrated on p. 23 of the issue of NATURE to which I have already referred.

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Jan. 8.

Absorption Spectrum of Sulphur Monoxide

IN a recent investigation[1], we attempted to detect sulphur monoxide in the photochemical decomposition of sulphur dioxide by examining the absorption spectrum of the latter before and after its irradiation. An absorption spectrum of the monoxide was reported to have been found by P. W. Schenk and H. Cordes[2] in the spectral region between 3300 A. and 2500 A., and although sulphur dioxide has very strong absorption bands in this region, they found evidence of the spectrum of sulphur monoxide, even when its concentration was 10^4 times smaller than that of the dioxide[3]. This spectrum, however, could not be detected in the photochemical decomposition of sulphur dioxide, and it has been assumed[1] that the act of photo-dissociation provides sulphur monoxide with a surplus amount of energy which makes it react instantaneously. But since this surplus amount of energy is only 13 cal. for 1950 A., this conclusion did not seem quite satisfactory. It seemed advisable,

therefore, to ascertain whether the absorption spectrum described by Cordes and Schenk was to be attributed to the presence of the monoxide.

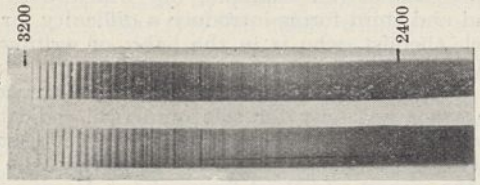

FIG. 1. Absorption spectrum of sulphur dioxide; (*a*) before, and (*b*) after discharge.

An electrodeless discharge was produced in sulphur dioxide and the absorption spectrum was taken before and immediately after the discharge, as shown in Fig. 1. The intensity of the spectra is not quite the same, for a thin sulphur film had partly covered the plate during the 2½ hours of discharge, and it seemed necessary to take a longer exposure. Nevertheless, in spite of the difference in intensity, the identity of the two spectra cannot be doubted, so that there is definitely no new absorption spectrum produced by the discharge. That is quite clear in the original plate, but naturally not so clear in the reproductions. The presence of sulphur monoxide, on the other hand, in the discharge is proved by its emission spectrum, taken during the discharge (Fig. 2), which shows the same bands as the spectrum that was analysed first by V. Henri[4] and later by E. V. Martin[5].

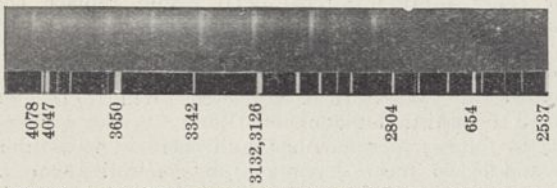

FIG. 2. Emission spectrum of sulphur monoxide, with mercury lines below.

It seems necessary, therefore, to ascribe the absorption spectrum found by Cordes and Schenk to some product of the discharge other than sulphur monoxide; in other words, our experiment indicates that sulphur monoxide in small concentrations has no absorption spectrum between 3100 and 2500 A.

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M. MCCAIG.
Physics Department,
University College,
Nottingham. Nov. 23.

[1] G. Kornfeld and M. McCaig, *Trans. Farad. Soc.*, **30**, 991; 1934.
[2] H. Cordes and P. W. Schenk, *Z. anorg. u. allgem. Chem.*, **214**, 33; 1933. *Z. Elektrochem.*, **39**, 594; 1933. *Trans. Farad. Soc.*, **30**, 31; 1934.
[3] P. W. Schenk and H. Platz, *Z. anorg. u. allgem. Chem.*, **215**, 113; 1933.
[4] V. Henri and F. Wolff, *J. Phys. et Le Radium*, VI, **10**, 81; 1929.
[5] E. V. Martin, *Phys. Rev.*, **41**, 167; 1932.

Sources of Error in Absorption Spectroscopy

IN studying the absorption spectra of the vapours of the homologous aldehydes[1] a band spectrum was observed in butyric and *iso*-butyric aldehydes, which was ultimately discovered to be due to benzene. Inquiries showed that the catalyst used in the preparation of the aldehydes had been washed with benzene, thus accounting for the presence of an aromatic impurity which would not normally be expected to occur in aliphatic compounds. The spectrum is, however, so intense that, when the observation tube had been used to secure a comparison spectrum of benzene, it was very difficult to get rid of this spectrum in subsequent exposures.

In attempting to photograph the fine structure of acetone, Dr. F. C. Garrow in 1931 observed a very fine series of bands, corresponding in general character with those recorded by Bowen and Thompson[2], which Norrish, Crone and Saltmarsh[3] and Noyes, Duncan and Manning[4] have not been able to reproduce. The bands observed by Dr. Garrow were, however, due to interference, since they were only slightly weakened when the tube was empty; they were also observed with a single end plate, and were only got rid of by using other quartz plates. Bands of a similar character have been described by Schaeffer and others[5], and those now recorded are probably similar in origin. The occurrence of a few weak bands at wave-lengths less than 2900 A. has already been recorded by us[1], but no trace of a genuine fine structure could be found in this region.

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Dec. 15.

[1] Snow and Eastwood, NATURE, **133**, 908, June 16, 1934.
[2] Bowen and Thompson, NATURE, **133**, 571, April 14, 1934.
[3] Norrish, Crone and Saltmarsh, *J. Chem. Soc.*, 1458; 1934.
[4] Noyes, Jr., Duncan and Manning, *J. Chem. Phys.*, **2**, 717; 1934.
[5] Selényi, *Math. u. naturw. Berichte aus Ungarn*, **27**, 76; 1909. Chinmayanandam, *Proc. Roy. Soc.*, A, **95**, 176; 1919. Ghosh, *Proc. Indian Soc. for Cultivation of Science*, **7**, 53; 1922. Schaeffer and Fricke, *Z. Phys.*, **14**, 253; 1923. Schaeffer, *Z. Phys.*, **17**, 155; 1923.

Properties of Liquid Films in Fine-Pored Systems

THE properties of liquids, and in particular of water, when held by finely porous material, are of interest to workers in both the pure and applied fields. A growing mass of evidence points to the necessity of assuming a modification in properties of such liquid films even in thicknesses corresponding with many molecular layers.

Shereshefsky[1] and others have produced definite evidence that measured vapour pressures of liquids in small capillaries (of radius 0·0005 cm. and less) are very much smaller than those calculated from the Kelvin equation. In view of this result, it is interesting to note that experiments at the Building Research Station, shortly to be published, have shown that for several finely pored plastic materials, the hydrostatic suction necessary to remove water is of quite a different order from that which would be expected from the vapour pressure relation. Similar anomalous behaviour has been found when the same moist plastic materials are brought to equilibrium with a solution of sugar of known osmotic pressure through a semi-permeable membrane. Calculations show that large discrepancies also exist in published literature, where it is possible to compare sets of determinations by two dissimilar methods. Thus Szigeti's[2] measurements of vapour pressures and negative absorptions from sugar solutions show these anomalies.

Among other cases of anomalous behaviour reported which may be due to the same causes the following may be noted: Glixelli and Wiertelak[3] found low values for the electro-kinetic potential in

silica gels which became normal in ignited gels. White, Urban and Van Atta[4] found very low values for stream potentials in pyrex glass capillaries of less than 0·001 cm. diameter. Wolkowa, in measuring the velocity of penetration of liquids into finely powdered materials, found regular behaviour with non-polar liquids but anomalous results with water and other polar liquids. Measurements carried out at the Building Research Station of the dielectric constant of liquids in porous materials and its variation with frequency have been found to exhibit discrepancies which may prove to be related with observations on water in soils made by Smith-Rose[6].

It is suggested that Hardy's[7] conception of molecular orientation in thin liquid films formed on the surface, for which strong evidence is afforded by their behaviour as lubricants, may provide a means of reconciling the anomalies to which we now direct attention. In such films, the work required to tear up 'by the roots' orientated chains of molecules, as is necessary in molecular exchanges between film and gaseous phase or across a semi-permeable membrane, may be much greater than that required to slide layers from the surface in a manner which may be considered to occur when a direct hydrostatic suction is applied. This crude picture is, of course, open to objections which it is not possible to discuss here, but it may serve to emphasise the desirability of carrying out measurements by two or more different methods in any studies designed to further our knowledge of the capillary properties of liquids in finely porous systems.

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Dec. 1.

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[6] Smith-Rose, R. L., "Electrical Properties of Soil", *Proc. Roy. Soc.*, A, **140**, 359; 1933.
[7] Hardy, Sir W. B., "Problems of the Boundary State", *Phil. Trans.*, A, **230**, 1; 1932.

Galvanometer Relays

THE use of the rectifier photo-cell to amplify galvanometer deflections is now well known; but I have never seen any explicit mention of the fact that, with the customary set-up[1], the deflections of the second galvanometer are not in general proportional to those of the first. The discrepancy arises because the area of the photo-cell illuminated changes as the deflection of the primary galvanometer changes.

I am now using a modified system in which this defect is absent. The beam of light from the primary galvanometer mirror forms a rectangular image on a lens, immediately behind which is a pair of right-angled prisms, which throw part of the light on to one cell and part on to another. The lens forms an image of the galvanometer mirror on each cell. As the rectangular image moves across the lens more light is thrown on to one cell and less on to the other: but there is no change of the cell area illuminated in either case, the only effect being to vary the brightness of the images on the cell surfaces. Thus, non-uniformity of the sensitivity of the surfaces cannot affect the proportionality between the deflection of the two galvanometers.

The two cells are connected across the galvanometer in parallel with, and in opposition to, each other; this method of connexion gives considerably greater amplification than can be obtained with a divided cell of the same photo-electric sensitivity.

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[1] A. V. Hill, *J. Sci. Instr.*, **8**, 262; 1931. NATURE, **133**, 685; 1934. R. V. Jones, NATURE, **133**, 872; 1934. *J. Sci. Instr.*, **11**, 302; 1934.

Addition of Hydrogen Bromide to Olefines

THE results of several investigations have confirmed the discovery[1] that oxygen and peroxides ('oxidants') may greatly affect the addition of hydrogen bromide to olefinic substances[2]. In all these investigations the double-bond has been in the terminal position ($CH_2 = CH - CH_2 -$), oxidants causing the addition of hydrogen bromide to yield $CH_2Br - CH_2 - CH_2 -$, and 'anti-oxidants' allowing the formation of $CH_3 - CHBr - CH_2 -$.

In order to ascertain whether the same effect could be produced in the reactions of an olefine containing a non-terminal double-bond, we have studied additions to *iso*-undecylenic acid[3] ($CH_3 - CH = CH - (CH_2)_7 - COOH$). This olefine adds hydrogen bromide relatively slowly, and yields the same proportions of 9- and 10-bromoundecoic acids, whether oxidants or anti-oxidants are present. As undecylenic acid ($CH_2 = CH - (CH_2)_8 - COOH$) clearly shows the peroxide effect (Ashton and Smith, loc. cit.) there is now some evidence that only terminal double-bonds are susceptible.

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[2] Kharasch and co-workers, *ibid.*, **55**, 2521, 2531; 1933. **56**, 244, 712, 1212, 1243, 1642, 1782; 1934. Smith, NATURE, **132**, 447; 1933. Linstead and Rydon, *ibid.*, **132**, 643; 1933. Ashton and Smith, *J. Chem. Soc.*, 435, 1308; 1934. Brouwer and Wibaut, *Rec. trav. chim.*, **53**, 1001; 1934.
[3] Krafft and Seldis, *Berichte*, **33**, 3571; 1900.

Ionisation of the Kennelly-Heaviside Layer

THE eclipse observations of August 31, 1932, and Appleton's Tromsø observations, indicate fairly certainly that the normal daytime ionisation in the *E* layer (100 km. height) is due mainly to solar wave radiation, and not to neutral corpuscles as Chapman suggested. But the ionising wave radiation may not be ultra-violet light (in amount corresponding to Planck's formula at the sun's temperature) as now generally supposed. As Eckersley has remarked, if the ionising agent is wave radiation, it must be so penetrating as to be of Röntgen type; but he disbelieves in the emission by the sun of an adequate amount of such radiation (Elias, however, for a time considered such rays to be the cause of the *E*-layer).

But solar conditions seem not to preclude such radiation. If, as Swann has suggested, very fast electrons are produced in sunspots, most of them

must lose their energy again in the photosphere and chromosphere, and in so doing will excite Röntgen radiation, both continuous, scattered and characteristic. The emission need not be confined to sunspots : Bartels' M-regions show that important solar phenomena can still remain undetected by us.

The mass-absorption coefficient (μ/ρ) of ultra-violet light is too great for this to penetrate to 100 km. height. Too little is yet known about the value of μ/ρ for light between the ultra-violet and the Röntgen region ; systematic measures using the Hopfield continuous spectrum of helium are very desirable. For ultra-soft Röntgen radiation, the course of the μ/ρ curve is known approximately to $\lambda = 68$ A., for which wave-length Messner recently found $\mu/\rho = 1{\cdot}46 \times 10^4$. At 700 A., μ/ρ is certainly much greater, probably similar to that of celluloids, for which O'Bryan found a maximum for μ/ρ ($5{\cdot}8 \times 10^5$) at 800 A. Probably Hulburt's estimate ($\mu/\rho \geqslant 8{\cdot}8 \times 10^5$) of μ/ρ for ultra-violet ionising light is truer than that used by Försterling ($1{\cdot}2 \times 10^5$).

The height of maximum ionisation depends essentially on μ/ρ. If $\mu/\rho = 5{\cdot}5 \times 10^5$ (ultra-violet light), the height at midday must exceed 130 km. if the air temperature T is 218° K, and a lower value of T has not been proposed. This assumes no diffusive separation of the separate gases : if this occurs, the height might be 4 km. lower. It would exceed 200 km. if the outer layers consist of atomic oxygen as suggested by Chapman. Again, the fact that the gases of the atmosphere have absorption *bands* in the ultra-violet implies that the thickness of the absorbing layer must much exceed that of the ionised layer (scarcely 30 km.) Hence ultra-violet light is unlikely to be the ionising agent for the E layer, unless its value of μ/ρ has been over-estimated a hundredfold.

We are thus led to conclude that the agent is Röntgen radiation. According as T is taken to be from 218° to 323° K. (and it cannot exceed 100° C. in the E-layer), the Röntgen wave-length will lie between 13 A. and 3·5 A., and also, on account of the K absorption limit of nitrogen at 31·1 A., from 40 A. to 31·1 A. As regards the characteristic radiations that may be involved, we may note the K-radiations from Na (11) to Ca (20), the L-radiations of Ca and those from Cu (29) to Sn (50), and the M-radiation from Ce (58) to U (92). The soft series for the elements near iron can be of importance only if $T < 218°$ K.

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Eocene Beds of the Punjab Salt Range

MR. E. S. PINFOLD and I have recently made a special examination, on behalf of the Attock Oil Company, of the Eocene beds of the Punjab Salt Range, with the view of determining their exact age. It will be remembered that opinions as to this have varied greatly in the past, some geologists referring them to the Laki, others to the Khirthar, while others again have shelved the question of their precise age by calling them "Hill" limestones or "Nummulitic beds", etc.

I have now found, on examining fossils collected from these Eocene beds by Mr. Pinfold, that the beds are actually divisible into two distinct portions, the lower one belonging to the Ranikot and the upper to the Laki. Having lately received permission from the Attock Oil Company to publish our results, Mr. Pinfold and I hope shortly to produce a paper in which the relevant field and palæontological evidence will be discussed in detail.

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"The Horizons of Thought"

I KNOW that a reviewer's comments on a book, especially when published in an international journal, travel many leagues while an author's reply is getting into an envelope, but for all that I would ask you to allow me to comment on your reviewer's words (in NATURE of October 20, 1934, p. 617) concerning my book, "The Horizons of Thought". I am surprised to read that there is a "peculiar method" employed in the book ; the reviewer seems to imply that it is a superficial eclecticism, which of course no one could countenance. As a matter of fact, the quotations are used for illustration and application of principles previously worked out and published in preliminary form elsewhere, as indicated in the preface. The reviewer seems to complain because contexts are not stated ; they are omitted for the sake of brevity, and also because I was interested not so much in contexts as in contacts and conflicts with the principles worked out. I was interested not so much in elaborating my perhaps "general and obvious", and perhaps even "more or less relevant" conclusions, as in showing how often in contemporary thought their principles are disregarded, with consequences all the way "from mathematics to ethics". Finally, I must disclaim the wish which the reviewer imputes to me, of solving problems which lie beyond the horizons. I think the primary task of philosophy is to work within the island-universe of the sciences (logical, mathematical, natural and social), and treat a great mass of traditional outlying questions non-committally.

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Dec. 5.

I AM interested in Prof. Conger's letter, and I understand his points clearly. To deal with them satisfactorily would, however, occupy more space than could reasonably be asked for in NATURE ; and I do not think a controversy on these subjects would serve any practical purpose.

THE REVIEWER.

Symbols for Chromosome Numbers

I AGREE with Miss Schafer[1] that the use of a Greek letter for the basic chromosome number has serious disadvantages and should therefore be dropped. But I think a new symbol is necessary, to avoid the confusion which results from a resuscitation of x for this purpose. This symbol tends to be overworked, presumably because every schoolboy begins his algebra with x as the unknown quantity. In the result we have papers written on the effect of X-rays on the X-chromosome. In this case, however, no confusion results, because the two uses of X are so different.

Formerly x and $2x$ were in universal use for the haploid and diploid chromosome numbers. Since then, usage has gradually shifted to n and $2n$, presumably to avoid confusion with X, which began, after 1900, to be used for the sex chromosome; but x and $2x$ are still employed to some extent in the original sense, as previously pointed out[2], so three uses of the symbol in relation to chromosomes have to be distinguished.

In these circumstances, and in view of the place x has already had in the nomenclature of chromosomes, confusion can only be avoided by adopting a new symbol for the new conception, and I suggest b as a suitable symbol for the basic number.

Since this was written, I find that b as a symbol for the basic chromosome number has already been proposed by Sinotô[3].

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[1] NATURE, **135**, 109, Jan 19, 1935.
[2] NATURE, **134**, 1011, Dec. 29, 1934.
[3] "Chromosome Studies in some dioecious Plants, with special Reference to the Allosomes." *Cytologia*, **1**, 112; 1929.

Miss Mirsky's "Northern Conquest"

IN my review of this delightful book I was wrong in making it appear on p. 884 of NATURE for December 8 that the work was done under the critical supervision of Dr. Stefansson. I now know that this was not the case. The great explorer did not see the book until it was submitted to him in a complete form by the publisher. Miss Mirsky is thus entitled to all the credit for her brilliant work.

In mitigation of my blunder, I can only say that, like the writer of the legendary article on Chinese metaphysics, I must have combined the information derived from two unrelated statements. These were the phrases in Miss Mirsky's prefatory note: (1) "During the three and a half years I spent on the book . . ." and (2) ". . . the generosity with which Vilhjalmur Stefansson placed his fine library at my disposal". Of course, I should not have inferred that the book was written in that library, the use of which only contributed to the compilation of the illustrative maps.

HUGH ROBERT MILL.

Points from Foregoing Letters

COSMIC rays are identified as particles accelerated to a speed near to that of light by the gravitational pull of the rest of the universe in the kinematic world model put forward by Prof. E. A. Milne. There is no upper limit to the energy that such a particle may acquire, since it is drawn from that of the whole universe.

According to Dr. G. I. Finch and Mr. A. G. Quarrell, the 'extra' rings observed in certain X-ray diffraction patterns are due to the shape of the minute crystals that compose the materials investigated, and may therefore help in finding the shape of sub-microscopic crystals. The ordinary X-ray diffraction rings are due, of course, to the lattice arrangement of atoms within the crystals.

Male hormone extracts, obtained from testes and from urine, while possessing the same power of stimulating growth of combs on capons, are found by Messrs. E. Dingemanse, J. Freud and E. Lacqueur to differ in their effect upon the growth of seminal vesicles in castrated male rats. This shows that the urinary and testicular extracts used are not identical.

Prof. A. I. Virtanen and Mr. S. v. Hausen point out that the nitrogen compounds (amino-acids) found in soil where leguminous plants are grown are excreted by the bacteria nodules of their roots and are not attributable to mechanical wounding of the roots, because it can be shown that excretion takes place also on an agar culture, provided access of air to nodules is facilitated. The authors have further discovered that pea and clover nodules containing bacteria can produce butyric fermentation of glucose, and they suggest that the bacteria are supplied by the plant with a suitable sugar, which provides energy for the nitrogen fixation. More knowledge of this mechanism may lead to the discovery of the conditions necessary in order that the bacteria may fix the nitrogen of the air *in vitro*.

Dr. G. Kornfeld and M. McCaig find that small amounts of sulphur monoxide present in sulphur dioxide after an electrodeless discharge, can be detected by means of the emission spectrum, but not by means of the absorption spectrum, because the dioxide itself has strong absorption bands similar to those of the monoxide.

Dr. C. P. Snow and Mr. E. Eastwood point out, as possible sources of error in determining the absorption spectrum of vapours, the possible presence of small amounts of impurities and the effect of interference bands due to the quartz plates of the apparatus.

Thin films of liquid such as may exist in finely porous materials have properties different from those of liquids in bulk. Messrs. B. H. Wilsdon, D. G. R. Bonnell and M. E. Nottage mention their lower vapour pressure, with which is related the greater hydrostatic suction needed to remove water from certain building materials. Their osmotic pressure and electrical properties are also abnormal. The authors point out that the behaviour of thin films may be connected with the fact that their molecules form more or less orientated chains.

Mr. D. H. Follett directs attention to the fact that at present, when a photo-cell is used to amplify galvanometer deflections, the amplified deflections are not proportional to the original. He describes an improved instrument avoiding this difficulty.

Neutrons and ultra-violet radiation have been suggested as possible agents responsible for the ionisation present in the electrically-conducting layers of the upper atmosphere which reflect radio waves. Eclipse observations have ruled out the neutrons as active agents, while the ultra-violet radiation, from calculations by Dr. E. A. W. Müller, cannot penetrate in sufficient amounts as far as the E-layer (100 km. high). To account for that effect Müller assumes that the sun emits, in addition, a more penetrating radiation of the X-ray type.

The search for oil has supplied valuable information to geological science in the past. Lieut.-Col. L. M. Davies announces that an examination of the fossils from the early tertiary (Eocene) beds of the Punjab Salt Range in the sub-Himalayan zone shows that these strata belong to two distinct formations (Ranikot and Upper Laki).

Research Items

Discoveries at Troy. The long-awaited discovery of a cemetery at Troy is announced by Dr. Carl Blegen, of the University of Cincinnati, in a communication issued by Science Service, Washington, D.C. This find was made by the third expedition of the University to Hissarlik. A second discovery of importance was on a site about three and a half miles from the actual citadel, at a marginal point of the area. Here Dr. Blegen found four graves, apparently of neolithic age, containing skeletons which in his opinion belong to a period antecedent to any settlement hitherto found on the site and representing the earliest inhabitants. At the same point, but at a higher level, were later remains, dating from the time of the fourth and fifth layers of the citadel. The cemetery belonging to Troy itself was found just outside the citadel. It is contemporary with the sixth city and consists of a series of urn burials containing ashes, remnants of burnt bones and traces of ornaments which had not been entirely consumed by the funerary pyres. The practice of cremation burial, naturally and unfortunately, has destroyed all evidence of the physical characters of the inhabitants of the city. A further discovery among the ruined houses was that of a well-preserved buried floor, which affords the first opportunity here for the investigation of a habitation site. The stone bases of columns which supported the upper story are still in place; but determining the alignment of the columns and the recovery of any household goods which the floor may have preserved will be the work of the expedition's next season.

Glazed Stones in Antiquity. The first of a series of notes on glazed stones, dealing with glazed steatite, is contributed by Mr. Horace C. Beck to *Ancient Egypt and the East* (pt. 2; 1934). The surface of steatite is found to have been altered by chemical processes due to at least three different methods of treatment. The first was to apply a vitreous glaze to the surface and then fire it. This is true glazed steatite; and even when the whole layer of glaze is flaked away, a very hard surface is left on the steatite. A second method was to apply an alkali and fire it, or to apply a glaze of such a nature that when it is flaked away, it leaves a very soft surface on the steatite. The third, perhaps a modification of the second, was to whiten the surface, probably with an alkali only and, after heating, to paint on a pattern. The effects of the various processes on the stone are different. All the Egyptian specimens of glazed steatite belong to the first class, and it is almost entirely an Egyptian product. It has been found extending in time from the Badarian period, being earlier than glazed faience, which does not appear until pre-dynastic times, down to the twenty-seventh dynasty. The process was used extensively for beads, amulets and scarabs; but after the twelfth dynasty the beads are rare. There are a few very fine specimens of glazed steatite of considerable size, belonging for the most part to the period from the twelfth to the eighteenth dynasty. The beads with the best glaze are the Badarian. The seals from Mohenjo-daro and Harappa, some early seals of a similar nature from Kish and Ur and the great majority of the beads from Harappa belong to the second type, while the third type comprises only a comparatively small number of important beads from Harappa. An examination of six seals and several hundred beads from Mohenjo-daro and Harappa indicates that a different method was employed there from that used in Egypt, and it seems probable that more than one method was practised in the Indus valley.

Phenological Observations in Great Britain. The "Phenological Report, 1933" (*Quart. J. Met. Soc.*, **60**, No. 255, 1934) deals as usual with facts relating to birds, insects and plants, such as the earliest date of arrival of a migrating species of bird, the earliest date of appearance of a particular insect or plant, supplied by voluntary observers distributed at more than five hundred places throughout the British Isles. The events recorded number more than sixteen thousand. This unwieldy mass of statistics is condensed and to some extent summarised with the aid of various tables and maps, and comparison between these and similar tables and maps in the reports for previous years will enable anyone interested in the natural history of the countryside to study the peculiarities of its seasonal course in this particular year. There is a sufficiently full meteorological summary to allow the influence of the weather in these matters to be gauged, and the year was remarkable enough for its deficient rainfall, its warmth and abundant sunshine to make it a good one for the pursuit of such studies. These reports must be of the greatest possible value for many branches of study, such, for example, as that of bird migration. Average arrival dates for twenty species of bird for this year and for the seventeen years 1914–30 are shown side by side by means of lines of equal arrival date (isophenes). The extraordinary warmth of March and April 1933 in those regions from the south-west of Ireland across to Sussex and Kent where this date falls on average rather late in April, did not produce any notable departure from the normal, and in general normality appears to have been the rule. Autumn migrations, both incoming and outgoing, appear to have been decidedly early; no reason for this is suggested in the report. It is interesting to learn that a phenological record has been maintained by one family at Hevingham (Norfolk) since 1736, with only one long break (1811–35). This establishes the average dates of arrival of the swallow, cuckoo and nightingale there as April 19, 25 and 26 respectively.

Echiuridæ, Sipunculidæ and Priapulidæ of Scottish and Adjacent Waters. Dr. A. C. Stephen has investigated the distribution of the species of these groups in the Scottish area by examining collections made by the Fishery Board for Scotland in the North Sea and adjacent waters. The greater part of the material was taken with the small Petersen bottom sampler, and has come from all over the North Sea, from coastal waters to the edge of the continental shelf (*Proc. Roy. Phys. Soc.*, **22**, Part 4; 1934). *Priapulus*, *Sipunculus*, *Phascolosoma* and *Echiurus* are of economic importance for they serve as food for several food fishes such as plaice, lemon sole, common dab, witch, gurnard, whiting and haddock. Of these, *Priapulus caudatus* is by far the most frequently consumed, especially by haddocks caught in the

Firth of Forth and St. Andrews Bay; also in fish from the east coast of Scotland, Moray Firth and from over the North Sea. As many as ten specimens have been taken from a single plaice in the Cumbrae district, where it is generally distributed on muddy ground. In the North Sea more than 1,200 stations have been examined with the Petersen grab, and many hauls with other apparatus have been made. *Phascolion strombi* is the only species captured with regularity: the other species have been found at few stations and in small numbers, the reason apparently being, not that they are scarce, but that they burrow beyond the reach of the collecting gear. Little is known about the breeding periods or larval histories of these animals, but a few notes on the subject are given.

Earthworm Migrations. In his fourth paper on the earthworms of Burma, G. E. Gates (*Records Indian Mus.*, **35**, Pt. 4, Dec. 1933) emphasises the need for the study of the extent of variation of the characters by means of which species are diagnosed and defined. He states that the lack of this information has resulted in the erection of unnecessary varieties and species, and that it is often difficult, if not impossible, to determine whether a particular individual or series of *Drawida* and *Eutyphœus* belongs to an old or a new species, and therefore it is imperative that the types of all old species be re-examined. In an interesting reference to migrations of earthworms, the author records an observation that "in the early morning on certain days in October and November at the beginning of the cold season the road is almost covered with worms; one can see worms tumbling down from the banks above on to the road. In the evenings not a worm is to be found. I have always assumed that the worms were moving down-hill perhaps in search of water". The author states that others who have been in the Chin Hills District during the same months reported that all the migrating worms were of the same kind and were all going down-hill. The specimens collected were all *Perionyx* (possibly *P. excavatus*) without clitellum.

Protozoan Parasites of Fishes. R. R. Kudo (*Illinois Biol. Mon.*, **13**, No. 1, 1934) reports on a preliminary survey of the protozoan parasites of the fishes of Illinois. About 1,300 fishes belonging to 35 species and 13 families were examined, mainly for Protozoa attacking the tissues. The specimens of *Polyodon spathula*, *Lepisosteus osseus*, *Amia calva* and twenty-two other species were not infected but nine others belonging to the families Catostomidae, Cyprinidae and Siluridae were found to be common hosts of histozoic Protozoa, especially Myxosporidia, of which nineteen new species are described. In reservoirs near Peoria were observed large numbers of carp (*Cyprinus carpio*) suffering from an extremely heavy infection by a parasitic ciliate, *Ichthyophthirius multifiliis*. On the integument, gills and mucous membrane of the mouth cavity this ciliate was so numerous that the entire fish appeared whitish. In addition another ciliate, *Cyclochœta*, and a flagellate, *Costia*, were found abundantly in the lesions produced by the *Ichthyophthirius*, and the fishes appeared to be much weakened. *Ichthyophthirius* is world-wide in distribution and is often present in large numbers in fish kept in small aquaria, but it is unusual for such an epidemic to occur among fully grown fishes kept in large outdoor ponds.

A New Permian Fish. Mr. James Brough describes *Lekanichthys housei*, n.sp., a new dorypterid fish from the Permian (*Ann. and Mag. Nat. Hist.*, 10, **14**, No. 81, Sept. 1934). The family Dorypteridæ has up to the present only contained *Dorypterus*. The new form displays many of the peculiarities of that genus, but shows clearly an intermediate grade of structure between the highly modified *Dorypterus* and the normal Palæoniscid. The type specimen, which is unique, was collected apparently many years ago, and has since lain in the Hancock Museum, Newcastle-upon-Tyne. It was unlabelled, but Mr. Brough has little doubt as to the horizon from which it was obtained, as both fossil and matrix possess all the characters of the Marl Slate (Lower Permian), particularly as it occurs in the south of Durham County, and the specimen was probably obtained from this stratum in the Middridge-Thichley Area. The fish is well preserved. Its general shape is similar to that of *Dorypterus*, showing specialisations of a like nature, but not developed to the same extent. In the characters in which it differs, it displays Palæoniscid affinities, and has therefore all the necessary qualities of a form ancestral to *Dorypterus* and intermediate in structure between it and the Palæoniscidæ; but, as the author states, this relationship is impossible since the remains are found in the same thin stratum, indicating that they lived side by side. He concludes that "*Lekanichthys* was a collateral ancestor—a form in the same group which either had evolved more slowly, or had reached a certain stage of specialisation and then halted, so that, although it is not a true ancestor, it reproduces the essential form of the ancestor at a certain stage".

Seasonal Variations of Carbohydrates in Fruit Trees. The second of a series of papers on "The Seasonal Cycles of Nitrogenous and Carbohydrate Materials in Fruit Trees" by members of the staff of Long Ashton Research Station (*J. Pomol. and Hort. Sci.*, **12**, No. 4, pp. 249–292, December, 1934) deals with the seasonal cycles of alcohol-soluble materials, of carbohydrate fractions and lignin in the wood, bark and leaves of terminal shoots of apple trees. Two cultural systems are involved, namely, trees grown on grassland, with annual dressings of nitrate in spring, and trees grown on arable land, without nitrogenous fertiliser. It is the work of Dr. Elsie S. Smyth. Well-defined seasonal variations in the amounts of all the carbohydrate fractions were found, and changes in the wood and bark were similar. Difference in cultural treatment did not greatly affect the seasonal changes, though reducing sugars were rather more abundant in material from the arable plot in summer, than in trees grown on grass. There were also differences in starch content. Carbohydrate-nitrogen ratios were, however, higher in the trees grown on grassland, than in the arable crop. Variations in the contents of alcohol-soluble matter, in reducing sugars, sucrose, starch, hemicellulose, total carbohydrates, cellulose and crude lignin, are all set out in detail.

A 'Traversing' Microscope. An example of a travelling or traversing microscope has been submitted to us for examination by Prof. E. W. Scripture, by whom it was designed for the examination and measurement of ordinates of curves having a considerable area, such as are obtained by tracings produced by changes of air pressure at the mouth during speech. It consists of a large rectangular base-plate of thick plate glass in metal frame supported on feet, which

can be inclined if necessary so as to tilt it. The microscope barrel is held by a carrier which can be moved by means of racks and pinion-screws, so that it traverses 145 mm. back to front along a transverse bar, and 545 mm. longitudinally along a longitudinal bar. The bars are graduated, and by means of verniers, readings to 0·01 mm. can be taken. The verniers are provided with lenses for reading, and are illuminated by small electric bulbs worked off a dry cell, and opaque objects may be illuminated by a bulb attached to the microscope tube near the objective. For transparent objects, a sheet of white paper placed on the table beneath the base-plate usually suffices. The objects to be viewed can be clamped to the base-plate by longitudinal or transverse adjustable bars, or kept in place by a piece of glass laid upon them. While there is, perhaps, nothing very novel in design and construction, the instrument is noteworthy for the large area it can cover, and in addition to tracings is obviously adapted for the examination of large sections, membranes, fabrics, etc. The instrument is well constructed in white metal, and was made by Messrs. F. Homan, 13 Florence Road, S.E.14.

Organic Sulphur Compounds. A paper by Messrs. F. Challenger and J. B. Harrison on sulphur compounds of technical interest, in particular the isomeric thiophthens, was read before a meeting of the Institution of Petroleum Technologists on January 8. Recently the occurrence of naphthalene, thiophen and thionaphthen in coal tar and Kimmeridge shale has led to the belief that thiophthen might also be an ingredient of similar substances, and the work undertaken on thiophthen and its derivatives and described in this paper was felt to be a necessary preliminary to proving or discounting that theory. Published technical data on these compounds are scanty. Various methods of preparation of thiophthen are reviewed and a precise account of that of Capelle, which was employed in this case, is given. In addition, notes are made on phenomena observed during reduction of solid thiophthen with sodium and alcohol and on the structure of the thiophthens as revealed by X-ray analysis. Part of the paper is devoted to reports of various experiments undertaken and apparatus and methods employed. These include purification of liquid thiophthen with mercuric chloride, preparation of liquid thiophthen with citric acid and phosphorus bisulphide, isolation of a by-product in the preparation of liquid thiophthen, oxidation and nitration of thiophthens, etc. Accounts are also given of the preparation of certain derivatives of isomeric thiophthens.

Cold Test for Fuels. Messrs. B. H. Moerbeek and A. C. Van Beest presented a paper on "Cold Test for Fuels" for discussion at a meeting of the Institution of Petroleum Technologists on January 8. Present methods of pour-point determinations of fuels were criticised and in particular the A.S.T.M. test was condemned on the grounds that results are dependent on the temperature at which the sample is pre-heated and on the thermal history of the batch of which it is part. Furthermore, maximum and minimum pour-point figures are returned which may lie far apart, and thus cause confusion in the mind of the consumer. The sensitiveness of residual fuels to their thermal history is attributed to the asphaltenes present, which are natural pour-point reducers, and experiments prove that their removal renders the fuel temperature-insensible. A new method of pour-point determination is therefore proposed which, it is hoped, will give more practical results. To this end the influence normally exerted by asphaltenes is eliminated by pre-heating followed by pre-cooling to such a temperature that the asphaltenes do not dissolve again. Results are returned in such a way as to indicate a temperature at which fuel can be shifted under a fixed pressure. The data collected as a result of these investigations are as yet insufficient to indicate whether the new method would be entirely satisfactory in practice; but there is enough information to arouse criticism and discussion of the principles involved.

Colour Indices of Stars in Open Clusters. A number of plates of open star clusters were taken by Prof. K. Lundmark at the Mount Wilson Observatory in 1922–23, using the 60-in. reflector with a wire grating placed in front of the mirror. These plates are now being measured by J. M. Ramberg, of the Lund Observatory, and a preliminary account of his results has just been published (*Lunds Medd.*, Ser. 2, No. 70). A brief account of the theory of obtaining effective wave-lengths from coarse-wire grating spectra is given, together with a description of the methods used in measuring the plates and correcting the results for various sources of error. The main object, however, was to standardise the measures for future work by comparing the resulting colour equivalents with the previously determined colour indices. For this purpose, five plates of Messier 37 were measured and the results correlated with colour indices by von Zeipel and Lindgren for stars in this cluster. The mean error of an effective wave-length was found to be $\pm$ 9·84 A., or $\pm$ 0·055 expressed in magnitudes. The final results are included in a catalogue giving the measured effective wave-lengths and calculated colour indices of 659 stars in Messier 37.

Nova Herculis. The *Observatory* of January publishes a summary of all further observations on this nova, which was discovered by Mr. J. P. M. Prentice, of Stowmarket, on December 13, 1934. The editors of the *Astronomische Nachrichten* have also published supplements and numbers containing short accounts of observations, sent in by numerous Continental observers. The nova when discovered had a visual magnitude of $2{\cdot}9^{m}$; after an initial decline, the magnitude rose to $1{\cdot}3^{m}$ on December 23. The brightness then declined sharply to $3{\cdot}4^{m}$ on December 26; it then increased very rapidly to $2{\cdot}6^{m}$ one day later. Since then there have been more fluctuations. The nova has exhibited characteristic spectra, namely, emission lines and bands due to hydrogen, helium and ionised metals, especially when decreasing in brightness. On December 20, when approaching maximum, the nova showed a spectrum which corresponded line for line with α Cygni (type *cA2p*). On December 23, the only marked emission line was $H\alpha$. On the other hand, on December 30, when the brightness had declined, the continuous spectrum had nearly vanished, leaving a strong emission band spectrum. The nova has been identified with a star of magnitude $15{\cdot}4^{m}$ on the Franklin Adams plates. There is some evidence to show that the star was a variable before the present outburst. An estimate of the star's distance, based on the intensity of the interstellar Ca+ lines, makes the distance 200 light years (a previous estimate was 2,000 light years).

Prize Awards for 1934 of the Paris Academy of Sciences

AT the annual public meeting of the Academy of Sciences the prize awards for 1934 were announced as follows :

Mathematics.—The Poncelet Prize to Maurice Fréchet for the whole of his mathematical work : the Francœur Prize to Jean Favard, for his work in mathematical analysis.

Mechanics.—The Montyon Prize to René Swyngedauw, for his studies on belts and ball bearings ; the Fourneyron Prize to Robert Mazet, for his work on friction ; the Henri de Parville Prize to Jean Leray, for his work on the mechanics of fluids.

Astronomy.—The Lalande Prize to Daniel Barbier, for his work on double stars ; the Valz Prize to Ferdinand Quenisset, for his observations on comets ; the Janssen Medal to Walter Sydney Adams, for his researches on stellar parallaxes.

Geography.—The Delalande-Guérineau Prize to Jules Sion, for his work entitled "La France méditerranéenne" ; the Gay Prize to Maurice Pardé, for his work entitled "Fleuves et rivières" ; the Tchihatchef Foundation to Jean Gubler, for the publication of his work on the palæontology of Cambodia : the Binoux Prize in equal parts between Jules Schokalsky, for his memoir on the measurement of the lengths of rivers in Asiatic Russia, and Pierre Tardi, for his treatise on geodesy.

Navigation.—The Navy Prize to Jean Ottenheimer, for his work on ballistics and on submarine explosions ; the Plumey Prize between René Anxionnaz (1,500 francs), for his work on internal combustion motors, André Chapelon (1,500 francs), for his work on the improvement of steam locomotives, and René Retel (1,000 francs), for his work on injection in Diesel motors.

Physics.—The L. La Caze Prize to Eugène Bloch, for the whole of his work in physics ; the Kastner-Boursault Prize to Théodore Lehmann, for his work in electrotechnics and especially for his studies on tracing magnetic lines of force ; the Hébert Prize to François Bedeau, for his "Traité de télégraphie sans fil" and for his researches on the methods of measurement with high frequency ; the Hughes Prize to René Lucas, for his work in electro-optics ; the Clément Félix Foundation to Marcel Laporte, for the continuation of his researches on the properties of the ions and on the electrical luminescence of gases.

Chemistry.—The Montyon Prize (Unhealthy Trades) to Paul Bruère, for his researches on individual or collective protection against poisonous gases or vapours ; the Jecker Prize to Henri Herissey for the whole of his chemical work ; the L. La Caze Prize to Augustin Damiens, for the whole of his work ; the Cahours Foundation to Louis Domange, for the continuation of his researches ; the Paul Marguerite de la Charlonie Prize to Maurice Nicloux, for his work in chemical analysis ; the Houzeau Prize to Georges Chaudron, for his studies on the reduction of the iron oxides and on their magnetic properties.

Mineralogy and Geology.—The James Hall Prize to Edouard Roch, for his work on the geology of Morocco.

Physics of the Globe.—The Victor Raulin Prize to Charles Poisson, for his work and publications on terrestrial magnetism and meteorology.

Botany.—The Desmazières Prize to René Dujarric de la Rivière, for his work entitled "Le poison des Amanites mortelles" ; the Montagne Prize to Jules Lebasque for his work "Les champignons des teignes du cheval et des bovides" ; the de la Fons Mélicocq Prize to (the late) Pierre Jouane and Pierre Chouard, for their memoir "Essai de Géographie botanique sur les forêts de l'Aisne" ; the de Coincy Prize to Maurice Lenoir, for his work on chromatines.

Anatomy and Zoology.—The Cuvier Prize to Jacques Pellegrin, for his ichthyological work ; the Savigny Prize to Jacques Colas-Belcour, for his researches on the arthropods of North Africa ; the Jean Thore Prize to Paul Vayssière, for his work on Coccideæ and the migratory Acridians.

Medicine and Surgery.—Montyon Prizes : Paul Armand-Delille, Charles Lestocquoy and René Huguenin (2,500 francs), for their work "La tuberculose pulmonaire et les maladies de l'appareil respiratoire de l'enfant et de l'adolescent" ; Corneille Heymans, Jean Jacques Bouckaert and Paul Regniers (2,500 francs), for their work on the carotid sinus ; Henri Lagrange (2,500 francs), for his book on ophthalmic studies. Honourable mentions (1,500 francs) to Félix Pierre Merklen, André R. Prévot and Jean Quénu. Citations to Hubert Jausion and François Pages, Carlos Lepoutre, Jean Quérangal des Essarts and Mme. Alix de Carbonnières de Saint Brice. The Barbier Prize to Georges J. Stefanopoulo, for his contribution to the study of yellow fever ; the Bréant Prize between Constant Mathis (3,500 francs), for his memoir on recurrent spirochætosis, and Jacques Bailly (1,500 francs), for his work on hydrophobia ; the Godard Prize to Mlle. Gilberte Pallot, for her study of microcysctic ovaries ; the Mège Prize to Pierre Lassablière, for his work entitled "Aliments, Régimes, Indications, Contre-indications" ; the Bellion Prize to Jean Troisier and Yves Boquien, for their book on spirochætosis ; the Jean Dagnan-Bouveret Prize to Auguste C. Marie and Paul Remlinger, for the whole of their work on hydrophobia.

Physiology.—Montyon Prize to Remy Collin, for his book on the hypophysis ; the L. La Caze Prize to Paul Portier, for the whole of his physiological work ; the Pourat Prize to Z. M. Bacq and Lucien Brouha, for their work on hormones ; the Martin-Damourette Prize to Edmond Benhamou, for his work on the spleen ; the Philipeaux Prize to Georges Teissier, for his morphological and physiological researches on the growth of insects.

Statistics.—The Montyon Prize to Pierre Jéramec (1,000 francs), for his work on statistics, and Louis Potin (1,000 francs), for his work in connexion with insurance risks.

History and Philosophy of Science.—The Binoux Prize between Paul Baud, for his book on chemical history in France, and Raoul Combes, for his history of plant biology in France.

Works of Science.—The Henri de Parville Prize to Jean Rostand (2,500 francs), for his books popularising general biology, and Pierre Sergescu (2,500 francs), for his book on the mathematical sciences.

Medals.—The Berthelot medal is awarded to Paul Bruère, Maurice Nicloux and Georges Chaudron.

Prizes Founded by the State.—The Grand Prize of the Mathematical Sciences to Emile Cotton, for the whole of his scientific work ; the Bordin Prize to Pierre Frémy, for his work on the Myxophyceæ ;

the Lallemand Prize to André Rochon-Duvigneaud, for his book on the eye and vision in the vertebrates: the Vaillant Prize to Henri Colin, for the whole of his work in plant physiology; the Hollevigue Prize to Léon Brillouin, for his researches and works on modern statistical mechanics; the Jean Jacques Berger Prize to Roger Boutteville, for his work in public lighting and hygiene; the Saintour Prize to Louis Dubertret, for his geological work and especially for his geological map of Syria; the Jules Mahyer Prize to Pierre Humbert, for the whole of his work in mathematical analysis; the Lonchamt Prize to Mme. Marguerite Lwoff, for her memoirs on nutrition of the Trypanosomides, and André Lwoff, for his memoir on the significance of hæmoglobin for the flagellated parasites: the Wilde Prize to André Duparque, for the whole of his work on the structure and petrographical characters of coal; the Caméré Prize to Jean Aubert, for his work concerning a new system of mobile barrage; the Thorlet Prize to Paul Dorveaux; the Albert I. of Monaco Prize to Jean Tilho, for his researches on the hydrography of the Lake Tchad region; the Marquet Prize to Frédéric Joliot and Mme. Irène Joliot, for their discovery of temporary radioactivity.

Special Foundations.—The Lannelongue Foundation to Mme. Gabriel Cusco; the Hélène Helbronner-Fould Prize to Mme. Pierre Savorgnan de Brazza.

Grand Ecoles Prizes.—The Laplace Prize to Jean Couture; the L. E. Rivot Prize between Jean Couture, Louis Eyssautier, Michel Legrand and Yves Monneret.

Grants for Scientific Researches.—The Gegner Foundation to Camille Vallaux, for his oceanographic work; the Jérôme Ponti Foundation to Jean Thibaud, for his method of concentrating electrons in the magnetic field; the Hirn Foundation to Gonzague Dubar, for his work on the stratigraphy and palæontology of the Lias, especially in the Pyrenees and Morocco; the Becquerel Foundation to Yves Rocard, for his work on the kinetic theory of gases and on optics.

The Loutreuil Foundation.—Out of thirty-five applications, the consulting committee has chosen the following:

Researches on definite problems.—Pierre Viala (6,000 francs), for his work on the parasite of the *Court-Noué* of the vine; André Aron (2,000 francs), for his researches on the magnetic properties of thin sheets of nickel; James Basset (5,000 francs), for experimental researches on ultra-pressures; Paul Henri Fleuret (2,000 francs), for the study of ketogenesis and oxaluria. Edmond Guillermet (3,000 francs), for his studies on electrolysis in solvents other than water; Mme. Louis Nouvel (4,000 francs), for work in a maritime laboratory; Marcel Petit (4,000 francs), for his researches on the molars of Equideæ; Maurice Pierre (3,000 francs), for his researches on the rôle of the different physical and mechanical factors governing swallowing, vomiting and ruminating; Henri Simonnet (9,000 francs), for his researches in plant toxicology; André Wahl (3,000 francs), for the continuation of his work relating to tinctorial chemistry.

Researches to be carried out in France overseas and countries under French mandate.—Roger Heim (12,000 francs), as a contribution to the expenses of a voyage to Madagascar for the study of the cryptogamic flora and various diseases of trees and cultivated plants; Antoine Poidebard (7,000 francs), for his geographical studies by photography from the air in the Syrian desert.

Purchase of Laboratory Material.—René Dubrisay (10,000 francs), for the purchase of a Jobin and Yvon spectrograph.

Publications.—*Annales des sciences naturelles* (5,000 francs), for the publication of special volumes commemorating the centenary of this publication; Camille Arambourg (6,000 francs), for the publication of the scientific results of his Omo expedition; Comité de physique du globe des colonies (10,000 francs), for assisting the publication of its *Annales*; Fédération Française des Sociétés de sciences naturelles (5,000 francs), for the publication in the "Faune de France" of the memoirs of Seguy on the Acalypters and of Brolemann on the Diplopods.

Grants to Libraries.—Académie d'agriculture de France (5,000 francs), for assistance with its catalogue; Bibliothèque nationale et universitaire de Strasbourg (5,000 francs), for printing a catalogue of its periodicals; Ecole nationale vétèrinaire de Lyon (5,000 francs); Ecole nationale vétèrinaire de Toulouse (4,000 francs); Ecole Polytechnique (5,000 francs); Institut national agronomique (5,000 francs).

The Mme. Victor Noury Foundation to Raymond Poisson (3,000 francs), for his studies in protistology; Paul E. Thomas and Paul de Graève (3,000 francs), for their work in biological chemistry; Mme. Edouard Salles (3,000 francs), for her studies on terrestrial magnetism; Edouard Lamy (2,500 francs), for the whole of his malacological work; Michel Volkonsky (2,500 francs), for his work in cytophysiology and plant physiology. The Le Chatelier Foundation to René Paris, for carrying out researches on the devitrification of glass. The Frément Foundation (2,500 francs) to Pierre Vernotte, for studies on the propagation of heat either by conduction or convection. The Roy-Vaucouloux Foundation to the Institut Marey.

Attacks of Birds upon Butterflies

CRITICS of the current theory of mimicry, but only so far as butterflies are concerned, claim that published records are insufficient to establish birds as the agents which may be considered mainly responsible for the production of mimetic resemblance in butterflies by preferential feeding. The following observation, communicated to me by Mr. T. H. E. Jackson, of Kitale, Kenya Colony, is therefore of great interest to all students of natural selection. Early in the present year, at Bulumbe camp in Busia, in the eastern province of Uganda, he noted on the first night "a few wings of butterflies lying about but it was not until next morning that the truth dawned on me. I then found that the ground was literally strewn with wings. There were four or five large *Spathodea nilotica* trees in the compound and swarms of butterflies were feeding on the flowers. Watching them that morning for birds I saw one swoop down on a *Papilio bromius* and take it off to a bare branch where it proceeded to beat off the wings, devouring the body only, and then returned to the tree for more. I made a list on paper of the butterflies present and only afterwards thought of

collecting the wings themselves as evidence: one *Acraea* we could not find again".

The following table gives Mr. Jackson's notes, together with the results of examining the wings sent by him. The number of *specimens* was reckoned by counting the maximum number of fore wings, right or left, whichever was the greatest.

Species present	Prevalence	Wings found	Estimated (minimum) number of specimens eaten (by wings sent)
Papilionidae.			
Papilio dardanus.	Very common.	Plentiful.	Males, 5.
Female form *hippocoonides.*	About equal numbers seen or taken.	A few.	Female form *hippocoonides*, 2.
" " *planemoides.*		None.	
Papilio bromius.	Very common.	Plentiful.	Males, 14. Females, 9. (An uneaten specimen with wings much torn also found.)
Papilio nireus.	A few.	A few.	Male, 1. Female, 1.
Papilio phorcas.	A few.	A few.	Males, 2. Female, 1. Female form *thersander*, 1.
Pieridae.			
Mylothris poppaea.	Common.	None.	
Eronia thalassina.	Common.	Of two specimens.	Males, 2.
Eronia argia.	A few.	Of one specimen.	Male, 1.
Nymphalinae.			
Charaxes brutus.	A few *Charaxes* flying round trees and wings recovered of those mentioned, one or two of each.		Male, 1.
Charaxes castor.			Males, 2.
Charaxes etesipe.			Females, 2.
Charaxes tiridates or *numenes.*			Female, 1.
Charaxes etheocles.			Female, 1.
Cyrestis camillus.	Common, but lower down on under-sides of leaves.	One or two.	One.
Precis westermanni.	Common.	A few.	Male, 1.
Acraeinae.			
Acraea pharsalus, *Acraea viviana.* *Acraea egina.* *Acraea encedon.*	Very common.	Wings of three only discovered after very careful search.	One male, whole except for head, and one right hind wing, of *A. egina.*

The following points deserve comment:

(1) Several wings show such clear beak-marks that it was possible, through the kindness of Mr. N. B. Kinnear of the British Museum, to compare them with imprints of the beaks of birds made by pinching soft paper between the mandibles, as was first suggested by Mr. C. L. Collenette. The description of the birds given by Mr. Jackson, whose ornithological knowledge unfortunately was not equal to his entomological, suggested a species of drongo. "The birds were black and smallish without markings that one could distinguish: there were eight or nine of them." But impressions from drongos, or black flycatchers, were shorter and broader than the marks on the wings, and the nearest approach came from a species of *Lamprocolius* (glossy starling): the numbers also favour that rather than a species of drongo.

(2) Mr. Jackson noted that "the butterflies present were first Papilios and Acraeas in about equal quantities". The Papilios comprised several black and green species, and *dardanus* with cream coloured male and two forms of mimetic female. The black and white *hippocoonides* resembles a species of *Amauris* (Danainae), the other, *planemoides*, has a conspicuous orange band producing a likeness to a *Planema* (*Acraeinae*). The males and black and white female were eaten, the other female was not. "Both forms appeared to be equally common; we took four of the former and three of the latter, and saw one more of the latter. No models for either form were observed." The latter remark, of course, simply implies that the models were not feeding on the trees: *Amauris* is exceedingly common.

(3) Evidence that Acraeas are relatively distasteful is supplied by the small numbers of wings of these very common insects found on the ground. One specimen "which is perfect except for the head was actually dropped at my feet under the tree while I was collecting the wings". It must be said, however, that the specimens sent comprised a *Papilio bromius*, the body of which was undamaged although the wings were torn. *Acraea egina* is extremely abundant, black and scarlet; the less common *pharsalus* is of the same colour; *encedon* and *viviana* are yellowish or brownish; they have all the characters demanded of species relying upon brilliant colours to advertise distasteful qualities. It is highly suggestive that the female *dardanus* which has an acraeine appearance was untouched.

(4) The large-bodied *Charaxes* (allied to our 'Purple Emperor' in habits) were evidently in demand, for wings of all the species seen were picked up. This confirms the evidence of Mr. C. F. M. Swynnerton[1].

(5) Some of the 'Whites' (Pieridae) were common, but apparently not greatly in favour. The two *Eronia* are white or greenish white; the *Mylothris* has a brilliant orange patch at the bases of the wings which is generally held to be an example of 'warning colour'; like *Acraea*, *Mylothris* is typically aposematic in habit, is mimicked by other butterflies, and is known by experimental evidence to be relatively distasteful. It will be noted that *M. poppaea*, 'common', was not attacked, while *Eronia* was.

(6) This most interesting and valuable observation does not support the statement so strongly emphasised by Mr. W. L. McAtee[2] that "predation takes place much the same as if there were no such thing as protective adaptations" and that "there is utilization of animals of practically every kind for food approximately in proportion to their numbers".

(7) Regarding published records, the difficulty has been in the past that many experienced naturalists have not thought it worth while to record the details of what they consider to be a "commonplace occurrence"[3]. The Hope Department, Oxford University Museum, has put together a body of evidence in the form of beak-marks upon the wings, which are constantly being discovered now that their appearance is recognised. During recent years, descriptions of many such have been published in the *Proceedings of the Royal Entomological Society of London*.

(8) It has been said that migrations of butterflies should afford evidence, if butterflies are devoured by birds to an appreciable extent. Observations on this have been published, but attention may be directed here to notes in a recent book of travel[4].

G. D. HALE CARPENTER.

[1] Swynnerton, C. F. M., Third Internat. Ent. Congr., Zurich, 1925, Bd. 2, Weimar 1926, 494–500.
[2] McAtee, W. L., *Smithsonian Misc. Coll.*, **85**, No. 7, 144, March 15, 1932.
[3] *Proc. Ent. Soc. Lond.*, **6**, 34; 1931.
[4] Puxley, W. L., "Wanderings in the Queensland Bush", p. 59. (London: G. Allen and Unwin Ltd.)

Rediffusion and Teleprogramme Systems in Broadcasting

'REDIFFUSION' is a method of distributing a broadcast programme over an independent line network to a number of subscribers. 'Teleprogramme' is the method which enables a telephone subscriber, by means of a small amount of additional apparatus, to receive the ordinary radio broadcast programmes over his telephone network. The object of both systems is the same, namely, to reproduce the broadcast programme in the subscriber's home with the maximum fidelity ; but the means employed are quite different.

A good paper by Mr. A. R. A. Rendall and Mr. S. Van Vierlo discusses the two methods in *Electrical Communication* of October. Both methods are in use in various parts of the world. In rediffusion, the programme is usually received by radio ; but it is better, when possible, to get direct reception from a studio. An amplifier station delivers the oscillations at such a level that all the subscriber needs to do is to bridge his loud speaker across the terminals. The sounds are then heard at the proper loudness, no adjustment being necessary. The choice of programmes is restricted, as although alternative programmes are easily provided, they add appreciably to the cost of the service. Recently designed systems offer a choice of four programmes. Considering this is all that is generally heard free from interference at an ordinary receiving set, this is satisfactory.

The success of the system depends a great deal on the position chosen for the amplifier station and the cables used for connecting it with the consumers. It should be near the centre of gravity of the load, and shielded cables should be used. In these undertakings, the maintenance of a high and uniform standard in the quality of the reception is essential if they are to compete successfully with receiving sets, the prices of which are being continually reduced. A partial failure or even periods of poor quality would seriously affect their prospects of success.

In a teleprogramme system, the radio broadcast is received on the subscriber's premises over his ordinary telephone network. This additional use of his telephone is sometimes a boon when it is not much used during the day and rarely in the evening. It is obviously a serious inconvenience to have the programme interrupted by a telephone call. Hence for subscribers with a high calling rate, an additional telephone cable is necessary to convey the programmes, and this adds to the expense. In most cases the subscriber has a choice between several programmes. By controlling a step-by-step selector at the telephone exchange, he is able to get the programme he wants. In this system it is necessary to limit the service to the normal speech level, and so an amplifier as well as a loud speaker has to be employed. In the rediffusion system this is not necessary as the transmission level is much higher. As the mere act of taking his receiver off the switch hook disconnects his amplifier, the subscriber can always use his telephone by interrupting the programme.

When considering the apparatus necessary for the supply of a group of 500 subscribers, it is customary to assume that not more than 60 per cent of them will be connected to a particular programme at the same time. In this case the amplifiers are usually rated for a power varying from 2 to 40 watts.

University and Educational Intelligence

CAMBRIDGE.—Mr. W. V. D. Hodge, University lecturer in mathematics, has been elected into a fellowship and appointed lecturer and director of mathematical studies at Pembroke College. Mr. Hodge was educated at George Watson's College, Edinburgh, the University of Edinburgh and St. John's College, Cambridge. He obtained a first class in Part 2 of the Mathematical Tripos in 1925 and was awarded a Smith's Prize in 1927. He also studied at Princeton University while holding a Senior 1851 Exhibition in 1926–31. He was on the staff of the University of Bristol and held a fellowship at St. John's College from 1930 until 1933.

EDINBURGH.—The Cameron Prize for 1935 has been awarded to Prof. Julius Wagner-Jauregg, emeritus professor of psychiatry and neuropathology in the University of Vienna, in recognition of his discoveries regarding the malarial treatment of general paralysis.

LONDON.—The following titles have been conferred in respect of posts held at schools of the University : professor of chemistry, Dr. J. W. Cook, the Cancer Hospital (Free) ; reader in organic chemistry, Dr. G. A. R. Kon, Imperial College—Royal College of Science.

The William Julius Mickle fellowship for 1935 has been awarded to Dr. Solly Zuckerman.

The Carpenter Medal for 1934 has been awarded to Dr. R. J. Lythgoe.

MANCHESTER.—Dr. A. H. Gibson, Beyer professor of engineering, has been appointed a pro-vice-chancellor, for a period of two years as from January 23, 1935, on the resignation of Prof. Lapworth.

Dr. F. P. Burt, reader in stoichio-chemistry, has been elected dean of the Faculty of Science for two years from January 1935.

Dr. W. N. Bailey, senior lecturer in mathematics, has been appointed Richardson lecturer in pure mathematics.

The Research and Standardisation Committee of the Institution of Automobile Engineers has presented to the Engineering Department an experimental petrol engine, and Mr. Charles Day, of Messrs. Mirrlees, Bickerton and Day, Limited, has loaned a Ricardo Diesel engine complete with all testing equipment.

THE American adult educational enterprise known as "The University of the Air" is now entering upon its third year. Prof. John Dewey, addressing an audience of sixteen hundred on December 8 at New York City Hall on "Radio's Influence on the Mind", claimed for broadcasting that it is the most powerful instrument of social education the world has ever seen and one urgently needed to redress the balance between the modern means of exchange of physical things and those of knowledge and ideas. One of the most crucial problems of to-day is how to ensure the employment of this instrument for the social public interest, in preference to its use for propaganda designed to distort facts and mislead the public mind. The 1935 programme embraces talks on : education for a new social order, economic planning, psycho-analysis and studies in a museum.

THAT biology should be taught in all schools to all pupils is one of the conclusions of the argument developed by Dr. C. J. Bond, Fernshaw, Springfield, Road, Leicester, in an address delivered to Section L at the Aberdeen meeting of the British Association last year. The address is now obtainable in pamphlet form. Young people suffer to-day from no sound biological foundation having been laid during school life for, at any rate, three departments of life in civilised societies: (1) sex, marriage and parenthood, (2) citizenship, (3) vocation. For (1) the foundation should include instruction in the general principles of genetics, including human heredity, with examples drawn from plant and animal life, and wise advice and guidance should be made available during school life and to young persons of both sexes who wish to marry. As regards citizenship, our present system of national education is marred by a lack of continuity and completeness answerable for the existence of a false conception in many minds of the real nature of individual liberty and of conflict of individual, social and racial interests. Vocational guidance is obviously more important for the welfare of the young citizen and prevention of waste of human capacity than examination of scholastic acquirements. It can only be given by skilled experts able to assess natural aptitudes and equipped with technical knowledge of the conditions and requirements of the diverse occupations open to 'school leavers', and this combination of psychological and technical knowledge must be acquired during and after the period spent in teacher training colleges by teachers specially interested in industrial life and vocational guidance. The address touches also on the steadily increasing ratio of old to young in the population, on biology and culture, on education in the right use of leisure and the limits of what can be achieved by education.

Science News a Century Ago

The Linnean Society

On February 3, 1835, at a meeting of the Linnean Society at which A. B. Lambert was in the chair, B. H. Hodgson, Dr. Kidd of Oxford and R. Garner, whose paper "On the Nervous Structure of Molluscous Animals" had lately been read, were elected fellows of the Society. The secretary read a paper by Mr. Bentham of the Horticultural Society "On the Various Species of the Genus *Lotus*, and the Allied Genera". The chairman exhibited the flowers and leaves of *Dracœna terminalis*, a plant from the islands of the Pacific successfully cultivated at his own residence in Wiltshire. The flowers were used by the natives of the islands, he said, to flavour a liquid like beer, and the fibres of the long leaves served as threads. Profs. Bartoloni, Fries, Harlan, Harrold, Lichtenstein and Reinwardt, with Baron Delessert, were nominated to fill the vacancies in the list of foreign members.

Meteorology at the Cape of Good Hope

Writing from Edinburgh on February 5, 1835, to Sir John Herschel at the Cape, J. D. Forbes said: "I had a letter from Whewell the other day, communicating your obliging message to me about your very interesting meteorological results. . . . The annual variation of mean pressure and also of hourly oscillation you mention is noticed by Humbolt in equatorial climates. Is the barometer highest in summer or winter? I fear we are likely to find little analogous to your observations at the Cape in the Mediterranean. The oscillation is undoubtedly greater: and I do not think the barometer is highest in bad weather. The variable pressure in different latitudes is a very important and to me, till lately, an unexpected fact. I hope that you will be able to bring your barometer safely home again, and so determine the height of your observatory. I hope you have your actinometer with you; here it has a sinecure, there being no sun worth measuring."

Henry's Electrical Experiments

On February 7, 1835, Prof. A. D. Bache wrote to the Committee of Publications of the Franklin Institute saying that "The American Philosophical Society, at their last stated meeting, authorised the following abstract of a verbal communication made to the Society by Professor Henry on the sixteenth of January last. A memoir on this subject has been since submitted to the Society containing an extension of the subject, the primary fact in relation to which was observed by Professor Henry as early as 1832, and announced by him in the American Journal of Science. Mr. Faraday having recently entered upon a similar train of observations, the immediate publication of the accompanying is important, that the prior claims of our fellow countryman may not be overlooked". Bache's letter was followed by an abstract from the report of the meeting of the American Philosophical Society which contained details of Henry's experiments with electric currents.

Death of Baron Dupuytren

On February 8, 1835, Baron Guillaume Dupuytren, the foremost surgeon in France, died in Paris. Born in humble circumstances at Pierre Buffière in Limousin on October 6, 1777, it is said that he was stolen when three by a lady of rank, but was afterwards recovered by his parents. Both in appearance and by his conversation he attracted the attention of people, and at the age of twelve years through the action of an army officer he was sent to the Collège de la Marche in Paris, and his youth was thus passed amidst the turmoil of the French Revolution. Subsisting on the most meagre of allowances, he was, however, able to study chemistry and anatomy and at the age of seventeen years, in 1794, obtained a post in the new School of Medicine founded under the direction of Fourcroy. From then his progress was unchecked. In 1803 he was made an assistant surgeon at the Hôtel-Dieu, in 1811 succeeded Sabatier in the professorship of operative surgery and in 1815 he was given the chair of clinical surgery, which he held until his death. He was also surgeon to Louis XVIII. "Haughty, austere, and brooking no rivals," says Seelig, "he trod through life always upwards, charming by his very disdain and constantly introducing technical innovations that have stood the test of time. By a queer twist of fate, one of the least significant of his accomplishments, a description of contracted palmar fascia, is the one to which his name has clung". The perseverance he had shown amid the difficulties of his early years was not more notable than the assiduity with which he always carried out his duties and the iron resolution which astonished all who came in contact with him. He was buried in the Père Lachaise cemetery, and a part of his large fortune was used for the founding of the Musée Dupuytren near the École de Médicine, Paris.

Societies and Academies

LONDON

Royal Society, January 24. M. BORN and L. INFELD: On the quantisation of the new field equations. (1) The new field theory uses the primary field vectors **E**, **B** and derives secondary field vectors **D**, **H** by differentiating the Lagrangian L (**E**, **B**) with respect to **E**, **B**. If one gives up the invariant form (that is, the four-dimensional tensor notation), one can introduce other pairs of primary variables; in each case there exists an action function, one of which is the energy density. Using this representation it is possible to formulate the quantum laws of the field. The field equations can be written without any space or time derivatives, only by means of commutators connecting the field vectors with the total energy and the total momentum. They formulate a coherent unitarian quantum theory of matter and field. (2) The commutation rules for the field components are given in a new form which makes no use of δ-functions. The behaviour of an electrodynamical system as a whole is described by a set of integral quantities: total energy, total momentum, centre of energy, total angular momentum. These quantities satisfy commutation rules which can be derived from those for the field components. The chief result is that the co-ordinates of the centre and the components of the total momentum are connected by the same commutation laws as in quantum mechanics, and that the components of the momentum commute; but the co-ordinates of the centre do not commute. H. BETHE and R. PEIERLS: The scattering of neutrons by protons. The result is practically independent of the special law of force assumed between neutron and proton; it depends only upon the known binding energy of the diplon. The cross-section obtained is about 50 per cent larger than the rather uncertain experimental value. The scattering is almost isotropic (in the relative co-ordinate system) for neutron energies up to about 40 million volts.

EDINBURGH

Royal Society, January 7. ESTHER LOWE: Anatomy of a marine copepod, *Calanus finmarchicus*, Günner. A muscular mechanism in the heart wall opens the aortic valve and closes the ostia during systole. Circulation is assisted by rhythmical movements of the pericardial floor, involving alternate contraction of two sets of muscles. A paired series of canals returns blood to the pericardium. A pair of giant fibres in the nerve cord, arising by a chiasma in the brain, give off branches supplying, alternately, the dorsal longitudinal trunk muscles, which determine direction, and the flexors of the swimming feet, which accomplish the darting movement. The system, evidently, constitutes the effector portion of an escape reflex. GERARD DE GEER: Dating of late-glacial clay varves in Scotland. A measurement by Dr. J. B. Simpson of varved clay exposed by the River Earn near Dunning, Perthshire, has been correlated with a series from Lyngby, near Copenhagen. According to this correlation, the Dunning section corresponds to an early stage in the goti-glacial sub-epoch of the Scandinavian ice-retreat, dating from about 13,000 years ago. J. WALTON: The fossil hollow trees of Arran and their branches, *Lepidophloios Wünschianus*, Carruthers. In 1865, Edward A. Wünsch, of Glasgow, made the interesting discovery that there were fossil trees in position of growth in the Lower Carboniferous volcanic ash beds on the north-east coast of Arran in the Clyde. The new methods which are available for getting sections of fossil plants are such that there is almost no limit to the size of block of material from which a section may be prepared. The trees had partly decayed before preservation and the hollow trunks contain fragments of many different kinds of plants (for example, *Bothrodendron*, *Protocalamites*, *Lyginorachis*), all very well preserved structurally. The trees themselves prove to belong to the genus *Lepidophloios*, a near ally of the better-known Carboniferous genus *Lepidodendron*. Only the bases of the trunks are preserved. In four examples the central core of wood is found, and from its structure something of the mode of growth of the original tree may be deduced. It is also evident that, like the nearest living representatives of this extinct genus, *Selaginella* and *Isoetes*, these gigantic trees developed from spores. By careful comparison of histological features, it has been possible to identify various sized branches and twigs found in the same beds as parts of the plant which possessed the large trunks. IAN SANDEMAN: The mathematical representation of the energy levels of the secondary spectrum of hydrogen (2). An analysis of the two states, $1s2s\,^3\Sigma$ and $1s2p\,^1\Sigma$, of H_2 is carried out on the basis of J. L. Dunham's solution of the wave-mechanics equation for the diatomic molecule. The consistency of the results indicates very little evidence of l-uncoupling for these states. Potential functions are obtained which indicate that the potential function of Morse is not applicable to the two states.

PARIS

Academy of Sciences, December 26 (*C.R.*, **199**, 1537–1694). The president announced the death of Willem de Sitter, *Correspondant* for the Section of Astronomy. JEAN CHARCOT: Notice on the works of M. de Gerlache. A. LACROIX: The discovery of tectites on the Ivory Coast. Description and analyses of three specimens of tectites from West Africa. H. DESLANDRES: A simple and general relation of the molecular spectrum to the electrons and rings of electrons of the constituent atoms. JULIEN COSTANTIN, JOSEPH BOUGET and JOSEPH MAGROU: New experiments on the germination of the seeds of the potato in the mountains (1934). Comparison of the results of the culture experiments in 1933 and 1934. HYACINTHE VINCENT: Streptococcæmia and suppurating meningitis with streptococci. The action of antistreptococcus serum in these infectious states. The author considers that the value of his serum treatment is best tested on the most serious forms of streptococcal infection, septicæmia and suppurating meningo-cephalitis. Of 218 such cases, 180 were cured. CHARLES NICOLLE and PAUL GIROUD: The observation of the Tunisian epidemics of historic and murin typhus and the study of their virus, showing that these two diseases are separate. CHARLES CAMICHEL and LÉOPOLD ESCANDE: The linear elements produced by the movements of fluids in the interior of systems under pressure. J. SCHOKALSKY: The physical map of the north polar region. LÉON POMEY: The last theorem of Fermat (divisibility by 3 and 5). N. ARONSZAJN: The series of Dirichlet with exponents linearly independent. JULES SCHAUDER: Quasi-linear equations of the elliptic type with continued coefficients. M. GHERMANESCO: The exceptional surface of a system of integral functions. SILVIO MINETTI: Some points of the theory of functions.

HENRI MINEUR : Mechanical systems in which the parameters are functions of the time. HENRI PONCIN : The stable hydrodynamical configurations which allow surfaces of discontinuities for the densities. MARIUS AUBERT, PIERRE CLERGET and ROGER DUCHÊNE : Detonation in injection motors. Description of an arrangement permitting the kinematographic study of flame propagation in a cylinder with two jets. Simultaneous injection of alcohol with gas oil reduced detonation, and benzaldehyde showed an even more marked antidetonating effect. ANDRÉ DANJON : A new transit instrument. This new form requires no essential geometric linkage, the meridian being defined by an optical method. The instrument has been used for some months at the Strasbourg Observatory. The corrections given by zenithal and equatorial stars do not show the systematic deviations of some hundredths of a second found with transit instruments of the ordinary type. H. GROUILLER : Photographic stellar photometry by the method of Ch. Fabry. The method proposed by Fabry in 1910 has been applied to an equatorial at the Lyons Observatory and a diagram is given showing the light curve of the variable star *RT* Aurigae. CHARLES BERTAUD : The spectrum of Nova Herculis. JEAN LAGRULA : Measurements of the intensity of gravity in northern Africa. P. LEJAY : The general characters of gravity along the southern coast of China. NICOLAS KRYLOFF and NICOLAS BOGOLIUBOFF : The quasi-periodic solutions of the equations of non-linear mechanics. JEAN LOUIS DESTOUCHES : The centre of gravity in Dirac's mechanics. Application to photons, to spin and to the proton. MAX BORN and LÉOPOLD INFELD : The deduction of Dirac's wave equation starting from quantic electrodynamics. C. BUDEANU : The working of a deforming apparatus. Y. ROCARD : The transfers of modulation in the Heaviside layer. PIERRE JACQUINOT : The Zeeman effect of mercury and its perturbations. GEORGES ATHANASIU : Photo-voltaic batteries and photo-electric cells with boundary layer. PIERRE GABIANO : The natural and magnetic rotatory powers of pinene vapour. The specific rotatory power of pinene as vapour is identical with that of the liquid, but the magnetic rotatory power of this hydrocarbon as vapour is 0·77 that of the liquid. PIERRE AUGER and PAUL EHRENFEST : Ultra-penetrating corpuscles of the cosmic radiation. WILFRIED HELLER : The frequency of the rotation and vibration bands and the chemical activity of molecules in the gaseous state. A. PORTEVIN and D. SEFERIAN : The absorption of nitrogen by the fusion of iron in the arc, and the iron-nitrogen diagram. Description of the proportions of iron nitride formed under different conditions of heating. 0·25–0·4 per cent nitrogen is absorbed when iron is fused in the flame of atomic nitrogen. The results of micrographic, dilatometric and thermo-magnetic study of the specimens are given in diagram form.

(*To be continued.*)

ROME

Royal National Academy of the Lincei : Communications received during the vacation of 1934. G. A. CROCCO : The conception of 'focus' in the stability of aeroplanes. A. RUSSO : Elimination of nuclear substance and adhesion of the gametes in a ciliate, in relation to the agglutination in the fertilisation of Metazoa. S. SARANTOPOULOS : A theorem concerning the method by recurrence (complete induction). G. BELARDINELLI : A class of analytic functionals (1). N. MOISSEIEV : The curves defined by a system of differential equations of the second order (2). Certain properties of the trajectories in Hill's problem of three bodies. Previous study of dynamic problems with two degrees of freedom revealed the existence, on the plane of motion, of a geometric locus of the points in which occurs contact of the trajectories with a given family of curves, $f(x, y) = \text{constant}$. This contact was not lower than the second order. Such a curve is now applied to the study of the properties of the trajectories in Hill's problem. (3) Concerning a method of studying the integral curves in the system of three differential equations of the second order. G. L. ANDRISSI : Measurements of double stars. Measurements made on a number of double stars from Burnham's "General Catalogue of Double Stars" (1906) by means of the 7-inch Cauchoix-Cavignato equatorial at the Campidoglio Observatory are recorded. A. G. BARBIERI : Compounds intermediate to ferrocyanides and ferro-ammines. When treated with potassium cyanide, ferro-dipyridyl and ferro-phenanthroline compounds of the type $[FeB_3]X_2$ ($B = \alpha\alpha^1$-dipyridyl or *o*-phenanthroline) yield ferrocyanide, with intermediate formation of compounds of the structure $\left[Fe\begin{matrix}B_2\\(CN)_2\end{matrix}\right]$ and $\left[Fe\begin{matrix}B_2\\(CN)_4\end{matrix}\right]K_2$, containing either two or three molecules of water of crystallisation. G. SCAGLIARINI and M. RAGNO : Influence of temperature on the formation of additive compounds. In the cold, cobalt chloride and bromide react with pyridine, giving the compounds $CoCl_2$, $4C_5H_5N$ and $CoBr_2$, $4C_5H_5N$. If, however, the solutions are kept for some hours at 70°–80°, the salts crystallising out contain only two molecules of pyridine per molecule of the cobalt salt. Other similar cases are recorded. CARMELA MANUNTA : Origin of the uric acid in the hibernating eggs of the silkworm. Experimental data confirm the hypothesis that this uric acid is derived largely, not from embryonal metabolism, but from the maternal blood.

VIENNA

Academy of Sciences, November 29. RICHILDE WAGNER : Admittance of radium emanation into the human body through the skin. The skin is slightly permeable to the emanation but this is, as a rule, not the chief means of access of the emanation to the organism from baths. MAX PESTEMER and BRUNO LITSCHAUER : Ultra-violet absorption of mustard oil and of the thiocyanate group. This absorption is determined mainly by the sulphur atom of the thiocyanate and isothiocyanate group. MAX PESTEMER and GERHARD SCHMIDT : Ultra-violet absorption of binary liquid mixtures (6) : the system ethyl thiocyanate – hexane. The curves representing the extinction coefficients of these mixtures are positive in comparison with those calculated additively. PAULA BERNSTEIN : Ultra-violet absorption of the system aniline – *m*-cresol in ethanol. In 0·01 and 0·1 molar solutions, the extinctions of these mixtures are virtually additive, although an equi-molecular compound is formed ; such compound apparently decomposes at the above dilutions. MAX PESTEMER and BRUNO LITSCHAUER : Ultra-violet absorption of the system acetone – benzene. In agreement with the results obtained for the system acetone – hexane, the extinction of the acetone is positive in comparison with the additive values for the mixtures. That of the benzene is, however, negative, probably owing to an inductive action of the polar acetone.

Forthcoming Events

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

Sunday, February 3

BRITISH MUSEUM (NATURAL HISTORY), at 3 and 4.30.—"The Interrelationship of Plants and Animals" (Parts 1 and 2).*

Monday, February 4

SOCIETY OF ENGINEERS, at 6.—Inaugural meeting for 1935. Col. H. C. Hawkins: Presidential Address.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Eric Shipton: "Nanda Devi and the Ganges Watershed".

Wednesday, February 6

ROYAL SOCIETY OF ARTS, at 8.30.—Sir Frederick Gowland Hopkins: "The Study of Human Nutrition—the Outlook Today" (Sir Henry Trueman Wood Lecture).

BRITISH SCIENCE GUILD AND ROYAL INSTITUTION, at 9—(at the Royal Institution).—Dr. C. H. Desch: "The Microscope and Metal Industries". (Research and Development Lecture.)

Thursday, February 7

ROYAL SOCIETY, at 4.30.—Prof. E. N. da C. Andrade and P. J. Hutchings: "The Mechanical Behaviour of Single Crystals of Mercury".

Prof. E. N. da C. Andrade and J. C. Martindale: "The Structure and Physical Properties of Thin Films of Metals on Solid Surfaces".

Dr. M. Born: "On the Theory of Optical Activity".

LINNEAN SOCIETY OF LONDON, at 5.—Exhibition meeting.

CHEMICAL SOCIETY, at 8.—Discussion on "Intermetallic Compounds" to be opened by Dr. C. H. Desch.

Friday, February 8

ROYAL ASTRONOMICAL SOCIETY, at 5.—Annual General Meeting. Prof. F. J. M. Stratton: Presidential Address.

ARMSTRONG COLLEGE, NEWCASTLE-UPON-TYNE (BEDSON CLUB), at 6.30.—Prof. C. R. Harington: "The Biochemistry of the Thyroid Gland" (Bedson Lecture).

ROYAL INSTITUTION, at 9.—Sir Gilbert Walker: "Clouds—Natural and Artificial".

Saturday, February 9

SCHOOL NATURE STUDY UNION, at 3.—Annual Conference to be held at University College, Gower Street, London, W.C.1.

Prof. Winifred Cullis (President-Elect): "Biology and the Community".

Official Publications Received

GREAT BRITAIN AND IRELAND

The University of Manchester: The Manchester Museum. Museum Publication, No. 107: Report of the Museum Committee for the Year 1933–34. Pp. 22. (Manchester.) 6*d*. net.

Proceedings of the Royal Irish Academy. Vol. 42, Section B, No. 6: Reports from the Limnological Laboratory, 3: The Food and Growth of Brown Trout from Lough Derg and the River Shannon. By R. Southern. Pp. 87–172+3 plates. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.) 3*s*.

Abstracts of Dissertations approved for the Ph.D., M.Sc. and M.Litt. Degrees in the University of Cambridge during the Academical Year 1933–1934. (Published by Authority.) Pp. 102. (Cambridge: Printed at the University Press.)

Ministry of Health. Report on the Work of the Central Midwives Board for the Year ended 31st March 1934. Pp. 18. (London: H.M. Stationery Office.) 3*d*. net.

University of Reading: Faculty of Agriculture and Horticulture. Bulletin No. 48: A Soil Survey of the Eastern Portion of the Vale of the White Horse. By Dr. F. F. Kay. Pp. 187. (Reading.)

The University of Leeds: Department of Coal Gas and Fuel Industries (with Metallurgy). Report of the Livesey Professor (John W. Cobb) for the Session 1933–34. Pp. 12. (Leeds.)

War Office. Report on the Health of the Army for the Year 1933. (Vol. 69.) Pp. iv+154. (London: H.M. Stationery Office.) 2*s*. 6*d*. net.

OTHER COUNTRIES

Ministry of Agriculture, Egypt: Technical and Scientific Service. Bulletin No. 145: Contribution to a Knowledge of the White Flies (*Aleurodidæ*) of Egypt, (3). By Prof. Dr. H. Priesner and Mahmoud Hosny. Pp. ii+10 plates. 5 P.T. Bulletin No. 148: The Nature of Soil Deterioration in Egypt. By David S. Gracie, Mahfouz Rizk, Ahmed Moukhtar, Abdel Hamid I. Moustafa. Pp. ix+22+8 plates. 4 P.T. (Cairo: Government Press.)

Conseil Permanent International pour l'Exploration de la Mer. Bulletin statistique des pêches maritimes des pays du Nord et de l'ouest de l'Europe. Redigé par D'Arcy Wentworth Thompson. Vol. 22: Pour l'année 1932. Pp. 79. (Copenhague: Andr. Fred. Høst et fils.) 3.00 kr.

The Indian Forest Records. Vol. 20, Part 12: New Ichneumonidæ from India and China. By R. A. Cushman. Pp. 8. 4 annas; 5*d*. Vol. 20, Part 14: Interim Report on Work under Project 8 (Testing of Indian Timbers for Veneer and Plywood). By W. Nagle. Pp. iv+56+3 plates. 1 rupee; 1*s*. 9*d*. (Delhi: Manager of Publications.)

The South African Journal of Science. Vol. 31: Being the Report of the Thirty-second Annual Meeting of the South African Association for the Advancement of Science, Port Elizabeth, 1934, 2 July to 7 July. Pp. xxxvii+618. (Johannesburg.) 30*s*. net.

India: Meteorological Department. Scientific Notes, Vol. 5, No. 58: On Forecasting Weather over Northeast Baluchistan during the Monsoon Months, July and August. By A. K. Roy and R. C. Bhattacharya. Pp. 125–131. (Delhi: Manager of Publications.) 4 annas; 5*d*.

U.S. Department of the Interior: Geological Survey. Professional Paper 185-D: A Flora of Pottsville Age from the Mosquito Range, Colorado. By Charles B. Read. (Shorter Contributions to General Geology, 1934–35.) Pp. ii+79–96+plates 16–18. (Washington, D.C.: Government Printing Office.) 10 cents.

U.S. Department of Agriculture. Circular No. 319: Fertilizer Studies with Sugar Beets in the Arkansas Valley Area, Colo., 1921–28. By L. A. Hurst and A. W. Skuderna. Pp. 20. (Washington, D.C.: Government Printing Office.) 5 cents.

Proceedings of the Academy of Natural Sciences of Philadelphia, Vol. 86. Castilleja in Alaska and Northwestern Canada. By Francis W. Pennell. Pp. 517–540. (Philadelphia.)

Conseil Permanent International pour l'Exploration de la Mer. Rapports et procès-verbaux des réunions, Vol. 92: Salmon in the Baltic Precincts. By Gunnar Alm. Pp. 63. (Copenhague: Andr. Fred. Høst et fils.) 3.00 kr.

Society of Biological Chemists. Industrial Possibilities of some Research Work done in India. By Dr. Gilbert J. Fowler. Pp. ii+42. (Bangalore: Indian Institute of Science.) 1 rupee.

Observatoire de Paris: Section d'Astrophysique, à Meudon. Cartes synoptiques de la chromosphère solaire et catalogue des filaments de la couche supérieure. Par L. D'Azambuja. (Vol. 1, Fasc. 1, Année 1931.) Pp. 40. Cartes synoptiques de la chromosphère solaire et catalogue des filaments de la couche supérieure. Par L. D'Azambuja. (Vol. 1, Fasc. 2, Année 1932.) Pp. 32. (Meudon.)

Verhandlungen der Schweizerischen Naturforschenden Gesellschaft. 115 Jahresversammlung vom 6 bis 9 September 1934 in Zürich. Pp. 550+69. (Aarau: H.R. Sauerländer et Cie.)

Dominion of Canada. Seventeenth Annual Report of the National Research Council, containing the Report of the President and Financial Statement 1933–1934. Pp. 149. (Ottawa.)

University of Toronto Studies. Geological Series, No. 36: Contributions to Canadian Mineralogy, 1934, from the Department of Mineralogy and Petrography, University of Toronto. Pp. 56+6 plates. (Toronto: University of Toronto Press.) 50 cents.

Brooklyn Botanic Garden Record. Vol. 24, No. 1: Delectus Seminum, Brooklyn 1934. Pp. 10. (Brooklyn, N.Y.: Brooklyn Institute of Arts and Sciences.)

Commonwealth of Australia: Council for Scientific and Industrial Research. Bulletin No. 84: The Basal (Standard) Metabolism of the Australian Merino Sheep, II. By A. W. Peirce. Pp. 22. Bulletin No. 85: Studies on the Phosphorus Requirements of Sheep, II: The Effect of Supplying Phosphatic Supplements to Growing Lambs depastured on Phosphorus-Deficient Country. 1: The Effects of allowing Growing Merino Sheep Free Access to Phosphatic Licks while depastured on a Phosphorus-Deficient Area at "Dismal Swamp", South Australia, by H. R. Marston; 2: Field Management of the Experiment, by E. W. Lines; 3: A Soil Survey of the Area under the Control of the Division of Animal Nutrition at "Dismal Swamp" by T. J. Marshall and J. S. Hosking. Pp. 22. Pamphlet No. 50: The Design of Overhead Irrigation Systems. By E. S. West and A. Howard. Pp. 39+6 plates. (Melbourne: Government Printer.)

Proceedings of the American Academy of Arts and Sciences. Vol. 69, No. 9: A Study of the Ant Genera Novomessor and Veromessor. By William Morton Wheeler and William Steel Creighton. Pp. 341–387+2 plates. 90 cents. Vol. 69, No. 10: Contribution from the Research Laboratory of Physical Chemistry, Massachusetts Institute of Technology, No. 333: The Apparatus and Method used for the Measurement of the Compressibility of Several Gases in the Range 0° to 325° C. By James A. Beattie. Pp. 389–405. 45 cents. (Boston, Mass.)

Western Australia. Annual Progress Report of the Geological Survey for the Year 1933. Pp. 16. (Perth: Government Printer.)

CATALOGUES

Sciences occultes. (Catalogue No. 2.) Pp. 44. (Paris: Émile Offenbacher.)

Dawson's Periodica. (Catalogue N.S. No. 15.) Pp. 28. (Catalogue N.S. No. 16). Pp. 20. (London: Wm. Dawson and Sons, Ltd.).

Catalogue of Books and Journals bearing on Medicine and Surgery and the Allied Subjects. (No. 447.) Pp. 34. (Cambridge: W. Heffer and Sons, Ltd.)

Chloramine Antiseptics—Boots. Pp. 16. (Nottingham: Boots Pure Drug Co., Ltd.)

Books and Periodicals on Natural History. (New Series, No. 38.) Pp. 48. (London: Wheldon and Wesley, Ltd.)