



SATURDAY, JANUARY 21, 1933

No. 3299

Vol. 131

CONTENTS

| | PAGE |
|---|------|
| The Arts in Industry | 73 |
| A Vanished World. By Dr. Allan Ferguson | 75 |
| Invertebrates | 76 |
| A New Surrey Flora | 77 |
| Practical Organic Chemistry. By E. F. A. | 78 |
| On the Roof of the Forest. By M. D. B. | 78 |
| Short Reviews | 79 |
| Effects of Solar Eclipse on Audio Frequency Atmospherics. By Everett T. Burton and Edward M. Boardman | 81 |
| Infestation of Stored Products by Insects. By Prof. W. J. Munro | 82 |
| Museums of Canada | 84 |
| Obituary: | |
| Dr. Ernest Clarke. By H. E. A. | 85 |
| Dr. J. J. Carty | 85 |
| Prof. A. M. Stalker | 85 |
| Mr. G. R. Carline | 86 |
| News and Views | 86 |
| Letters to the Editor: | |
| Characteristics of Highly Active Vitamin A.—Dr. Francis H. Carr and William Jewell | 92 |
| Irradiation of Nucleic Acids and Uracil.—Francis F. Heyroth and John R. Loofbourow | 92 |
| Meaning of Neoteny and Pædogogenesis.—G. E. H. Foxon | 93 |
| Oxidase of the Crystalline Style.—C. Berkeley | 94 |
| Nutritional Condition of Sheep and Susceptibility to Stomach Worm.—A. H. H. Fraser and Dr. D. Robertson | 94 |
| Local Lists of Animals.—Prof. A. E. Boycott, F.R.S. | 94 |
| Inheritance of Acquired Characters.—Dr. R. L. Jenkins | 95 |
| A Method of Extending the Frequency Range of the Cathode Ray Tube.—Prof. H. Hartridge, F.R.S. | 95 |
| Capacitance Hygroscopy and some of its Applications.—Dr. R. Kenworthy Schofield | 96 |
| Heights of Nuclear Potential Barriers.—E. C. Pollard | 97 |
| Corrections to the Times of the <i>P</i> Wave in Earthquakes.—Dr. Harold Jeffreys, F.R.S., and K. E. Bullen | 97 |
| Viscosity Measurements of Liquids by the Oscillating Disc Method.—Prof. C. E. Fawsitt | 97 |
| Research Items | 98 |
| Astronomical Topics | 100 |
| Recent Discoveries in Mexico and Guatemala | 101 |
| Band Spectra of Diatomic Molecules. By Dr. R. C. Johnson | 102 |
| International Auxiliary Languages. By H. S. H. | 102 |
| New Applications of the Cathode Ray Oscillograph | 103 |
| Heavy Current Circuit-Breakers | 103 |
| Climate of Hong-Kong | 104 |
| University and Educational Intelligence | 104 |
| Calendar of Nature Topics | 105 |
| Societies and Academies | 106 |
| Forthcoming Events | 108 |
| Official Publications Received | 108 |

The Arts in Industry

THE view that mass production necessarily tends to a mechanisation of industry and society, although stoutly challenged by such leaders of industry as Mr. Henry Ford and Mr. E. A. Filene, finds sufficient support to emphasise the importance of recent surveys of the position of industrial art in Great Britain. Indeed the fact that Mr. Ford and Mr. Filene base much of their argument on the opportunity afforded by increased leisure for developing the arts to some extent accentuates the importance of a critical examination of the position of art in relation to industry, and necessitates some effort to determine whether or not under modern industrial conditions mass production involves so little intelligence or craftsmanship in its processes that the outcome is the staffing of industry mainly by cheap people of low intelligence. If, indeed, such is the necessary consequence of power production, the mechanisation of society may be too high a price to pay for the advantages which mass production confers. Ruskin's picture of the industrialisation of England has to-day an application and a validity which is far from being confined to the significance which he first attached to it: "Unless you provide some elements of beauty for your workmen to be surrounded by, you will find that no elements of beauty can be invented by them."

It would be unfair to charge modern industry, in spite of mass production, with indifference to æsthetic considerations. Attention has already been directed to the relations of art and industry in the important reports issued in recent years by the Balfour Committee on Industry and Trade. In "Factors in Industrial and Commercial Efficiency" the Committee points out that the difficult problems of art and design which have emerged from the disturbing and sometimes disastrous effect of mechanisation, with its sub-division of employment and mass production, on industrial art by breaking up the old craft traditions, revolutionising technique and severing or weakening the close relations which previously existed between designer and executant, have scarcely yet been fully faced. Since success in international competition depends more and more on quality of output, an adequate solution of these problems is of critical importance to the position of British trade.

A survey of the present position of British industries in respect of industrial art contributed

to the same report by the British Institute of Industrial Art stresses the opinion that modern tendencies in certain trades to sever design from manufacture and to rely unduly on foreign sources for the former involve serious danger to the well-being of British industries and art. The survey was limited to the position of industrial art in relation to productive industry, but the growing gap in modern industry between the original producer and the ultimate consumer makes its position in relation to the distributive trades likewise of crucial importance. The final report of the Committee on Industry and Trade similarly confined its observations mainly to productive industry, expressing the opinion that the situation was far from satisfactory in view of the vital importance of fine design and workmanship in maintaining and enhancing the reputation and attractiveness of many classes of British products.

A good deal of similar evidence was in existence on the relations of art and industry when in July 1931 a Committee was appointed by the Board of Trade under the chairmanship of Lord Gorell on the production and exhibition of articles of good design and every-day use. The report of this Committee was published in March 1932 but its excellent recommendations are still awaiting action, and this hiatus appears to be partly responsible for prompting a recent suggestion by Mr. J. A. Milne, in his inaugural address to the Royal Society of Arts on beauty in industry, for the establishment of a ministry of fine arts. Mr. Milne urged that reasons of economy have weakened all the recent tentative Government efforts to deal with this important subject and that, without effective financial backing such as a ministry of arts could supply, there was little prospect of improvement.

The terms of reference of the Gorell Committee, like the pleadings of Mr. Milne, recall the arguments of John Ruskin, one of the pioneers of the movement in the latter part of the nineteenth century to foster healthier relations between creative design and craftsmanship, and in particular his assertions that the wisdom of art consists in its unselfish devotion to the service of men, and that art does its duty "in completing the comforts and refining the pleasures of daily occurrence and familiar service". The chief recommendations of the Committee are indeed concerned with the promotion of exhibitions of industrial art organised to improve the taste of designers, manufacturers, distributors and the general public by the display

to the best advantage of beautiful modern manufactured goods, due regard being paid to the purchasing power of the householder of moderate means. The establishment of a central body with executive powers, responsible for such exhibitions and in close association with the Department of Overseas Trade, the enlistment of the support of local art museums, and the co-ordination of the activities of the British Institute of Industrial Art with those of the new national organisation, are all recommendations directed to this end.

The above proposals are perhaps those which are most likely to involve direct expenditure and which Mr. Milne had chiefly in mind in his appeal for a ministry of fine arts. No less significant, however, than a new exhibition policy are other concurrent measures of general policy advocated by the Committee. Prominent among these is the initiation of steps to terminate the divorce of 'fine' and 'industrial' art and "to secure that numbers of the leading and most promising artists and craftsmen of the day should be encouraged to turn their energies into the industrial manufacturing field and that they find there as secure, remunerative and honoured a career as in painting and sculpture". The report continues in words which will have a familiar ring to scientific workers: "Unless first rate industrial work by artists receive national recognition in future to the same extent as the best work in the field of painting and sculpture many of the best artists will continue to avoid an industrial career".

Closely related is the question of the improvement of art education of the country, itself, which is one aspect of the general problem of improved and closer relations between education and industry and as such falls within the purview of inquiries recommended to be undertaken through the British Institute of Industrial Art. It is clear that much remains to be done in order that teachers and students in art schools should have a clear conception of the requirements of industry, and industrialists a first-hand knowledge of these schools.

While, however, these measures should help to promote the supply of competent designers and artists, the question of demand must not be overlooked. The supply is unlikely to be adequate in either quality or quantity unless the demand for such services is sufficiently widespread and the appreciation awarded them sufficiently generous either in remuneration or status. From this point of view it is essential that the nation should, as

urged by the Gorell Committee, face, in the public, secondary and elementary schools the problem of making the understanding and enjoyment of beautiful things an essential part of the day-to-day life of the school. It is only from the vision and training thus imparted that we can expect either in leisure or working hours a general level of artistic judgment and appreciation sufficient to resist any untoward effects of mass production.

It is indeed here that we touch on the fundamental problem which even in the Gorell report scarcely receives expression. Valuable as are the results already attending what is generally known as the 'arts and crafts movement', in the main the products of this movement have scarcely been within the regular purchasing power of consumers of moderate means. The movement has largely been concerned with the encouragement of handicraft and has not penetrated the processes of modern industry. A reversion to handicraft could not solve the problem of beautifying articles of common use within the purchasing power of the ordinary consumers and the technique of handicraft differs fundamentally from that of industrial manufactures. It is this field which has now to be captured for art. We have to face the task of expressing beauty in the materials and products and processes of modern industry even under the conditions of mass production. The production of goods in quantity is not necessarily a bar to the production of articles intrinsically beautiful. Mass produced goods commonly lack artistic merit because insufficient attention has been devoted to the design, to the materials of which the product is made or the purposes to which it is to be put—in a word, because the manufacturer has been concerned more with imitating the past than discovering new methods of artistic expression for his new powers and materials.

The reports to which we have directed attention pose fundamental problems which even in days of financial stringency cannot be shelved. For certain aspects of them the scientific worker himself must accept responsibility, and it is indeed only as he works in closer alliance with the designer and artist that we can hope for a full solution. Science has once more set mankind the task of harnessing new forces not merely to utilitarian but also to æsthetic purposes, and in the advent of an age of leisure the latter assume even greater importance. The man of science has much to contribute to the full understanding of the properties of the materials of industry and the processes by which they are

worked. The artist has to transmute the material and the processes so that the outcome may be a product which ministers to man's artistic and æsthetic needs as well as to his material needs or comforts—"beautiful and quaint in design but also adapted for every day service and decorous in humble and secluded life". The Gorell Committee in its report does well to stress that note of service upon which both art and science depend, in which they have their strongest common bond and most splendid spur of rivalry in their contribution to the amelioration of the human race.

A Vanished World

Biographical Fragments. By Sir Arthur Schuster. Pp. xiii+268+8 plates. (London: Macmillan and Co., Ltd., 1932.) 10s. 6d. net.

THE world of 1851, the birth year of Arthur Schuster, differed almost *toto caelo* from the age which has witnessed the publication of these biographical fragments. Posting as a means of travel was not altogether a thing of the past; the electric telegraph was still a novelty; the telephone had not yet appeared upon the scene. In the England of that era, shopkeepers in the capital still lived over their shops; merchants drove into the city in horse-drawn carriages, or rode in on horseback; for sixteen years to come malefactors were strangled outside Newgate in the presence of roaring crowds.

Of this civilisation, Frankfort, Schuster's birth-place, was a fascinating microcosm. The confederacy of German States which ensued on the break-up of the Holy Roman Empire had its Diet located at Frankfort, which in consequence took on something of an international character. On the outbreak of the war between Austria and Prussia in 1866 the city declared its neutrality but nevertheless had to submit to the entry of the triumphant Prussian troops; and Sir Arthur, from first-hand knowledge, draws a most graphic picture of this vanished world with its clanking dragoons, its whispering statesmen and ambassadors and, towering over all, the vast figure of Bismarck, then in his most arrogant *Blut-und-Eisen* mood.

Schuster tells us, too, something of his school-days in Frankfort, of his life as a student at Geneva and of his early days in England when, despite his longing for a scientific career, he found himself, an apprentice in the firm of Schuster

Brothers, copying letters and checking accounts in their office in Sackville Street, Manchester. It is not without a smile, too, that we read of the house taken by his father at Lytham under the impression that that homely Fylde seaside village was the Nice of England. A scientific career being decided upon, he gives us some account of the Quay Street period in the development of Owens College, of his wander-years, and of the circumstances that led to his taking charge of the eclipse expedition to Siam in 1874. Of this expedition and of its sequel, a journey through India, we have a most interesting and vivid account, and then, when we are looking forward to the tale of that splendid outburst of activity which marked Schuster's tenure of the chairs of applied mathematics and of physics at Owens College, the curtain rings down on the main theme, and the remainder of the book is concerned with a series of episodes and a number of admirably drawn sketches, which appeared originally in *NATURE* under the title "Biographical Byways", of eminent men of science of a generation that has gone.

The fragments that fall from Sir Arthur's table provide better fare than many another man's banquet, and we are most fortunate in possessing these skilfully etched portraits, giving life to many a personality otherwise but the shadow of a name. We see Henry Wilde, one day telling Schuster that he was unfit to be a university professor, the next day making amends for his hasty words by a present of hothouse grapes; Joule, receiving his manuscript rejected by the Royal Society, and envisaging a committee of rejection who should say "What good can come out of a town where they dine in the middle of the day"; and Balfour Stewart, of whom Sir Arthur gives a most sympathetic and understanding account, remarking "every billet has its bullet", after reading a letter from the Principal of the College in which the sting was distinctly in the tail. Leverrier, Boltzmann, Kirchhoff, Bunsen, Weber, Helmholtz, Reynolds, Stokes . . . it is a remarkable gallery, and we are very much in Sir Arthur's debt for these studies sketched with both kindness and insight; specially valuable are the accounts of Wilde, Stewart, Boltzmann, and Reynolds.

But we miss the story of Joule's Stone Ales!

Of the minor episodes, the tale of the thief and the barograph is not without human and scientific interest. A worker in the laboratory missed coins

from the pocket of a coat which he left hanging overnight. Suspicion fell on a charwoman and a night-watchman, who visited the room at different times. A decoy coin was left in the coat pocket, so arranged that its removal would break a simple circuit and cause the pen of the barograph to make a jerk in its time record. The experiment was completely successful; the honour of the charlady was vindicated; and the peccant (and, we trust, repentant) figure of the night-watchman vanishes into the mists of forty years ago.

We close the volume with regret; not the least valuable of the impressions which have remained is that of the author himself, a great genius, versatile, kindly, humorous, and charitable; one who has seen much, and suffered not a little; who has followed the scriptural injunction to prove all things, and hold fast to that which is good. May we express the hope that he will find himself able to unfold to us the story of the development of the Manchester school of physics—a story which none can tell as he can, and in which he himself has played so great a part?

ALLAN FERGUSON.

Invertebrates

The Invertebrata: a Manual for the Use of Students.

By L. A. Borradaile and F. A. Potts. With Chapters by Prof. L. E. S. Eastham and J. T. Saunders. Pp. xiv + 646. (Cambridge: At the University Press, 1932.) 25s. net.

THIS volume has been prepared for the use of students who have completed a year's study of zoology and are entering upon an advanced course. The book opens with an admirable introduction to the study of the structure and biology of the Protozoa, after which follows the systematic consideration of the four main sub-divisions, including a scheme of classification and references to the special points exhibited by representative examples. This chapter is especially praiseworthy for the attention devoted to free-living forms. The student tends to stress the parasitic Protozoa and this account provides a most useful corrective, and he who reads and digests this chapter of 109 pages will have acquired a sound and balanced basis of knowledge of the Protozoa.

A brief account of the sub-kingdom Parazoa (Porifera) follows and the rest of the volume is devoted to the invertebrate Metazoa and to two sub-phyla of the Chordata—the Enteropneusta and the Tunicata. For each of the more important

phyla or sub-phyla a concise definition is given and is followed by observations on the general structure and development; the sub-divisions are defined, a representative example is usually described and references made to other genera which serve to illustrate special points in anatomy, life-history and biology.

The chapters on Crustacea (85 pp.) and insects (60 pp.) may be mentioned for their excellent treatment of the subject and for the quality of the illustrations.

The author of the chapter on Nematoda, in a brief discussion on the systematic position, holds that the simple structure of the nervous and muscular systems and the absence of vascular system are signs of a lowly origin and not of degeneration, and that there is no real connexion between these worms and the Arthropoda. He points out that the Nematoda present no signs of segmentation or appendages, the cuticle is of an entirely different chemical nature in the two phyla and the loss of cilia in the Nematoda is certainly secondary.

The text is supported by well-chosen illustrations, mostly in line, many of which are either original or are drawn from recent memoirs. The figure of the larva of *Echiurus*, from Hatschek, which shows the septa of transitory segments, would have been better replaced by one of Baltzer's representing the mesoderm as unsegmented, as it appears actually to be.

The work has been carefully planned and the authors have been at great pains to arrive at a fair balance of its principal parts. They state that the choice of examples has been difficult and that they have not been able to include all they could have wished. The omission of the Mesozoa is probably justifiable, but whether for example *Gordius* with its interesting life-history should have been entirely ignored is more doubtful. The authors have imposed on themselves a restriction in extent of the text which in places is rather severe, for example, the Hydrocorallinæ are dealt with in twenty lines, the Gephyrea in twenty-three and the Phoronidea in a dozen lines of text (but for each group there are also one or two illustrations with adequate legends), and of the Heteropoda only *Pterotrachea* is mentioned and of the Pteropoda only *Cavolinia*. It is, of course, recognised that to bring an account of the Invertebrata within the compass of a single volume of 600 pages compression is necessary, and it must be admitted that the authors have dealt on the

whole judiciously with the conflicting claims for space of the different groups.

Errors are remarkably few and unimportant, and the proof-reading has been effective so that misspellings are very scarce. It should, however, be noted that *Ancylostoma*, not *Ankylostoma*, is the officially recognised form of this generic name. The authors are to be warmly congratulated on a work which is concise, accurate and adequately illustrated, and is a compendium of the most significant knowledge on invertebrates.

A New Surrey Flora

Flora of Surrey: being an Account of the Flowering Plants, Ferns and Characeæ, with Notes on the Topography, Climate and Geology, and a History of the Botanical Investigation of the County. By C. E. Salmon. Edited by W. H. Pearsall. Pp. 688. (London: G. Bell and Sons, Ltd., 1931.) 42s. net.

ALL those interested in British plants will welcome the appearance, after so many years' delay, of this new "Flora of Surrey". At the end of last century, W. H. Beeby was working at a new "Flora" of the county, but he did not complete his project and, in 1908, handed his manuscripts over to the late C. E. Salmon. His untimely death unfortunately prevented Salmon, in turn, from finishing the "Flora" and the volume now appears under the editorship of Dr. W. H. Pearsall, who is responsible for the introductory chapters and about one-third of the genera. The greater part of the work, however, is Salmon's, and the volume, with his portrait as a frontispiece, will remain as a lasting memorial to his unrivalled knowledge of the British flora.

There are excellent introductory chapters on the topography, climate, geology and botanical history of the county, together with a very full list of the authorities consulted. The "Flora" itself is, on the whole, admirably arranged, and especially valuable are the taxonomic notes and personal observations at the end of many of the species entries. It seems, however, an unnecessary waste of space to quote pre-Linnean names under each species; sometimes these occupy two or three lines and do not add to the value of the work. Under *Polygala* there is a reference to an appendix containing a key to the British species; no such appendix appears, however, to be in the volume.

The botanical value of the "Flora", as was to be expected from the authorship, is considerably greater than that of many works of a similar kind. Full treatment is accorded to critical genera and, in most cases, their distribution in the county is worked out in detail (for example, *Batrachian Ranunculus*, *Viola*, *Epilobium*, *Rubus*, *Rosa*, etc.). A useful feature is the constant reference to the literature of difficult groups. It is to be regretted, however, that these references do not include work on experimental and genetical lines as well as purely systematic papers. Under *Erophila*, for example, the work of Rosen and Winge might have been mentioned as well as that of Jordan; and under *Hieracium* there is no reference to Ostenfeld's researches on the apogamy of the genus. In omitting work of this type an opportunity has been missed of bringing into closer touch the old and the new schools of taxonomy. Unless this can be done, no further advance in our knowledge of the British flora is possible.

This, however, is a general criticism, applicable, unfortunately, to a great deal of the work on the British flora during the last thirty years, and does not prevent the volume from being one of the most attractively produced and valuable of our county 'floras'. The illustrations of places of botanical interest in the county and the two maps add considerably to its interest, and also, unfortunately, to its price, which is surprisingly high, even for a work of such limited circulation. Dr. Pearsall is to be congratulated on bringing to successful completion a work which has passed through so many vicissitudes during the last forty years.

Practical Organic Chemistry

Laboratory Methods of Organic Chemistry. By L. Gattermann. Completely revised by Heinrich Wieland. Translated from the Twenty-second German Edition by Dr. W. McCartney. Pp. xvii + 416. (London: Macmillan and Co., Ltd., 1932.) 17s. net.

THIS is one of the classic textbooks of the organic chemist; there can be few who have not made use of it at the beginning of their manipulative training even in Great Britain, and the reviewer can plead guilty to struggling with the first edition, dated Heidelberg, August, 1894, in the original German in his student days. In issuing the nineteenth edition from Freiburg in 1925, H. Wieland, the successor to Gattermann, emphasised

the fact that the equipment which sufficed during the last three decades has now become insufficient for those who desire to work at present-day problems, so that in rewriting the book the theoretical and practical requirements have been deliberately increased. We now have the twenty-second edition dated from Munich in July, 1930, with the English translator's date of April, 1932, which shows many changes, all directed to place the student in contact with modern fields of inquiry. Thus, two enzyme preparations have been included, and a biochemical flavour, showing the trend of the times, is also imparted by the preparation of natural compounds, such as furfural, glucose, arginine, nicotine, hæmin and the constituents of bile.

The number of preparations is, of course, in excess of what any student can complete in his course of about a year's training—in Munich it is usual for the student to carry out fifty to sixty preparations, as well as some six or eight from the original literature. The translation into English appears to be well made; and this new edition will be welcomed by students of practical organic chemistry unfamiliar with the German language. Serious students ought, however, to work through such a book in the original German—in no other way can they obtain so easily the essential knowledge of the construction and vocabulary of chemical German.

It would be attractive to use the first and the newest editions as the basis for moralising on the advances in organic chemistry during thirty-six years and on the method of teaching it, but lack of space prevents this being done here. At least it is more important to-day than ever that the worker must be a practical manipulator of the highest skill; and Gattermann's course of work is admirably designed to attain that end.

E.F.A.

On the Roof of the Forest

A Naturalist in the Guiana Forest. By Major R. W. G. Hingston. Pp. xiii + 384 + 16 plates. (London: Edward Arnold and Co., 1932.) 18s. net.

THE treetop canopy of the Amazons forest has always attracted the attention of naturalists; but hitherto the difficulties of exploration in this 'forest above the forest' have been thought to be almost insurmountable. The success of Major Hingston and his colleagues of

the Oxford University Expedition to Guiana was due, not only to good organisation but also to perseverance and enterprise. Most of the party were young and with no previous experience of the tropics; and it says much both for the fine discipline of modern youth and for the wisdom of their leader that they lived successfully under canvas for months, thus disposing once again of the old idea of the dangers of camping in the jungle. In fact, such was the excellent organisation that we are told: "We always if we wished it could have a hot bath daily, and we always had our meals off a clean tablecloth."

The book is made up rather unevenly of two parts. The first, which contains an account of the general work of the expedition, is the most interesting and contains vivid descriptions of the forest, which, unlike the perorations of some other writers on the subject, never flush to 'precious purple'. The story of the attempts to establish a footing in the treetops makes exciting reading. Rather surprisingly, the arboreal ants and bees did not prove so ferocious as anticipated; and the rope-throwing rockets and other apparatus were less efficacious than the more primitive methods of the climbing Indian. Observation posts were planted as high as 120 feet; and the records obtained demonstrated what had previously been only suspected, namely, the well defined vertical

distribution of life in the trees. For example, it was found that moths dominated the night fauna of the forest at ground level, and Hemiptera in the treetop roof. There remains a rich field for investigation into the different ecological factors—light, humidity, etc.—which condition animal life in the various zones.

The second part of the book, which deals with specific observations chiefly on the protective devices of spiders and caterpillars, is grafted a little clumsily on the first. Major Hingston is a whole-hearted believer in the mimicry theory, and he gives here a number of instances that came under his notice in Guiana. Most of them are new, all of them are interesting, but the section on spiders' snares overweights the book a little and would be better if abridged. Mimicry, having held the field for years against assaults on the theory of natural selection, has recently been sharply challenged; and new instances, if they are to help the case, must be beyond cavil. From this point of view the example of the *Ascalaphid* on p. 281 is of doubtful value, and that of *Laternaria* with its 'alligator-like' head never seems very convincing.

The book is illustrated by some excellent line drawings of the devices that the author describes; and by some adequate, though not outstanding, photographs of the forest.

M. D. B.

Short Reviews

(1) *Patents, Trade Marks and Designs: their Commercial Aspect and Development*. By Charles Waldron Thomas. (The Nutshell Series, Vol. 1.) Pp. 88. (London: Ocean Publishing Co., 1932.) 4s. 6d. net.

(2) *British Patents and Designs Statutes as Amended and Consolidated to 1932*. With an Introduction and Index by H. J. W. Bliss. Pp. viii + 126. (London: Stevens and Sons, Ltd., 1932.) 4s. 6d. net.

(1) THIS book is remarkable, and probably unique, for its admirable advice on the business details connected with the exploitation of inventions from the point of view of the inventor. It gives an excellent summary of patent law and procedure, adequate to the needs of an applicant for a patent who is prepared to employ a patent agent, and this part of the book takes cognizance of the changes introduced by the Patents and Designs Act, 1932. Of considerably greater interest, however, is the astute advice, characterized by much worldly wisdom, given by the author on the commercial aspect of inventing. The limits of the advantages to be gained by mass production, the question of price, advertising, the characteristics of mail-order sales, are some of the topics on which

light is shed. The author is something of a psychologist, as when he utters the warning: "Unfortunately the personal friends of inventors are apt to praise any invention out of friendship. . . ." Sir Richard Gregory contributes an interesting foreword in which he discusses some famous patented and unpatented inventions.

(2) This comprises the various patents and designs acts now in force, in consolidated form, together with an alphabetical index to their subject-matter, references being to sections of the consolidated acts; and also a summary, arranged alphabetically on the basis of subject-matter, of the changes introduced by the Patents and Designs Act, 1932.

C. W. H.

Die mitogenetische Strahlung, zugleich zweiter Band der "Probleme der Zellteilung". Von Prof. Dr. Alexander Gurwitsch. Unter Mitwirkung von Lydia Gurwitsch. (Monographien aus dem Gesamtgebiet der Physiologie der Pflanzen und der Tiere, Band 25.) Pp. ix + 384. (Berlin: Julius Springer, 1932.) 33.80 gold marks.

DURING the past decade, the writings of Gurwitsch and others have made biologists familiar with the

conception of mitogenetic rays, that is, radiations emitted from one organic body which stimulate or increase the rate of mitosis in another. The latter biological object is called the detector, and the process of stimulation is known as a mitogenetic effect. Biologists are, however, not yet convinced of the nature or even of the existence of mitogenetic rays.

The present volume explains the methods and instruments used in such experiments and discusses the results, especially in their biological aspects. The book is divided into three parts, dealing respectively with the physics and chemistry of mitogenetic rays, their occurrence in the economy of organisms, and the various biological aspects of the 'mitogenetic effect'. These rays are believed to be produced by bacteria and yeasts as well as the meristems and phloem of higher plants, while other tissues are thought to produce them after wounding or necrobiosis. Experiments also described are supposed to show their production by animal embryos, tissue cultures, blood, ciliated and nerve cells, and numerous experiments with carcinomata are set forth. Since the proof of an induction or mitogenetic effect depends upon the counting of the relative frequency of mitotic figures in the exposed tissue, the difficulty of proving even a single case will be clear.

The real nature of these effects remains to be proved, but anyone interested in the subject will find the experimental work well summarised in this volume.

R. R. G.

Medieval Faith and Fable. By the Rev. Canon J. A. MacCulloch. Pp. 345. (London, Bombay and Sydney: George G. Harrap and Co., Ltd., 1932.) 15s. net.

IN "Medieval Faith and Fable" Canon MacCulloch deals with various aspects of religious life and thought in the Middle Ages, regarding them as a student of folk-lore and comparative religion rather than as a theologian. It is generally recognised that the rank and file of the early Christian Church retained many of their pagan beliefs; while popular observance of ecclesiastical feasts and festivals often was allowed to incorporate a considerable element of an earlier ritual. This, however, is not all. The doctrine of the early and medieval Church was itself in many respects an assimilation of conceptions derived from the religions which preceded it.

Canon MacCulloch, bringing his extensive knowledge of elder faiths and folk-lore to bear upon the Middle Ages, here shows to what extent the elements of paganism may be detected as surviving in the medieval view of such matters as fairies, the supernatural mistress or wife, demons, the cults of the Virgin and the saints, the Host, miracles and so forth. One of the most interesting and informative of his chapters deals with medieval heresies, which, when regarded from the point of view taken here, throw much light on the witchcraft belief and persecutions, a subject which the author reserves for future treatment. Canon

MacCulloch's knowledge of his subject is encyclopaedic. He wastes little time on theory, but gives his readers facts in full measure, not to say running over.

The Atomic and Molecular Forces of Chemical and Physical Interaction in Liquids and Gases, and their Effects. By Prof. R. D. Kleeman. Pp. vii + 133. (London: Taylor and Francis, 1931.) 10s. 6d. net.

THE difficulties inherent in the task of giving a coherent theory of the fluid state of matter are illustrated in this volume, in which Prof. Kleeman discusses the nature of the law of force between the atoms and molecules of liquids and gases. The physical and chemical properties of fluids must evidently be conditioned by this law, but since the molecules may be in rotation, the law must necessarily be complicated in character. The law can, however, be shown to possess some general functional properties that hold approximately. Prof. Kleeman points out an important property of the force exerted by an atom, namely, that it is measured by the square root of the atomic weight.

The volume contains at least 175 equations, some theoretical, some purely empirical, and some of a hybrid character. How many of the equations in the latter classes will survive critical examination it is difficult to say. Prof. Kleeman has done a useful piece of work in collecting this material but much original investigation, probably on quite new lines, is still required before satisfactory theoretical conclusions can be reached.

The Neural Energy Constant: a Study of the Bases of Consciousness. By John Bostock. Pp. 178. (London: George Allen and Unwin, Ltd., 1931.) 6s. net.

DR. BOSTOCK advances a theory that "the nerve energy engaged in consciousness is a constant quantity". It cannot be said that he makes out a good case in support of his theory. His diagrams are like so many of those produced by writers on psychology, probably best understood by himself. There is a number of irritating spelling mistakes and grammatical errors, which should have been eliminated. The statement "fortunately for science this region [the thalamus] is very frequently the site of small hemorrhages" is inaccurate. The thalamic syndrome is distinctly rare. What is described in the text as the occipital lobe is figured on a diagram as the decipital lobe. The old proverb "when in doubt sleep on it", does not, as the author would have us believe, mean that some mental process full of wisdom takes place during sleep, but simply that on thinking a question over more carefully, and using our judgment more wisely, we may alter our view. There is no need for the author to be troubled at "the intellectual brilliance of many epileptics". They are most certainly the exception; the proportion of clever people among epileptics is distinctly smaller than amongst the normal population.

Effects of Solar Eclipse on Audio Frequency Atmospheric

By EVERETT T. BURTON and EDWARD M. BOARDMAN, Bell Telephone Laboratories, New York City

STUDIES of low-frequency atmospheric have shown marked diurnal variations, the night-time intensity considerably exceeding that of the day.¹ These variations may be attributed to radiation from the sun through its effect on ionisation in the reflecting and absorbing layers of the upper atmosphere. Although it is believed that the major portion of this ionisation is due to sunlight, an appreciable effect may be due to a corpuscular radiation from the sun. A solar eclipse affords an opportunity for comparing light and corpuscular effects, since a difference in velocity of these types of radiation should result in a time separation of the two eclipses at the earth's surface. Prof. S. Chapman² has shown that, with an assumed corpuscular velocity of 1,000 miles a second, the corpuscular eclipse precedes the visible one by about two hours. The motion of the moon through a corpuscular radiation results in a trailing shadow. In overtaking the visible shadow of the moon, the earth arrives first at the location of the corpuscular shadow.

Observations of atmospheric during the progress of a solar eclipse should show at least an approximation to night-time conditions, because of the accompanying reduction of radiation intensity. The effects of the two types of radiation on the ionisation in the atmosphere should be sufficiently separated in time to render their effects

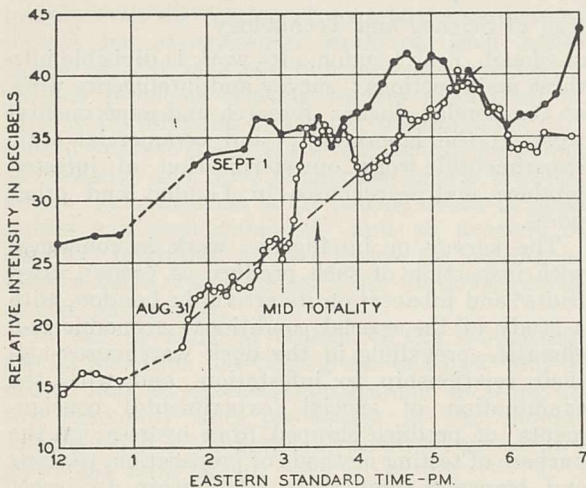


FIG. 1.

distinct. To obtain experimental data, apparatus was set up at Conway, New Hampshire, which was in the path of totality of the solar eclipse of August 31, 1932. A vacuum tube amplifier was connected to a vertical loop antenna which consisted of two sections placed at right angles to reduce directional effects. Between the loop and the amplifier were placed networks so designed that all frequencies above the range of interest

were eliminated, thus insuring direct reception of audio frequencies without a detection process occurring anywhere in the apparatus. The amplifier output was connected to a thermocouple for amplitude measurement and to a telephone for aural observations. The amplifier gain was essentially uniform from 20 to 3,800 cycles per second.

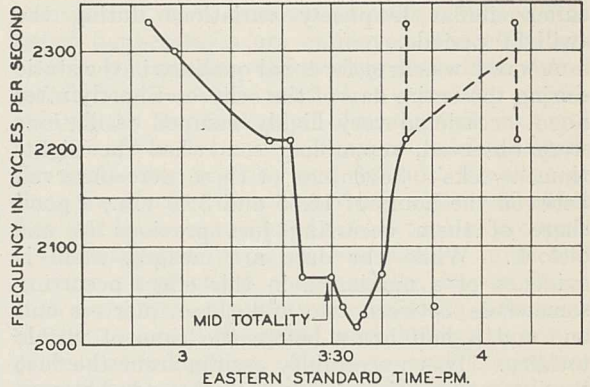


FIG. 2.

The telephones were of the dynamic type with regular response throughout the voice range. These permitted more accurate observations on static qualities than have been possible with the telephone receivers used heretofore. A calibrated tone circuit, loosely coupled to the amplifier system, was provided for use in determining frequencies of musical atmospheric.

Tests at Conway extended from the evening of August 30 until the morning of September 2. Frequent determinations of static amplitude and of static tonal qualities were made. The atmospheric intensity during all of this time was unusually high because of the presence of musical atmospheric of the previously reported type known as 'swish'.¹ While the 'swish' obviously was not related to the eclipse, its presence was unfortunate because of the introduction of irregular variations of intensity. The static intensities for the afternoons of August 31 and September 1 are shown in Fig. 1. While the two curves follow the same general contour, that of the former date shows an abrupt rise shortly before the time of eclipse totality and an abrupt fall after totality. The duration of this period of high intensity is 55 minutes, its mid-time occurring 5 minutes after mid-totally.

Certain types of so-called 'musical atmospheric' normally occur only during twilight or night. One of these, known as the 'tweek', is a short damped oscillation which appears to result from multiple reflections of a static impulse between the earth's surface and a reflecting layer located in the upper atmosphere. 'Tweeks' have never been observed during full daylight, their existence evidently being prevented by absorption in the low-altitude

ionisation maintained by sunlight. A phenomenon closely related to the 'tweek' is a weak resonance, observed during evening and morning twilight periods. The resonance has been found to appear near sunset with a frequency of approximately 2,300 cycles per second, reducing gradually to 1,800 cycles per second in approximately two and a half hours, after which it appears to submerge in the night-time static. During the morning twilight period the resonance reappears, rising through the same frequency range and persisting for approximately half an hour. The 'tweeks' suffer similar frequency variations during the twilight periods.

A watch was kept for tonal qualities in the static during the entire day of the eclipse. Shortly after noon, occasional very highly damped oscillations were observed, resembling somewhat the night-time 'tweeks'. Seventeen of these were observed between the hours of 12.35 and 3.50 P.M., a good share of them occurring just previous to one o'clock. While our data are meagre, there is evidence of a maximum in this effect occurring somewhere between two and three quarters and one and a half hours before the time of visible totality. This uncertainty results from the fact that no observations of tone were made between the hours of one and two in the afternoon. As totality approached these highly damped tones were seldom observed, but a weak resonance similar to that of an evening twilight period

appeared. The frequency was observed to reduce gradually, reaching its minimum approximately seven minutes after totality. Thereafter it increased rapidly, and disappeared after a short period of rather indefinite frequency. The observations of the resonance tone are shown in Fig. 2.

Our observations of audio-frequency atmospheric intensity indicate an approach to night-time intensity near the period of totality. Data on resonance tone indicate an approximation to evening conditions before and during totality, followed by a condition similar to that of morning. Both the intensity and tonal data show lags of a few minutes in respect to the time of totality. These observations point to sunlight effects on the ionisation of the atmosphere. The occasional occurrence of the highly damped tones long before the time of visible totality may be taken as evidence of the existence of corpuscular radiation, although the data indicate a minor effect. The difference in tonal quality between the early highly damped oscillations and the resonance observed near the time of visible totality indicates the occurrence of some marked change in the atmospheric conducting or reflecting properties, due possibly to difference in penetrating properties of the two types of radiation.

¹ E. T. Burton, "Submarine Cable Interference", *NATURE*, 126, 55, July 12, 1930.

² S. Chapman, "Influence of Solar Eclipse Upon Upper Atmospheric Ionization", *Mon. Not. Roy. Ast. Soc.*, 92, 413; 1932.

Infestation of Stored Products by Insects

By Prof. J. W. MUNRO, Imperial College of Science and Technology

ALTHOUGH the losses caused to growing crops by insects have long been recognised, the losses caused to crops after harvesting and during storage and transport have been strangely neglected both by the biologist and the industrialist. These losses are none the less of grave importance and take in the main three forms: absolute loss of goods resulting from consumption by the insect, indirect loss resulting from the lower price paid for soiled or infested produce and indirect loss resulting from loss of prestige by the merchant or manufacturer who inadvertently places infested produce on the market. This last form of loss is almost wholly incalculable, but that it is high is evident from the almost extravagant care which our food industries take to prevent any knowledge of infestation from reaching the general public.

In 1926, the Empire Marketing Board appointed a committee—Committee on Stored Products Infestation—to consider this problem and on its recommendation made a grant to the Imperial College, in 1927, for the establishment of a special laboratory for the study of the scientific problems underlying infestation of stored products by insects and fungi.* This laboratory is stationed

* The term 'stored products' as used here excludes timber, which is dealt with by the Forest Products Research Laboratory of the Department of Scientific and Industrial Research.

at Slough, near London. Its work is divisible into three main sections: survey and intelligence work at the London docks; research and experimental work in the laboratory; and commercial scale experimental work on sterilisation of infested produce and warehouses in London and other ports.

The survey or intelligence work is concerned with inspection of such produce as cocoa¹, dried fruits² and tobacco³ on its arrival in London, with a study of the special conditions—economic and climatic—prevailing in the dock warehouses and their relationship to infestation, and with the examination of special 'experimental consignments' of produce shipped from overseas for the purpose of testing methods of preparation, packing and transport and their relationship to insect infestation. With this inspection work there is also regular correspondence and exchange of programmes with departments of agriculture and other institutions in the Dominions and Colonies on problems arising in the work.

A survey of the insects associated with cocoa, dried fruits, spices and tobacco stored in London warehouses showed that upwards of a hundred and forty species of insect are represented, but of these only a few are of primary importance.⁴ These are the phycitid moths of the genera *Ephestia*

and *Plodia*, of which the 'flour moth', *Ephestia kühniella*, the 'cocoa moth', *Ephestia elutella*—which is also a serious pest of stored tobacco—and the Indian meal moth, *Plodia interpunctella*—the major pest of dried fruits—are much the most important economically.⁵ Of the Coleoptera, the grain weevils, *Sitophilus granaria* and *S. oryzae*; the flour beetle, *Tribolium castaneum*; the 'saw-toothed grain beetle', *Oryzophilus surinamensis*; the 'biscuit weevil', *Sitodrepa panicea* and *Ptinus* and *Dermestes* species, are the more important or more prevalent.

The characteristics of the stored products fauna have been discussed by van Emden and by Richards⁶. The chief of these appear to be low water requirements and lack of specialised oviposition response.

The main results of the survey work so far have been to show that in nearly all—if not all—instances, infestation begins in the exporting country and that it is aggravated by storage in Great Britain. The work has also served to show that close co-operation of the producers, merchants, wharfingers and manufacturers is essential if freedom from infestation problems is to be attained. In the dried fruit industry it has been clearly shown that due precautions taken in the packing sheds of the exporting country will ensure lower insect infestation of fruit on its arrival in Great Britain.

The laboratory research and experimental investigations in progress comprise entomological, mycological and chemical work. In the entomological branch, the problems studied are concerned mainly with the rearing of very large numbers of insects for experimental work on such lethal agents as heat, cold and fumigant gases, and with various problems relating to the respiration of insects in different stages of development. Of special interest is a study of the factors governing the fertility and rates of increase of the phycitid moths. A description of the pairing habits of these moths has been published⁷ and an account of sterility produced in the males by rearing at temperatures above the optimum for development awaits publication.

In the mycological branch of the laboratory, special attention has been given to copra⁸ and to cocoa⁹ and an extensive programme of work on the taxonomy and physiology of the mould-causing fungi of the genera *Penicillium* and *Aspergillus* has been begun.

In the chemical section of the laboratory, research and experimental work on the relative toxicity of various fumigants to insects and on the partial vapour pressures of fumigant vapours and gases generally used in admixture, for example, ethylene dichloride and trichlorethylene has been carried out and awaits publication. Especially important is a study of the methods of measuring the concentration of gases during fumigation¹⁰ and the devising of special apparatus for this purpose. Work on the methods of determination of the fumigants ethylene oxide¹¹ and hydrocyanic

acid, both in the air spaces and in the products fumigated has made good progress.

The commercial scale experimental work undertaken by the laboratory has been made possible by the generous facilities placed at its disposal by a number of interested firms, among whom Messrs. Weber, Smith and Hoare, wharfingers, and the London agency of the Australian Dried Fruits Board deserve special mention. While laboratory experimental work has very high value, it is almost impossible to simulate in the laboratory the extraordinarily varied conditions affecting sterilisation on a commercial scale. Where cold lethal temperatures are employed, the chambers used in commercial cold storage have been found satisfactory and this method is especially applicable to the sterilisation of almonds and nuts and tobacco. Where, however, fumigation is employed, the problems are many and difficult, for some of these warehouses have a capacity of 250,000 cubic feet and house many hundreds of tons of produce.

In fumigation of ships, warehouses, mills and produce as practised commercially, it was found that no serious attempts are made to determine the behaviour of the gases used during the actual process of fumigation. Moreover, such concentrations of fumigants as are recommended or employed in practice are based on experimental work in which the kind and extent of living insect material used are quite inadequate. Five, ten or, in rarer cases, thirty insects of unknown antecedents appear to be considered ample for this work. In our experience, such numbers are far too small and until we were employing in our commercial work from 2,000 to 4,000 insects or insect eggs reared or produced under known conditions, we were not satisfied with our results. A study of the behaviour of gases during fumigation showed that temperature effects are not allowed for at all, the very high absorption of fumigants by the products themselves and by such things as walls and 'dunnage'—boards used as a base for piles of fruit boxes, sacks, etc.—is altogether underestimated and quite inadequate measures are taken to ensure proper diffusion and distribution of the gas. It is probable that the most important direct contribution our laboratory has so far made to the 'control' of insect infestation is in directing attention to these defects and providing means of overcoming them. The methods used in measuring concentrations of gases in fumigation have already been described elsewhere¹⁰; meanwhile, two very important advances in the technique of fumigation have followed. On one hand a higher percentage of destruction of the insects has been secured, and on the other, a more uniform distribution of the gas has been attained, even in very large warehouses in cold weather. This work is, of course, still in the experimental stage, but there is every reason to hope that soon we may find commercial fumigation placed on a scientific basis, with the result that it will be safer for those engaged in it, more efficient against insects and less injurious to the product treated.

Efficient fumigation, however, is not the final aim of our work, which is the reduction of infestation at its source, and while physical and chemical measures may prove palliative, it cannot be too strongly emphasised that the ultimate reduction of the losses caused by insect infestation of stored produce depends on the acquisition of a fuller knowledge of the insects concerned than we possess at present. Subjects on which promising research work is being conducted as time and funds allow are the temperature and humidity conditions—both in the atmosphere and in the products—which are most favourable to various insects, and the relationship of the mould-causing fungi to the insects' food supply. For the present, this research work may appear of less practical importance than the improvement of remedial measures, but as these measures lessen the incidence and extent of infestation and more attention is given to preventive measures, the value of the more purely biological research work will be more appreciated. Already in some of the industries affected by insect infestation of their raw materials, the need is felt for fuller knowledge of the influence of ventilation and air conditioning and of different

kinds and intensity of lighting on the prevalence of warehouse insects.

REFERENCES

- ¹ Munro, J. W., and Thomson, W. S., "Report on Insect Infestation of Stored Cacao". London: H.M. Stationery Office; 1929.
- ² Myers, J. G., "Report on Insect Infestation of Dried Fruit". London: H.M. Stationery Office; 1928. This report deals with work carried out by Dr. Myers on behalf of the Imperial Bureau of Entomology. At the request of the Bureau and of the Australian Dried Fruits Board, the investigation was transferred to the Imperial College in 1928.
- ³ A report on the infestation of tobacco by *Ephestia elutella* will shortly be published by the Empire Marketing Board.
- ⁴ Richards, O. W., and Herford, G. V. B., "Insects Found Associated with Cacao, Spices and Dried Fruits in London Warehouses". *Ann. App. Biol.*, vol. 17, No. 2; 1930. See also, Reports of the Royal Society Grain Pests (War) Committee (1919-1921), London.
- ⁵ A systematic study of the moths of the genera *Ephestia* and *Plodia* by Messrs. Richards and Thomson will appear in the forthcoming *Transactions of the Entomological Society of London*, vol. 80.
- ⁶ Richards, O. W., "Insects Attacking Stored Products". *Sci. Prog.*, No. 103; 1932.
- ⁷ Norris, M. J., "Contributions Towards the Study of Insect Fertility. (I) The Structure and Operation of the Reproductive Organs of the Genera *Ephestia* and *Plodia* (Lepidoptera, Phycitidae)". *Proc. Zool. Soc. Lond.*, Part 3; 1932.
- ⁸ Passmore, F. R., "Deterioration of Copra in Store". *Bull. Imp. Inst. Lond.*, vol. 29, No. 2; 1931.
- ⁹ Bunting, R. H., "Deterioration of Cacao by Internal Moulds". *Bull. Off. Fabricants Cacao et Chocolate, Brussels*, vol. 1, No. 7; 1931.
- ¹⁰ Bunting, R. H., "Actinomyces in Cacao-Beans". *Ann. App. Biol.*, vol. 19, No. 4; 1932.
- ¹¹ Passmore, F. R., "A Survey of Damage Done by Insects and Moulds to West African Cacao Before Storage in Europe". *Bull. Imp. Inst. Lond.*, vol. 30, No. 3; 1932.
- ¹² Page, A. B. P., "The Measurement of Gas Concentrations for the Control of Fumigation". *J. Soc. Chem. Ind.*, vol. 51, No. 46; 1932.
- ¹³ Lubatti, O. F., "Determination of Ethylene Oxide". *J. Soc. Chem. Ind.*, vol. 51, No. 44; 1932.

Museums of Canada*

THE two volumes referred to below may be regarded as a continuation, first, of the report on the public museums of the British Isles drawn up for the Carnegie United Kingdom Trust by Sir Henry Miers in 1928, secondly, of the new edition of the "Directory of Museums", originally published by the Museums Association in 1911, of which vol. 1, covering Great Britain and Ireland, appeared in October 1930. This continuation, which will eventually deal with all the public museums of the Empire, has the aid of the Carnegie Corporation of New York. The report, by Sir Henry Miers and Mr. S. F. Markham, is confined to the museums of Canada, but the "Directory" comprises also the other museums on or adjoining the American continent and is on the same clear and practical lines as the first volume. We base our further remarks on the Canadian report.

The authors include any building that houses objects of art, history, science, or industry to which the public has even limited access. Of such museums they reckon 125, and nearly all have been inspected by one or the other author. The museum service of Canada differs from that of Great Britain in the relatively smaller number of museums maintained by public funds. While 28 are administered by the Dominion Government or provincial governments and only seven by a city or county, there are 32 maintained by a society, 53 by educational establishments, and

5 owned by industrial firms. The classification is not exact as the administration is often shared between public and private bodies. Of the society museums, at least half are historical, and these are mostly in Ontario; of the educational museums 22 belong to Roman Catholic institutions in Quebec. Fifteen, of varied character, are classed as art museums and range through eleven towns from Vancouver to Halifax.

While a few of these museums, both large and small, are on a high level, it is not surprising that many are open to the criticisms that not so long ago were passed upon most of the museums in Great Britain. To the defects of building with which we are familiar, especially when collections are shown in a house not intended for that purpose, is frequently added that danger from fire natural in a country where wood is used so largely. Save in the half-dozen leading museums, cases are not dust-proof and often not moth-proof, or even lacking altogether. While some exhibits are commended, there is generally a want of adequate labelling and in this respect the art galleries, as elsewhere, are sadly to seek. Still worse is an absence of plan, so that objects which might teach a lesson remain mere curios; here the special museums have an advantage over those covering a wider field. Underlying all these defects is, as usual, the lack of a proper staff. It is almost incredible that "only in a score of museums . . . is there a competent full-time curator, and that in only eight of the score are there adequately qualified museum assistants". Not only this, but also the best of the curators are attracted to the United States by the higher pay and status.

* A Report on the Museums of Canada, by Sir Henry A. Miers and S. F. Markham, to the Carnegie Corporation of New York, to which is appended a Directory of the Museums of Canada and other parts of the British Empire on the American Continent. Pp. vi+63+2 plates. Directory of Museums and Art Galleries in Canada, Newfoundland, Bermuda, the British West Indies, British Guiana and the Falkland Islands. Compiled by Sir Henry A. Miers and S. F. Markham. Pp. 92, 5s., with Report. (London: The Museums Association, 1932.)

It is plain that Canada, in spite of its fine schools, universities, and public libraries, has not yet realised the educational value of museums, a value that has only recently been admitted in Great Britain. There are indeed some school museums, but most of them are neglected and bear no more relation to the curriculum than with us. In nearly half the museums, some instruction is given to school classes, but there is no true co-operation with the educational authorities. Thirty museums lend specimens to schools and a

few are really active in this direction. These are hopeful signs and one can scarcely doubt that the lead of the United States will before long be followed.

Looking at the state of affairs still more broadly, the authors find an absence of co-operation. Were this need supplied, the few really good museums could do much to raise the general level. Towards future progress the criticisms and suggestions of this most valuable report cannot fail to be an inspiration and a guide.

Obituary

DR. ERNEST CLARKE

ERNEST CLARKE was a well-known London eye-specialist. Born in Hampstead on July 21, 1857, he died on November 22, 1932. His career is well described in the medical journals of December 3. Educated at University College School, he joined St. Bartholomew's Hospital Medical School in 1876. He began his career in 1880, as a general practitioner at Blackheath but soon turned to ophthalmic work and moved to Chandos Street, W. He was very successful, through making the correction of small errors of refraction his special care.

A linguist, a traveller, a musician specially devoted to the organ, an enthusiastic collector, a keen freemason, gifted with a cultivated mind, both artistic and scientific, Clarke was a most engaging personality. Happy in his success, he enjoyed good health until recent years, when he suffered much as a result of some infection, I believe, but was stoically cheerful and active to the last. A member of the Royal Institution since 1896, he was a constant attendant and one of its most valued helpers.

I knew him in his student days, as an alert member of my First M.B., University of London tutorial class, at St. Bartholomew's Hospital. No small part of my organic chemistry (1874) was ingested into him; how much he eventually digested I will not say. Among medical men he has always appealed to me by the clearness of his scientific outlook and entire absence of pose. It is interesting to compare training such as he had with the present. Except anatomy, no preliminary subject was then taught practically. A beginning had been made, in physiology, at University College and we know that Michael Foster introduced the subject at Cambridge in 1876; yet Lauder Brunton and I, already in 1868-69, had attended a wonderful lecture course by Ludwig, in Leipzig, which was minutely experimental from beginning to end and, as a consequence, unforgettable. Idealists have made such teaching impossible here to-day.

H. E. A.

DR. J. J. CARTY

DR. J. J. CARTY, for many years connected with the Bell Telephone System in America, died on December 27 at the age of seventy-one. He

had retired from active service in 1930. Carty played a great part in the development of electrical communication, and was probably as instrumental as any one man in the creation of the present-day American telephone system, which involves some twenty million stations and eighty million miles of wires.

Carty was appointed chief engineer of the New York Telephone Company at a time when the problem of placing exchange wires underground was pressing for a solution, and he guided the successful development of the lead-covered paper-insulated cable. Later he became chief engineer of the American Telephone and Telegraph Company, and in this capacity he carried through to successful conclusion the building of the first trans-continental telephone lines in 1914-15, including the adaptation of the vacuum tube amplifier to the telephone repeater. Later in the same year he was able to announce the bridging of the Atlantic Ocean by radio telephone. He was also instrumental in the development of lead-covered cables for long distance telephony, the first undertaking of this kind being the Boston-Washington toll cable of large gauge wire which was placed in operation in 1913. This was followed by the New York-Chicago toll cable, the first to use small gauge wire, in 1921.

Dr. Carty was a member of the National Research Council of America, and a member of council of the National Academy of Sciences of the United States. In 1915 he was elected president of the American Institute of Electrical Engineers. In 1903 he was awarded the Longstreth medal and, in 1916, the Franklin medal of the Franklin Institute; and in 1918, the Edison medal of the American Institute of Electrical Engineers.

To those who worked for him, Dr. Carty will be as much remembered for his inspiring leadership as for his deep knowledge of electrical communication.

PROF. A. M. STALKER

ALEXANDER MITCHELL STALKER, who died in Dundee on December 23, was born in Leven in 1853. After an arts course from which he graduated with first-class honours in mental philosophy, he entered on the study of medicine and after graduating at Edinburgh he studied also at Leipzig.

Ultimately he started practice in Dundee, where he was soon appointed physician to the Royal Infirmary. Distinguished not only by his clinical skill but also by his wide philosophic outlook, he became a leader in a group of younger men who were raising medicine in Dundee to the academic standard that fitted it, when the time was ripe, to furnish the Medical School of the University of St. Andrews.

In 1898 Stalker was with universal approval appointed the first professor of medicine in the new School and grasped whole-heartedly the opportunities afforded of service to medical education in the training of his students. His aim throughout was to lay clearly the main lines on which medical knowledge could be interpreted and applied. In this he was singularly successful, while at the same time he imbued his pupils with an enthusiastic curiosity that encouraged them to track to its place anything which they might encounter outside the range of their previous experience.

Prof. Stalker was endowed with an unusual memory and, widely read, not only in philosophy but also in general history and literature, he was able by accurate reference to keep medicine in touch with the general body of knowledge. Though a good writer and a fine lecturer, his publications were limited to occasional papers, in the interests of his routine duties as physician and teacher. In 1924, when he retired, the University in recognition of his services conferred on him the degree of LL.D.

MR. G. R. CARLINE

GEORGE REGINALD CARLINE, who died in London on December 24 at the age of forty-seven years, succeeded the late H. Ling Roth as keeper of the Banksfield Museum, Halifax, in 1924. He continued the work of his predecessor in adding to the collections of the Museum illustrating the development of the primitive loom and weaving technique. Formerly he had been assistant curator to the

Wellcome Historical Medical Museum, London, and afterwards at the Pitt-Rivers Museum, Oxford. In 1929 he accompanied the British Association to South Africa, contributing to the proceedings of Section H (Anthropology) a paper on the handloom in Africa, and afterwards spending some time in observation among the Mambwe tribe of Northern Rhodesia. He had excavated with Sir Flinders Petrie in the Fayum in 1925 and was closely associated with the work of the Folk-Lore Society and the Royal Anthropological Institute, and was a contributor to their journals.

WE regret to announce the following deaths :

Mr. Cecil Fowler Beadles, curator of the Pathological Department of the Museum of the Royal College of Surgeons, on January 3, aged sixty-six years.

Prof. Robert Donaldson, Sir William Dunn professor of pathology in the University of London, on January 3, aged fifty-five years.

Dr. Malcolm Evan MacGregor, director of the Wellcome Entomological Field Laboratory, of the Wellcome Research Institution, who has done much work in connexion with malaria, on January 12, aged forty-three years.

Mr. J. L. S. Hatton, Vice-Chancellor of the University of London, and first principal of East London College, on January 13, aged sixty-seven years.

Sir Robert Jones, K.B.E., president of the Association of Surgeons of Great Britain and, in 1921-25, president of the British Orthopædic Association, on January 14, aged seventy-four years.

Mr. Basil H. Soulsby, formerly librarian of the British Museum (Natural History), on January 14, aged sixty-eight years.

Prof. C. M. Thompson, emeritus professor of chemistry in the University College of South Wales and Monmouthshire, on January 4, aged seventy-seven years.

News and Views

Sir Edward Sharpey-Schafer, F.R.S.

SIR EDWARD SHARPEY-SCHAFFER, who will retire from the chair of physiology in the University of Edinburgh at the end of next September, went to Edinburgh in 1899 from the Jodrell chair of physiology in University College, London. He has administered an important department and lectured to large classes of medical students, but he has also had abundant energy left to devote to his numerous investigations, which have extended over a wide field including general histology, the endocrine organs, the nervous system, the pulmonary circulation and artificial respiration. His published books include his masterly work on the endocrine organs and his well-known "Essentials of Histology", which has passed through seven editions since its author

went to Edinburgh. The feature of Sir Edward's work in the University of Edinburgh has been his emphasis on, and his encouragement of, research. In his eighty-third year, he is still active and acute in mind, and as keen and assiduous as ever in the prosecution of research. His retirement from the chair will remove one of the best-known figures in the University Medical School and the senior member of the Faculty of Medicine.

APPRECIATIVE reference should also be made to Sir Edward's services, outside his University duties, for example, as founder in 1908 of the *Quarterly Journal of Experimental Physiology*, which he has edited throughout its existence, and to his continued interest in the Physiological Society, of which he is now

the only remaining founder member. Of his more general services to science may be noted his work as general secretary of the British Association (1895-1900) and as president of the Dundee meeting in 1912, and his presidency of the Royal Society of Edinburgh since 1929. Sir Edward was elected a fellow of the Royal Society of London so long ago as 1878. He received a Royal medal in 1902 "for his researches into the functions and minute structure of the central nervous system, especially with regard to the motor and sensory functions of the cortex of the brain", while in 1924 he was awarded the Society's supreme honour, the Copley medal. In making the presentation of the Copley medal, Sir Charles Sherrington described Sir Edward's fundamental work on the adrenal and pituitary glands as opening up a modern chapter of physiological knowledge with important consequences for medical studies and treatment.

China and American Scientific Expeditions

By favour of Dr. Henry Fairfield Osborn, president of the American Museum of Natural History, we have received a copy of his reply to the communication from the Chinese National Committee for the Preservation of Antiquities in reference to the Museum's expedition to Inner Mongolia and the rupture in the relations for scientific co-operation between the Museum and Chinese scientific men (see *NATURE*, 130, 803, Nov. 26, 1932). In his reply Dr. Osborn points out that the American expedition has worked under an agreement made in 1921 whereby, provided its operations were confined to regions where the Geological Survey of China could not work, it was to be unhampered in Mongolia; but, he maintains, the Geological Survey has not adhered to its part of the bargain. In 1928 the expedition's collections were detained at Kalgan for six weeks, without legal or moral right; and the expedition was charged with possessing only "hunting permits", although the permits were the same as in preceding years and the character of the work on which the expedition was engaged was universally known. In 1929 the expedition was not allowed to proceed in the field as the demands made by the Chinese commission were "exorbitant and without international precedent".

IN the Chinese communication, it will be remembered, stress was laid on the fact that Dr. Andrews had assured the commission that the expedition of 1930 was to be the last of the series, but that in 1931 he had applied for a permit for further work in Mongolia. Here Dr. Osborn states that further work had been made necessary by the discoveries of the expedition in 1930 and the negotiations were opened at his request; yet Dr. Andrews was not even given an interview. He then deals with the termination of the Museum's work in China and the transfer of its activities to Manchukuo, a decision which was reached after mature deliberation. Further, he points out, the closure of the Museum headquarters at Peking by Dr. Andrews was not unauthorised,

as has been suggested, but was effected with full authority as the officer of the Museum in charge of exploration and under direction. In expressing the regret of the American Museum that the friendly relations between Chinese scientific men and the American Museum, which existed until 1928, should be thus severed, Dr. Osborn feels that it is through no fault on the side of the Museum. Dr. Andrews insisted on the privilege of completing the work in Mongolia under the agreement of 1921. This made him unpopular with the commission, but no other course was open to him. Dr. Osborn concludes, "It is difficult to see how it would be profitable for this Museum to conduct field work under any other conditions."

Technocracy

RECENTLY in the United States the new economic doctrine of 'Technocracy' has aroused much attention and provoked much discussion. This movement has been sponsored by a number of engineers and scientific workers, and according to an article in the *Times* on January 5, its underlying thesis is that the tremendous technological advance made in industrial processes during the past century and particularly during the past twenty-five years has rendered all existing social and economic mechanism obsolete and futile. 'Technocracy' claims that scientific discovery and modern engineering skill have now armed mankind with powers that would ensure leisure and plenty for all if only they were properly employed. It asserts that the basic factor in social life is the amount of energy available for productive purposes and that no solution is possible so long as the present price system is retained. Energy, according to the exponents of 'technocracy', is the real measure of human labour and human wealth and therefore real prosperity will only be obtained when individualism is discarded and an entirely new system of distribution based on 'energy certificates' instituted. At present, however, as the *Times* article states, the highly technical language in which most of its statements are shrouded make certain aspects of the theory obscure while others could be refuted by any economist without difficulty. The lines of research and the deductions drawn from the assembled facts are obviously the work of engineers thinking in terms of mechanical production and ignoring all considerations of human psychology.

British Industries Fair

THE 1933 British Industries Fair, which opens on February 20 and continues until March 3, will be held, as last year, at Olympia and the White City in London, and at Castle Bromwich in Birmingham. It still goes on expanding. This year the Fair will be bigger, the exhibits more varied and the exhibitors more numerous than ever before. What is perhaps of more importance is that all indications up to the present point to the probability of a great increase in the number of buyers who will attend. For example, the acceptances by overseas buyers of invitations issued by the Department of Overseas

Trade, which organises the Fair, are already 30 per cent more numerous than those received last year. Sixteen European countries, as compared with only five countries last year, are providing special travelling facilities at reduced rates to encourage their buyers to attend the Fair. Altogether some fifty-six different countries and territories will be thus represented. The Fair may be expected to show in what ways and to what extent British manufacturers have availed themselves of the competitive advantages obtained through Britain's abandonment of the gold standard and as a result of the Ottawa Conference. We hope to deal with scientific aspects of the Fair at a later date, but it is satisfactory to note now that scientific and optical instrument makers will be well represented.

Association of British Zoologists

DR. J. GRAY was in the chair as president at the annual meeting of the Association of British Zoologists, which was held in the rooms of the Zoological Society on Saturday, January 7. The morning session was given to discussion of several motions concerning the teaching of biology. It was moved by Prof. E. W. MacBride that vacation revision courses at the universities are highly desirable for teachers of science in schools. This motion was supported by several speakers, but the danger that such courses should be considered sufficient substitute for previous training in the sciences which the teacher was expected to teach was emphasised by Prof. W. Garstang and Prof. Graham Cannon. Mr. H. R. Hewer gave an account of the proceedings of the recent National Conference on the Place of Biology in Education. It was suggested by Prof. Douglas Laurie and Prof. J. S. Huxley that in elementary education a general scientific course is required rather than one in which the scientific subjects are separately organised, but that in such a general course biology must have a leading part. A discussion on the best way of influencing the teaching of biology in schools was introduced by Prof. Graham Cannon. He suggested that this could best be done through the examination boards of the country and in this was supported by Dr. Philippa Esdaile. The president suggested that many of the present difficulties are due to the absence of any body with the function of correlating school and university teaching.

DR. GRAY spoke on "The Importance of Zoological Advice to the State". He said that although the supply of biologists has greatly increased in recent years, there is still great difficulty in persuading good students to undertake work in Government employ. He considers this is partly due to the absence of liaison between the teachers at the universities and those who would later employ the biologists. Some body which could undertake the maintenance of this liaison would be useful. In the afternoon, Mr. W. B. Alexander spoke on the conduct of British ornithological surveys and mentioned the proposed founding of an Institute of Ornithology to deal with such

subjects. Several speakers joined in the discussion of a motion introduced by Prof. F. Balfour Browne concerning the confusion in systematic zoology which results at present from the frequent change of zoological names necessitated by the strict application of the law of priority to them and from the small number of *nomina conservanda* which the International Commission on Nomenclature is able to set up. It was agreed by 23 votes to 3 "that British zoologists should at once set about making a list of proposed *nomina conservanda*, and that to this end a committee of zoologists should be constituted".

Earthquake in the North of England

AN earthquake, rather strong for England, occurred at about 8.30 A.M. on January 14. It has been suggested that it was one of the numerous earth-shakes felt along the Irwell Valley fault near Manchester rather than a genuine earthquake. It differed, however, both in intensity and disturbed area from these local shocks, the strongest of which so far known (that of November 25, 1905) only attained the degree 7 (Rossi-Forel scale) and disturbed an area of 144 square miles. So far as we can judge from the early reports, the earthquake of January 14 was strongest in and near Wensleydale, so that it may have been connected with the well-known Craven fault. At Hawes and the neighbouring village of Bainbridge, a few field-walls and chimney-pots were thrown down. The shock was felt over a wide area, from the Point of Ayre lighthouse in the Isle of Man to Whitby and Bridlington, as well as at Manchester, Altrincham, etc. The disturbed area must thus contain about 25,000 square miles. The earthquake was recorded at Stonyhurst and West Bromwich, but not at Kew Observatory.

Recent Chinese Earthquake

A VERY severe earthquake occurred in north-west China on December 25. From records at nine widely distributed observatories, the U.S. Coast and Geodetic Survey places the epicentre in lat. 40° N., long. 98° E. (Wire Report of Science Service, Washington, D.C., Dec. 27.) This point lies between the towns of Su-chow and An-hsi-chow, near the edge of the Gobi desert, about 300 miles north-west of the epicentre of the great earthquake of 1927. The earthquake must have been very destructive, but, owing to the isolation of the district, weeks may elapse before accounts arrive from the central area.

The Institute for Advanced Study

THE Institute for Advanced Study in the United States was founded in 1930 by a grant of 5,000,000 dollars from Louis Bamberger and Mrs. Felix Fuld. Dr. Abraham Flexner, director of the Institute, has announced that it will be opened in the autumn of 1933, and will be housed temporarily in Fine Hall, the graduate mathematics building at Princeton University. Prof. Albert Einstein has accepted a life appointment as head of the Institute's School of Mathematics. Prof. Einstein will make his home at Princeton; he will be in residence at the

Institute annually from October 1 until April 15, beginning next autumn, and will make a yearly visit to Germany. He will devote all his time to the Institute, and his trips abroad will be vacation periods at his summer home outside Berlin. The following appointments have also been made: Dr. Walter Mayer, of Berlin, Prof. Einstein's assistant, to be associate in mathematics; Prof. Oswald Veblen, generally recognised as one of the leading American mathematicians, and at present professor of mathematics in Princeton University, to be professor; Dr. J. L. Vanderslice, a young Princeton graduate student who has been Prof. Veblen's assistant at Princeton, to be his assistant at the Institute.

THE Institute will be unique among American institutions of higher education, being based upon ideas designed to make it 'a scholar's paradise'. It will concentrate its aim exclusively upon quality in the selection of its teachers and students, and in the nature of its work in scholarship and research. It is hoped that the Institute will accomplish certain definite things in setting a new trend in higher education in America. The salaries paid to its staff and faculty will be on such a scale as to show how much greater results may be obtained when teachers are freed from the necessity of seeking additional remuneration outside the university, and the entire staff of professors and assistants will be on the full-time basis of employment. More emphasis will be laid upon the individual among university graduates, and it is expected to attract students of an independent turn of mind. In order to further this aim of individualism, the Institute will remain entirely separate from any conventional university or college conception. Dr. Flexner makes it clear that while the Institute will occupy temporary space in a Princeton building, it will not be a part of Princeton University. The Institute will consist of a series of schools the first of which will be the School of Mathematics; the second, it is hoped, will be a School of Economics and History. It will be exclusively post-graduate.

'Ethnogenics'

CAPT. GEORGE PITT-RIVERS has published in amplified form (*Human Biology*, vol. 4, No. 2) an address originally given before the Section H (Anthropology) of the British Association, in which he coins the term 'ethnogenics' for "the study of those forces, amenable to social control, which may influence the fertility and survival rate of variations of type in a population". He discusses the early history of anthropology, its long period of infancy as a science, and the reasons why anthropologists continue to regard it as an infant science. This appears to arise from a failure to agree about the scope of anthropology or as to how its subject matter should be classified. The view is emphasised that the progress of anthropology depends on a re-synthesis of its various branches, biological and cultural, including eugenics, genetics, demography, population questions and psychology. The concep-

tions of race, population and culture as the tripartite aspects of man in time, conditioning and being conditioned by the environment—all are included in the implications of race-population change or ethnogenics. The need for studies of racial, social and economic disintegration among civilised as well as primitive peoples is emphasised.

Expedition to Northern Iraq

THE departure is announced of a joint expedition of the British Museum and the British School of Archaeology in Iraq (Gertrude Bell memorial) to conduct excavations at Arpachiyah, on the upper Tigris, four miles east of Nineveh. The expedition will be under the direction of Mr. M. E. L. Mallowan, who was with Dr. R. Campbell-Thompson at Nineveh last year. The choice of site has been determined by the fact that it is the only known prehistoric site in northern Mesopotamia. The investigation on which Mr. Mallowan was engaged last year on the neighbouring site of Nineveh reached virgin soil at a depth of 92 ft., of which 72 ft. was prehistoric material, and revealed evidence of five stages of culture, ranging in date from about 3000 B.C. (Stage 5) to about 5000 B.C., polychrome pottery being found in Stage 2, which in its earliest form showed affinities with Samarra ware. At Arpachiyah evidence of culture comparable with that from the archaic levels at Ur, Kish and Erech has been found and the surface finds are similar to material from the bottom of a pit at Nineveh. It may, therefore, be expected with some confidence that excavation at Arpachiyah will yield evidence which will much enlarge knowledge of the very early periods of civilisation in northern Mesopotamia.

Spike Disease in Indian Sandal

AN editorial article in the September number of the *Indian Forester* (vol. 43) deals with progress in forestry research. The writer commences by directing attention to the report of the seventh Spike Conference (reproduced in this number). It is more than thirty years since the first attempts to study the spike disease of sandal were made. Sandal is one of the major forest products throughout southern India, and the value of the trade in this precious timber amounts to 30-40 lakhs of rupees annually, apart from the market value of the sandalwood oil. Most of the sandal-bearing forests are affected by the spike disease, the presence of which reduces the sandal output by about half, and in many places has killed out valuable crops. So far, in spite of the close study made, no cure has been found and the issue is complicated owing to the sandal being itself a parasite and unable to flourish without some other tree species as a host. The various governments affected have combined in the research work which is now being conducted on an intensive scale. Spike disease of sandal is but one out of many problems which await the investigator in Indian forest research. The Government forest estate alone covers an area of 160,000,000 acres; the forest area in the Indian States covers 45,000,000 acres; whilst in addition

there is an even larger area of private and village forest lands. Probably about half of the 160 million acres of forests under the control of the Indian Forest Department are commercially productive, the other half being conserved for the use of right holders or serving as purely 'protection forests'. In spite of this, the revenue has risen from 70 lakhs (a surplus of 17 lakhs) in 1870 to 6 crores of rupees (surplus $2\frac{1}{2}$ crores) in 1930. Research has, so far, cost Rs. 3.6 per square mile, as against a surplus of Rs. 105 per square mile.

Agricultural Research in Great Britain

THE report on the agricultural research work carried out in Great Britain with the aid of State funds during the year 1930-31 has now been published by the Ministry of Agriculture (London: H.M. Stationery Office, 1932). The volume, which aims at presenting in convenient form the progress made at the various research institutes and other centres in Great Britain, is planned on the same lines as that issued in the preceding year, with the additional feature of a list, at the end of each report, of papers published during the year by the institute or research centre in question. References to the papers will be found in the text, and the lists will take the place of the annual volumes of "Abstracts of Papers on Agricultural Research in the United Kingdom", the publication of which has been discontinued. It is evident that many important results have been obtained in a number of branches of the subject, but the investigations are too numerous and cover too wide a field to allow of even brief reference being made to them individually. Those desiring further information regarding any subject dealt with in the reports are invited to communicate with the director or other persons concerned, for which purpose a list of names and addresses of directors of research institutes and persons in charge of investigations at other centres is given in the appendix.

High Pressure Boilers

A PAPER on high pressure boilers read to the Institution of Electrical Engineers on December 15 by C. H. Davy and C. H. Sparks gives an interesting account of the development of the use of very high pressure steam in modern boilers. Prior to 1918, no plants had been placed in commercial service with steam pressures exceeding 350 lb. per sq. in. In 1923 the Edison Company at Boston ordered the first boiler unit suitable for a pressure of 1,200 lb. per sq. in. The construction of this boiler was made possible by the use of the first seamless forged steel boiler drum. Recent developments of X-ray technology have given the manufacturer of welded drums the long sought non-destructive test. A definite proof of the satisfactory condition of a metallic arc fusion weld can now be given by radiographic examination. By means of scientifically controlled welding, drums can be produced which are more suitable for working conditions than the riveted structures used in the past. The drums forming part of the 1,400 lb. per sq. in. pressure sectional boilers at present being

installed at the Dagenham plant of the Ford Motor Co. are 45 ft. long, 48 in. in internal diameter, 5 in. thick and weigh 62 tons. The production of such forgings reflects great credit on the forge-masters. Whilst the trend of invention has been definitely towards higher final steam temperatures, it is probable that these will be limited, at least for the present, to below 850° F. This is due to the fact that the cost of 'special' steels is still very high and so it is not economical to use them. The Philip Carey Works at Ohio, which started last year, use a steam pressure of 1,800 lb. per sq. in. The demand for high pressures and consequently high temperatures continues for power stations but super-pressure boilers are mainly used in industrial work.

Map of East Greenland

A NEW map on a scale of 1 : 200,000 of the coastlands of East Greenland between Sofia Sound in about lat. 73° N. and Young Sound in about lat. 74° 10' N. based on surveys by Norwegian expeditions in 1929 and 1931 has been published by Norges Svalbard og Ishavs-Undersökelse. This includes the coasts to the north and south of the Norwegian meteorological observatory at Myggbukta in Mackenzie Bay in lat. 73° 29' N., long. 21° 34' W. This coast was first sighted by Hudson in 1607 and has since been explored by various expeditions, including those of Clavering in 1823, Nathorst in 1899 and in the north by Wordie in 1926. While much detail is still omitted, the new chart shows many advances on previous ones.

Anti-Veterinary Propaganda

IN the autumn issue of *The Fight Against Disease*, the quarterly journal of the Research Defence Society, attention is directed to the attacks which anti-vivisectionists, and notably the National Anti-vivisection Society, have made and persist in making on the Royal Veterinary College and on any other organisation which helps to further veterinary science, with attempts to divert funds from the Tail Waggers' Club. In regard to the last named, the governors of the College have stated that no part of the funds or income arising therefrom is applied in vivisectional experiments. Prof. F. T. G. Hobday, whose name appeared in the New Year honours list as the recipient of a knighthood, the principal of the Royal Veterinary College, in the recent Alexander Pedler Lecture of the British Science Guild (British Science Guild, 6 John Street, London, W.C.2. 1s.), also emphasises the humane side of veterinary practice for the animals themselves, and declares our deep and heavy responsibility in ensuring that we act humanely towards the animals in our charge.

Collecting and Preserving Worms

A USEFUL guide for the collector, No. 12 of the British Museum (Natural History) series of "Instructions for Collectors", deals with the various groups of worms. Short descriptions and illustrations are given of the characteristic features of the main groups, with hints as to the places where they are

likely to be found. But the most serviceable features are the precise instructions for collecting worms, free and parasitic, and for anaesthetising and preserving them. The pamphlet, of 22 pages, is sold at the British Museum (Natural History) at 6d.

Ultra-Violet Light at British Health Resorts

FIGURES of the amount of ultra-violet light enjoyed by thirty-two British health resorts during the summer months, July, August, and September, are given in *Sunlight* (vol. 2, No. 7, p. 209). St. Ives heads the list with a daily average of 6.6 'units', and none had less than 1.3 units. Half a unit is sufficient to cause perceptible sunburn.

Spring Lectures at the Royal Institution

THE session of public afternoon lectures at the Royal Institution was opened by Prof. J. C. McLennan, who is giving an experimental course on the work on "Low Temperatures and Low Temperature Phenomena" with which he and the University of Toronto have been specially identified. A course on "Recent Advances in Genetics" is to be given by Prof. J. B. S. Haldane, who has recently returned from a visit to the laboratories at the University of California and elsewhere in the United States. Later courses are by Sir William Bragg, who will review the progress in the past twenty years of the science of crystal analysis by X-rays; and Mr. A. R. Hinks, secretary of the Royal Geographical Society, on "Geography in the Public Service". Mr. Hinks will speak on the new one inch Ordnance Survey map, and the delimitation of national boundaries. Lord Rutherford will give a Saturday course on the "Detection and Production of Swift Particles". The course will be experimental, and as a part of his subject Lord Rutherford will describe the recent progress at the Cavendish Laboratory by Chadwick, Cockroft and Walton and others. Sir James Jeans will give a course on "Modern Astronomy". The new Fullerian professor of physiology at the Royal Institution, Prof. G. Elliot Smith, will give a course on the "Evolution of the Mind". The session will conclude with a display of films, entitled "Developments in Cinematography". Instructional films, colour films, and films in relation to aeronautical research will be shown.

Announcements

AT a meeting of the Harrison Memorial Prize Selection Committee on January 13, the Harrison prize for 1932 was awarded to Dr. H. J. Emel us, of the Imperial College of Science, London.

THE Gold Medal of the Royal Astronomical Society has been awarded this year to Dr. V. M. Slipher, director of the Lowell Observatory, for his spectroscopic researches on planets, stars and nebulae. Dr. Slipher has been invited to deliver the George Darwin Lecture for 1933. At the annual general meeting of the Society on February 10, the president, Dr. H. Knox-Shaw, will deliver an address on "The Distances and Motions of the Extra-Galactic Nebulae".

THE following have been appointed to the Safety in Mines Research Board: Dr. C. V. Drysdale, director of Scientific Research at the Admiralty, Mr. F. Edmond, chief mining agent to the Wigan Coal Corporation, Ltd., and Major H. M. Hudspeth, chief mining engineer to the Board. The appointment of Prof. J. F. Thorpe would normally have ended on December 31 last, but Prof. Thorpe has accepted a special extension of his term of service for a period of two years. Prof. C. H. Lees, whose appointment was specially extended at the end of 1931, has now completed his term of service.

DR. R. R. MARETT, Rector of Exeter College, Oxford, has been appointed Donnellan lecturer for 1933 in Trinity College, Dublin. The lecture will probably be delivered in the second week in May. An earlier date than usual is being arranged to suit Dr. Marett's other engagements. He has announced the subject of the lecture as "Pre-theological Religion in Feeling, Thought and Action".

A COURSE of four public lectures entitled "An Introduction to Indian Archaeology" will be given by Mr. F. J. Richards, honorary lecturer in Indian archaeology at University College, London, beginning on Tuesday, January 24, at 5.30 P.M., and thereafter at the same time on each Tuesday until February 14. The subjects of the lectures will be: physical factors; human factors; religious complexities; arts, useful and otherwise. The lectures are open and the public will be admitted without fee or ticket.

By arrangement with the Polytechnic, Regent Street, London, and the National Illumination Committee and the Illuminating Engineering Society, a course of ten lectures on illumination will be given at the Polytechnic on Wednesdays beginning February 8. The lectures will deal with various aspects of illumination and will be delivered by experts in the respective subjects. Further information can be obtained from the Director of Education, The Polytechnic, 309 Regent Street, W.1.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A whole-time abstractor and translator (at Sheffield) for the Safety in Mines Research Board—The Under-Secretary for Mines, Establishment Branch, Cromwell House, Dean Stanley Street, Millbank, London, S.W.1 (Feb. 4). A public and agricultural analyst and gas examiner for the County of Derbyshire—The Clerk to the County Council, County Offices, Derby (Feb. 4). A librarian for the Halesowen Urban District Council—The Clerk, Cornbow House, Halesowen (Feb. 10). A specialist in biochemistry and physiology in relation to food and nutrition in the medical staff of the Ministry of Health—The Director of Establishments, Ministry of Health, Whitehall, S.W. (Feb. 13). A metropolitan meat industry commissioner for the Government of New South Wales—The Minister for Public Works and Health, Department of Public Health, Sydney, Australia (March 31).

Letters to the Editor

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, nor to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. No notice is taken of anonymous communications.]

Characteristics of Highly Active Vitamin A

THE recent publications of Karrer, Morf and Schöpp¹, and of Heilbron, Heslop, Morton, Webster, Rea and Drummond², have pointed to the conclusion that the highest concentrations of vitamin A they were able to obtain were almost pure. We have recently been able, by the help of high-vacuum technique, to prepare a much more highly active vitamin A. The physical data relating to our preparation are recorded below.

For the final stages of purification a pumping system with a limiting pressure of 10^{-7} mm. was employed, and the vacuum was of the order of 10^{-5} mm. The conditions of distillation were such as to secure vaporisation with as small a path of traverse as possible for the molecules from the evaporation surface to the condensation surface, the mean distance being 12 mm. for an evaporation area of 30 sq. cm. Provision was made to regulate the heat input so that the end point of distillation of the various fractions might be as sharp as possible, a temperature advance equal to about 5° – 7° C. being necessary to bring about the commencement of distillation of the next higher fraction after removal of the main fraction. By this means it was possible to effect separative distillation over a range of temperatures between 115° and 170° C. The fraction boiling between 136° and 137° C. gave physical constants and figures on analysis which lead to the conclusion that the substance is a purer vitamin A preparation than has hitherto been described. They are as follows:—

The antimony trichloride blue value is 78,000.

Spectroscopic figures:

(1) From the colour produced with antimony trichloride

| | | | | |
|----------|---|------------|---------------|-------|
| <i>E</i> | { | 1 per cent | 693 m μ . | 465 |
| | | 1 cm. | 617 m μ . | 5,000 |
| | | | 580 m μ . | 2,600 |

(2) Direct spectrophotographic measurement:

| | | | | |
|----------|---|------------|---------------|-------|
| <i>E</i> | { | 1 per cent | 328 m μ . | 1,600 |
| | | 1 cm. | | |

The figures for the purest vitamin A previously obtained by Heilbron and his colleagues were: Antimony trichloride blue value of 65,000.

| | | | | | |
|-----|----------|---|------------|---------------|-------|
| (1) | <i>E</i> | { | 1 per cent | 693 m μ . | 450 |
| | | | 1 cm. | 617 m μ . | 4,650 |
| | | | | 580 m μ . | 2,550 |

| | | | | | |
|-----|----------|---|------------|---------------|-------|
| (2) | <i>E</i> | { | 1 per cent | 328 m μ . | 1,370 |
| | | | 1 cm. | | |

Ultimate analysis gave the following figures: C = 83.5 per cent, H = 10.6 per cent, which are in excellent agreement with the formula suggested by Karrer, C₂₀H₃₀O, requiring C = 83.9 per cent, H = 10.5 per cent. It has also been found that the product in alcoholic solution shows no optical rotation.

The biological test showed that 0.0006 mgm. a day administered to rats gave slightly better growth than 0.001 mgm. (or 1 unit) a day of International

Standard Carotene. This dose sufficed to cure xerophthalmia.

We desire to express our thanks to Miss K. Culhane for the biological test and to Prof. Heilbron and Dr. Morton for much help with the analysis and physical determinations.

FRANCIS H. CARR.
WILLIAM JEWELL.

The British Drug Houses, Ltd.,
Graham Street, London, N.1.
Jan. 10.

¹ *Helv. Chim. Acta*, **14**, 1431.

² *Biochem. J.*, **28**, 1178.

Irradiation of Nucleic Acids and Uracil

GUHA and Chakravorty¹ recently announced the formation of vitamin B₁ by the ultra-violet irradiation of adenine sulphate. We wish to report similar experiments with nucleic acids and uracil.

Studies of the relation of the constituents of the cell nucleus to the effects of ultra-violet light on cells led us to examine the absorption changes of these materials upon irradiation with various ultra-violet wave bands². In the course of these investigations, we were struck by the fact that modifications of the spectra of these materials upon irradiation—more particularly if wave-lengths shorter than 2900 Å. were excluded—brought them into close resemblance to the spectra of certain B₁ concentrates³. The similarity of the sources of B₁ and these materials, and the observation that uracil and adenine acquire the ability upon irradiation of reducing arsenophotungstate solutions³—a colour test held by some to be a property of vitamin B₁—suggested that B₁ might be a modified purine or pyrimidine of the type produced by the irradiation of such materials.

In most of the experiments by which we undertook to test this hypothesis, thymus and yeast nucleic acids were used, since, as each contains four nitrogen bases, any activation of either or all of these to any or several of the components of the vitamin B complex might, we thought, be so secured. The injection of irradiated nucleic acids into polyneuritic rats appeared in some instances to indicate moderate vitamin B₁ activity. Indeed, one apparent cure resulted from the administration of irradiated uracil. But careful examination of the results with large numbers of animals made it appear that the positive effects should be attributed to variability of the rats, and it was necessary to conclude that ultra-violet irradiation was probably ineffective in producing vitamin B₁ from these substances. Our irradiated materials were also tested for vitamin B₂ potency, with negative results. A paper by one of us describing these experiments is now in press⁴.

The negative results are borne out by the fact that our more recent spectrographic work^{5,6} indicates vitamin B₁ to be characterised by a maximum at 2600 Å., whereas the absorption changes believed at first to be associated with the production of vitamin B₁ were mainly in the shorter wave region³. Our studies of the absorption spectrum of irradiated adenine sulphate² show it to be less, rather than more, similar to what we now believe to be the characteristic spectrum of vitamin B₁^{5,6}.

The reported finding of sulphur in the most potent vitamin B₁ concentrates⁷, is another factor which now makes it seem unlikely that any sulphur-free base could yield vitamin B₁ upon irradiation. That irradiation could introduce sulphur as an integral

part of the molecule from the sulphuric acid bound by the base appears a very remote possibility.

Aside from these arguments, it is possible that if adenine is the only precursor of vitamin B₁ in the nucleic acids, one might fail to find activity upon irradiating nucleic acids, but succeed in finding it upon irradiating adenine sulphate, either because of the higher concentration of the material capable of activation in adenine sulphate solutions, or because the chemical binding of adenine to other constituents might prevent its activation when a part of the nucleic acid molecule.

FRANCIS F. HEYROTH.
JOHN R. LOOFBOUROW.

Basic Science Research Laboratory,
University of Cincinnati,
Cincinnati, Ohio.
Nov. 30.

¹ NATURE, 130, 741; 1932.

² Heyroth and Loofbourow, *J. Amer. Chem. Soc.*, 53, 3441; 1931.

³ Heyroth and Loofbourow, *Bull. Bas. Sci. Res.*, 3, 237; 1931.

⁴ Heyroth, *Bull. Bas. Sci. Res.*, 4, 119; 1932.

⁵ Heyroth and Loofbourow, NATURE, 130, 773; 1932.

⁶ Heyroth and Loofbourow, *Bull. Bas. Sci. Res.*, 4, 35; 1932.

⁷ Windaus, et al., *Z. physiol. Chem.*, 204, 123; 1932; Kinnersley, O'Brien and Peters, *J. Physiol.*, 76, 17P; 1932.

Meaning of Neoteny and Pædogensis

FOR a scientific term to be of value it is absolutely necessary that in all circumstances it should be used with strict regard for its definition; otherwise only confusion of thought and faulty argument can result. This should be obvious, but unfortunately some terms readily lend themselves to misuse. 'Pædogensis' and 'neoteny' are terms the definitions of which have been treated with very scant respect. Because of the confusion that has resulted it seems desirable that attention should be directed both to the origins of these words and to their real significance.

The term 'pædogensis' was first proposed in 1866 by K. E. von Baer¹ who was writing of the phenomena which had recently been observed in *Miastor*, and it is quite clear that he regarded pædogensis as a form of parthenogenesis. The fact that von Baer regarded parthenogenesis as a form of asexual reproduction does not affect the definition.

O. Hamann² (1891), when he described an Acanthocephalan which became sexually mature in the larval stage, was one of the first to misuse the term 'pædogensis'. This was noticed by Chun,³ who when defining 'dissogony' protested against Hamann's use of 'pædogensis'. It may be noted here that Hamann was the first to propose the idea of evolution taking place on a large scale by means of 'pædogensis', an idea which in a modified form finds favour with some modern authors, notably Prof. W. Garstang⁴ and Mr. G. R. de Beer.⁵

Kollmann⁶ was the first to use the term 'neoteny', and he used it to describe the phenomena which had been observed in the Amphibia. He distinguished between 'partial neoteny', which is said to occur when metamorphosis is delayed beyond the normal period, for example, the wintering of certain tadpoles; and 'total neoteny', which is found in the case of the Axolotl, where the animal retains its gills but becomes sexually mature.

'Neoteny' and 'pædogensis' therefore indicate two distinct phenomena. In 'pædogensis' a form of parthenogenesis is found, but in 'neoteny' we see a case of normal sexual reproduction. The distinction between the terms is clear cut and is of biological importance.

In re-defining the terms under discussion, Mr. de Beer has disregarded their origins and the definitions of their authors. So he uses 'neoteny' as a wide term which implies an alteration in the rate of development of the germen as compared with that of the somatic tissues: an idea which cannot be brought into line with Kollmann's views. This alteration may be brought about in a number of ways; if by the speeding up of the rate of ripening of the germen, that of the somatic tissues remaining constant, 'pædogensis' will result, and Mr. de Beer considers that the most perfect cases of this are those of *Miastor* and *Polystomum integerrimum*; if the acceleration has not proceeded so far a case like that of the Axolotl will result. On this view all these cases are different aspects of the same phenomenon.

It is very doubtful whether the matter should be considered in this way; it would appear to be giving the status of a fundamental biological concept to the observed fact that in a few isolated cases in the animal kingdom the normal relation between the rates of ripening of the germen and of the somatic tissues, as judged by observations on the majority of closely related species, has become modified.

That such a state of affairs has been brought about by changes in the external environment is undoubted, and in the case of the Ctenophores described by Chun⁷ this is abundantly clear. It is impossible therefore to consider the sporadic occurrence of the early ripening of the germen as more than a fortuitous happening; and it would appear to be of more value to use the words 'pædogensis' and 'neoteny' to distinguish forms of parthenogenesis and normal sexual reproduction respectively than to combine under them isolated examples having no biological relationship and drawn at random from all over the animal kingdom.

We are thus brought to the conclusion that the cases of the Axolotl, the Ctenophores and the Acanthocephala are cases of 'neoteny', whilst 'pædogensis' occurs only in the insects; the case of *Polystomum integerrimum*, in which the fusion of gametes is said to occur, must be regarded as 'neoteny' in an hermaphrodite animal.

To those who incline towards the view that evolution on a large scale has taken place by the process of the shortening of the ontogeny, it may be pointed out that in discussions on this subject the older definitions of 'pædogensis' and 'neoteny' are of great importance, for it is obvious that if the ontogeny were to be shortened in a truly pædogenic form sexual reproduction would be lost to that species.

In conclusion it must be noted that 'dissogony' must be regarded as a form of 'neoteny', Chun himself having compared the phenomenon which he had observed with the case of the Axolotl, and contrasted it with the phenomena seen in *Miastor*.

G. E. H. FOXON.

Department of Zoology,
University of Glasgow.
Nov. 17.

¹ *Bull. Acad. Imp. Sci. St. Petersburg*, T.9.

² *Jena. Z. Naturw.*, Bd. 25.

³ "Festschrift z. siebenzigsten Geburtstag Rudolf Leuckarts". Leipzig.

⁴ *Quart. J. Micr. Sci.*, London. Vol. 72, 1929.

⁵ "Embryology and Evolution". Oxford, 1930.

⁶ *Verh. naturf. Ges. Basel*, Bd. 7.

⁷ "Fauna und Flora des Golfes von Neapel". Monographie I, Ctenophoren.

Oxidase of the Crystalline Style

MY observation of the occurrence of an oxidase system in the crystalline style of *Saxidomus giganteus*, *Paphia staminea* and *Mya arenaria*¹ has been confirmed by Yonge in that of *Ostrea edulis*, but in this case the reaction of the style extract to guaiacum was found to be extremely feeble².

Recently I have had the opportunity of testing the crystalline styles of three species of oyster (*O. virginica*, *O. lurida* and *O. gigas*) for oxidase and have found the reaction to guaiacum quite marked. There is considerable variation in each case in the activity of extracts made under identical conditions from different batches of crystalline styles, depending, apparently, on the condition of the styles, which is affected very quickly by small changes in environment, but each species has yielded extracts equalling, or exceeding, in oxidase activity those from *Saxidomus giganteus* made in precisely the same way and tested with guaiacum.

In addition to those species already mentioned, *Schizothaurus Nuttalli*, *Cardium corbis* and *Bankia (Xylotrya) setacea* have now been found to contain the oxidase system in their crystalline styles. It is probably of general occurrence in the lamellibranchs.

C. BERKELEY.

Pacific Biological Station,
Nanaimo, B.C.
Dec. 9.

¹ Berkeley, C., *J. Exp. Zool.*, **37**, 477; 1923.

² Yonge, C. M., *J. Mar. Biol. Assoc.*, N.S., **14**, 369; 1926-27.

Nutritional Condition of Sheep and Susceptibility to Stomach Worm

THE important influence of the nutritional condition of the host in resisting worm infestation has been demonstrated by Zimmermann *et alia*¹, Ackert *et alia*^{2,3,4} in chickens, Foster and Cort^{5,6,7} and Nagoya⁸ in dogs, Kobashi⁹ and Chandler¹⁰ in rats. The problem is one of supreme importance in sheep, the parasitic infestation of which frequently constitutes a limiting factor in the carrying capacity of pastures. The number of sheep on a farm may be limited by the potential infectivity of the pasture, rather than by the amount of grazing it provides. Since the information derived from the experiments of these workers would appear to have a very important bearing on the control of parasitic gastritis in sheep, an experiment was commenced in the spring of 1932 to determine the degree to which differences in clinical condition produced by nutritional means might affect the degree of parasitic infestation of sheep exposed to an equal chance of infection.

Forty lambs were taken from their dams soon after birth and fed in concrete pens (sawdust used as bedding) on cow's milk, meals and grass cut from pastures which had never been grazed with sheep or cattle. At the age of three months the lambs were divided into two groups of sixteen (eight having died), the two groups being comparable in weight and appearance. One group was given 7-8 lb. of green tares and oats per head daily. The other group received, in addition to the tares and oats, three pints of separated milk and one pound of mixed meals daily. Faecal examination on three separate occasions showed that no helminth eggs were being passed.

When four months old the lambs were grazed on worm infested pasture. At this period the average

weight of the poorly-fed group was 60 lb. and of the well-fed 84 lb. The well-fed group continued to receive 1 lb. a head of meals, but the separated milk was discontinued.

After six weeks grazing the lambs were slaughtered, their fourth stomachs removed intact and the worms counted. The average number of worms in the poorly-fed group was 103, in the well-fed 31. There was a surprising individual variation within each group, the numbers in the poorly-fed group ranging from 0 to 222 and in the well-fed group from 2 to 76. Statistical analysis of the results, kindly undertaken for us by Dr. Tocher, showed that the difference between the two groups was significant and that the chances against the group difference being fortuitous were 1,400 to 1.

It may therefore be deduced that under natural conditions of infection, the nutritional state of the sheep plays a significant part in determining the degree of its susceptibility to stomach worm infestation.

A. H. H. FRASER.
D. ROBERTSON.

Rowett Institute, Aberdeen,
and

North of Scotland College of Agriculture,
Aberdeen.

¹ Zimmermann, N. B., Vincent, L. B., Ackert, J. E., *J. Paras.*, **12**, 164; 1926.

² Ackert, J. E. and Spindler, L. A., *Amer. J. Hyg.*, **9**, 292; 1929.

³ Ackert, J. E., McIlvaine, M. F. and Crawford, N. Z., *Amer. J. Hyg.*, **13**, 320; 1931.

⁴ Ackert, J. E. and Nolf, L. O., *Amer. J. Hyg.*, **13**, 337; 1931.

⁵ Foster, A. O. and Cort, W. W., *Science*, **73**, 681; 1931.

⁶ Foster, A. O. and Cort, W. W., *Amer. J. Hyg.*, **16**, 241; 1932.

⁷ Foster, A. O. and Cort, W. W., *Amer. J. Hyg.*, **16**, 582; 1932.

⁸ Nagoya, T., *Jap. J. Exp. Med.*, **9**, 573, 587, 595, 603; 1931.

⁹ Kobashi, S., *J. Chosen Med. Assoc.*, **22**, 31; 1932.

¹⁰ Chandler, R. C., *Amer. J. Hyg.*, **16**, 750; 1932.

Local Lists of Animals

MAY I make a mild protest against the rather derogatory remarks about local lists of animals in the notice of Bolam's "Birds of Northumberland" in NATURE of December 3 (p. 841)? Natural history studies have made great progress in recent years by the methods practised by Mr. Nicholson, Mr. Elton and others, which find expression in the excellent new *Journal of Animal Ecology*. But because the new is very good, it does not follow that the old is bad: the two are surely complementary.

Local lists are the basis of our knowledge of geographical distribution and there is still plenty to be done at that. The facts for the various groups of animals in Britain are certainly not yet fully known; even when the data must be adequate (for example, Lepidoptera, Coleoptera) they have not been put together as they have for plants and Mollusca and so made generally available. I much hope that before long the Entomological Society and similar bodies will see that this is done; it will make the interest of internal distribution much more obvious.

The time, too, is just coming when local lists are beginning to have some historical interest; some things have remained as they were, some have changed, and changes are, I believe, of more than usual interest among the very birds with which the note in NATURE deals.

These considerations concern the benefit of naturalists in general. Local lists are also of great help to the individual who likes going about the country trying to understand what he sees, because they give him some definite object in pursuit of which he picks up all sorts of good knowledge.

It is, I suppose, just a natural human passion to like to have something definite to do, just as it is to find out something which no one else knows. To observe the beetles of the parish of Edvin Loach in a diffuse and general way probably leads nowhere except to an interest in something else; to set out to make a list of them is a defined purpose which will have the stimulus and joy of approximate achievement and be punctuated by exciting discoveries—new to the parish, new to the county, possibly new to Britain. Incidentally, it will lead to the accumulation of a great deal of knowledge of how the local beetles live and breed, and possibly to the differentiation of fresh forms; the list will, of course, be all the better if some of this is incorporated.

Local lists are, in short, one of the classical techniques of natural history in Great Britain; they have been the framework in which much of the best work has been set, and there is, I think, every reason to expect that the method will be equally fruitful in the future. The average naturalist has not generally got very much spare time and he cannot be a trained scientific biologist, but he can and does serve the same ideal to very good effect.

Dec. 10.

A. E. BOYCOTT.

Inheritance of Acquired Characters

IN NATURE of October 1, p. 508, is published an interesting communication from A. F. Dufton to the effect that the fathers of eminent persons tend to be older at the time of birth of the eminent (or shall we say pre-eminent?) child than is typical of fathers of children who do not attain eminence. Mr. Dufton's communication is a confirmation on a more extensive scale of a relationship reported by Francis Galton¹, A. H. Yoder², and Havelock Ellis³, in their more limited studies. It is in keeping with the discovery by Minnie L. Steckel⁴ of a positive correlation between age of parent and intelligence of child among the school population of Sioux City, Iowa.

In NATURE of October 15, Dr. R. A. Fisher comments upon Mr. Dufton's letter, one of his suggestions being that "A more satisfactory comparison would be between the ages of paternity for eminent persons, and those of their less eminent brothers and sisters". This comparison has been made upon small series by Yoder and by Ellis with conflicting results. Yoder² found the distribution of great men in the older as compared with the younger half of the sibship to be 24 to 13. Ellis³ found a slightly greater frequency of genius in the position of first-born than of genius in the position of last-born (97-67).

There is available, however, more direct evidence of a positive relationship between parent age and intelligence (or between birth order and intelligence, since parent age and birth order are at present inextricably interwoven). In a study⁵ of children examined at the Illinois Institute for Juvenile Research there was found to be a definite tendency for later-born children to exceed their earlier born siblings in intelligence quotient. This finding was confirmed by Dr. Steckel⁶ in a study of nearly 7,000 children in the school system of Sioux City, Iowa. In both of these studies, comparisons were made only between siblings and in this way any possible distortions resulting from a correlation of intelligence with age of marriage or family size were eliminated. That these findings were not due to an inadequate standardisation of the tests is indicated by the fact that these relationships were still present when test

results were re-standardised upon the child populations from which this sibling material was drawn.

While it is entirely possible to explain this relationship by assuming the inheritance of acquired characters, it is, as Dr. Fisher points out, by no means necessary to make this assumption. Parents are apt to be more experienced in child training and in better economic condition when their later children arrive and it is difficult to judge the possible advantage which an older sibling may give to a younger child's intellectual development. If an explanation is to be sought upon the biological level, I personally should be more inclined to seek it in the physiological effects of the prolonged labour and difficult deliveries with their attendant risk of brain damage which are more common with the earlier born children, than in the inheritance of acquired characters.

The question of order of birth in relation to the development of the child has also been discussed at some length by H. E. Jones⁷.

R. L. JENKINS.

Institute for Juvenile Research,
907 South Lincoln Street,
Chicago.
Dec. 10.

¹ Galton, Francis, "Hereditary Genius", Second edition, London: Macmillan, 1892; p. 78.

² Yoder, A. H., "The Study of the Boyhood of Great Men", *Ped. Sem.*, 3, 134-56; 1894.

³ Ellis, Havelock, "A Study of British Genius". London: Hurst and Blackett, 1904.

⁴ Steckel, M. L., "Parental Age and Intelligence of Offspring". *J. Educ. Psychol.*, 22, 212-220; 1931.

⁵ "Order of Birth, Parent-Age, and Intelligence", by L. L. Thurstone and Richard L. Jenkins. Behavior Research Fund Monograph, University of Chicago Press, 1931.

⁶ Steckel, M. L., "Intelligence and Birth Order in Family". *J. Soc. Psychol.* 1, 329-344; 1930.

⁷ Jones, H. E., "Order of Birth in Relation to Development of Child". Chap. vii, Handbook of Child Psychology published by Carl Murchison, Clarke University Press, Worcester, Mass., 1931.

A Method of Extending the Frequency Range of the Cathode Ray Tube

THE cathode ray tube could be employed on several present-day problems if records could be obtained at somewhat higher frequencies than those obtainable at present. The use of brighter tubes, lenses of wider aperture, faster films and higher film speeds should achieve the required improvement. With regard to lenses, where a cinema lens is used the following arrangement should be found useful:—A long focus collimating lens receives the light from the cathode ray tube and renders the rays parallel. A short focus cinema lens of large aperture receives these parallel rays and focuses them on to the photographic emulsion. The reason for using two lenses in preference to a single lens is that these lenses are usually designed to receive parallel rays, and therefore if they receive rays which are not parallel the definition suffers unless the aperture is reduced. It will be noticed that the collimator is a long focus lens compared with the convergent lens. In consequence a reduced image of the end of the cathode ray tube is formed in the plane of the photographic plate or film.

The advantage of this arrangement is that since the image is smaller than the object, the spot of illumination on the plate is correspondingly smaller than that on the end of the cathode ray tube. Consequently, if the plate is moving at a constant rate at right angles to the deflection of the cathode ray, the precision of observation in the direction of travel will be increased in the same proportion as the size

of the spot is diminished. Now the brightness of the spot is also correspondingly increased so that the exposure of any given part of the plate is correspondingly increased. Three alternatives present themselves: (1) to use the usual speed of plate and increase the deflection, in which case the precision of measuring the deflection will be increased in proportion; (2) to increase the speed of the plate, in which case the precision of measuring in the direction of travel is still further increased; (3) to decrease the speed of the plate, in which case it is the precision of measuring the deflection which is increased. These alternatives are summarised for a case in which there was a ten-fold reduction in the size of the image in the following table:

| Alternative schemes. | Speed of plate. | Accuracy of measuring deflection. | Accuracy of measuring in direction of motion of plate. |
|----------------------|-----------------|-----------------------------------|--|
| (1) | 1 | $\times 10$ | $\times 10$ |
| (2) | $\times 10$ | 1 | $\times 100$ |
| (3) | $\div 10$ | $\times 100$ | 1 |

From a consideration of other cases it is found that the product of the improvements shown in the last two columns is approximately equal to the square of the linear reduction in the size of the image. All the above figures have been calculated on the assumption that the aperture of the lens system at the tube is a constant one. The data given above show that accuracy is improved the more the image is reduced in size by the lens system. A limit to the improvement is set by the grain of the photographic emulsion, by the difficulty of designing lenses of large aperture and adequate definition, and also by inaccuracies present in the optical instrument used for making measurements of the photographic records which are obtained.

With regard to suitable lenses there appears to be a definite need for a special lens for cathode ray work. A lens having a numerical aperture of 0.8 or 0.7, a focal length of 25–50 mm. and adequate definition on the film over an area of 3–5 mm. would be useful, on the lines of a well-corrected microscope substage condenser. The end of the modern cathode ray tube which presents to the lens a convex surface makes the obtaining of good definition difficult. It would be better from the optical point of view for the surface presented to the lens to be concave. This might be done by coating a suitably curved glass surface with the fluorescent material and by placing this inside the bulb of the cathode ray tube.

With regard to the camera, since film speeds between 10 and 100 metres per second will be required, the use of the ordinary spools and gate would present difficulties. A suitable alternative would be a motor-driven drum with the film wound round its circumference. Exposures on film $\frac{1}{2}$ –1 m. long could be obtained in this way. A method of exposing such a rapidly rotating film during one revolution only is to drive a worm wheel from the shaft of the film drum, this worm wheel carrying contacts which short circuit the charge on one of the deflector plates of the cathode ray tube. Prior to and subsequent to the short circuit the cathode ray is deflected behind a screen, so that the illuminated spot does not enter the lens. During the temporary short circuit the spot oscillates about its central position and its movements are photographed. With a worm wheel of 20 cm. in circumference driven at one hundredth the speed of the drum the short circuit contacts should be 2 mm. long.

Longer exposures than those given by a single drum rotation could be obtained by winding the

film in a spiral round the drum and causing the lens system to move sideways during exposure, so that the image corresponds approximately to the centre of the film during exposure.

H. HARTRIDGE.

Physiological Laboratory,
St. Bartholomew's Medical College,
London, E.C.1.

Capacitance HygroscoPy and some of its Applications

BEING myself concerned with the properties of both soil and cotton, I read with particular attention the article on this subject by Dr. Lawrence Balls in NATURE of December 17. I have found it difficult to decide exactly how Dr. Balls considers the moisture content of the soil or cotton bale under test affects his condenser reading. From his opening paragraph one might conclude that he believes the dielectric property of water to be the dominant factor. Later, however, he remarks that "variations of resistance in the unknown capacity can also alter the 'capacitance' readings". An instrument which responds to changes in electrical resistance is influenced by the salt as much as by the moisture content. One responding to the high dielectric constant of water contained in a material would, on the other hand, be most valuable. There are some who might easily be misled into thinking that a dielectric constant is involved merely because condensers are used in the measurement. In view of the statement I have quoted, it appears that Dr. Balls is aware that his apparatus measures the equivalent parallel capacity of the system tested.

Suppose a condenser of capacity C and resistance R were connected in series, and tested, the 'capacitance' would be $C/(1 + R^2\omega^2C^2)$. If, for example, $C = 100\mu\text{F}$, and $R = 1,000$ ohms, at a frequency of 2,000 kc., $R^2\omega^2C^2 = 1.66$, and the 'capacitance' measured would be $37.6\mu\text{F}$. If R rose to 2,000 ohms without any change in C , the value would be only $13.1\mu\text{F}$. The systems investigated by Dr. Balls are, of course, more complex than this; but there is nothing in his article to show that the 'capacitance' changes which he observes are not mainly due to resistance effects.

The matter can easily be settled by finding how sensitive the 'capacitance' readings are to frequency. If, in the simple case taken above, R were so high as 10,000 ohms, $R^2\omega^2C^2$ would be large in comparison with 1, and the 'capacitance' measured would be substantially $1/R^2\omega^2C$. The value obtained would therefore change inversely as the square of the frequency, and would fall with increase of C .

In more complicated systems the issue is less clear-cut; but in cases where the measured 'capacitance' varies inversely with the frequency raised to a power between 1 and 2, it is not justifiable, when deducing the properties of the material between the electrodes, to assume it to be a non-conducting dielectric. The frequency test is easily applied, and until the results of it are forthcoming, we are not in a position to place a precise interpretation on Dr. Balls' results.

There is one further point that deserves comment. In connexion with his results with soil, Dr. Balls remarks: "Some very complex curves for changes in soil-capacity with change of moisture have recently been published, determined by a compensated bridge method. They contrast very sharply with such simple curves as Fig. 2, which seem to me to be more inherently

probable." These "complex curves" were obtained by Mr. G. H. Cashen of this Station, and the reason advanced for setting them aside does not seem to me at all convincing. I am inclined to regard simplicity as a craving of the human mind rather than a reality of Nature. In any event, Dr. Balls could probably learn a lot about what takes place at the surface of the iron hoops of his cotton bales by employing a method of as critical a nature as that used by Mr. Cashen; 'surface' or 'electrode' capacity must certainly enter in here.

R. KENWORTHY SCHOFIELD.

Rothamsted Experimental Station,
Harpenden.

Heights of Nuclear Potential Barriers

As a result of experimental work in the past few years on the artificial disintegration of light nuclei and the nuclear scattering of α -particles, we now have a means of estimating the heights of the potential walls surrounding these nuclei. I have collected the evidence from a variety of sources which can be summarised as below.

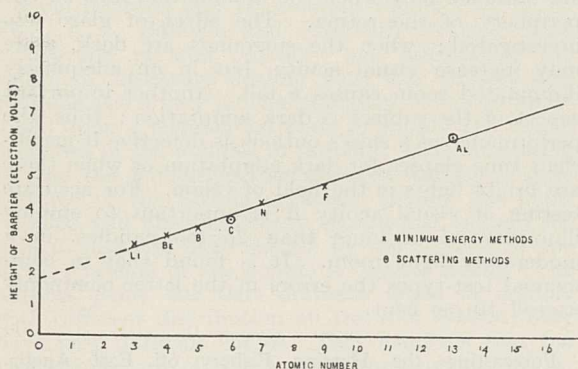


Fig. 1.

(a) *Minimum energy methods*: Here the value of the range of the α -particle of least velocity which will enter the nucleus and cause the emission of either a proton or a quantum of radiation is found. The energy of this particle will correspond to the height of the nuclear barrier.

(b) *Scattering experiments*: The anomalous scattering of α -particles which make close approach to the nucleus gives a measure of the probability of their entry within. The radius of the nucleus for which this scattering is appreciable can be estimated and from this we can deduce the smallest potential for which an observable penetration takes place: this will correspond to the height found by the minimum energy methods.

The heights so found (given in terms of the potential of an α -particle of charge 2) are plotted against atomic number, giving a straight line (Fig. 1).

This therefore suggests the simple rule that *the heights of the nuclear barriers of the light elements are proportional to the atomic number.*

If this relation is true outside the limits of the elements for which evidence exists, then we must conclude that the protons produced from phosphorus by α -particles from polonium (energy 5.2×10^6 electron volts) and potassium with radium C (energy 7.6×10^6 electron volts) are due to resonance with a

virtual α -particle level, since the α -particle will have insufficient energy to surmount the barrier.

The full details of the calculations will be published shortly.

Physics Laboratories,
University of Leeds.

E. C. POLLARD.

Dec. 12.

Corrections to the Times of the P Wave in Earthquakes

A REDISCUSSION of about eighty earthquakes from the International Seismological Summary is in progress. Revised epicentres and apparent times of starting have been found, the revised tables of P recently published by one of us being used. The S tables were not used because it was known that the identification of S is less trustworthy than that of P . The new residuals of P show that the correction needed at distances near 30° is somewhat larger than was found before. In East European and North American earthquakes the tables seem accurate to 15° , but need a correction rising to $+1s.$ at 19° . Then there is a sharp bend in the curve, the corrections needed reaching $-5s.$ about 30° . They remain negative to 58° , and then are positive to 70° , the greatest correction being $+2s.$ At greater distances the corrections needed are small.

Japanese earthquakes show a similar behaviour up to 50° , but beyond that distance they are not suited for determining corrections, since an error in the tables has the same effect on the residuals at the European stations as a displacement of the epicentre to the north-west, which cannot be checked on account of the distribution of the near stations. Oceanic earthquakes seem to show no need of corrections near 30° , but the small number and uncertainty of the observations make the probable error of the times large.

Byerly noticed the bend near 20° in the observations of the Montana earthquake, but it remained to be seen how general it was. Miss I. Lehmann has also, we understand from a letter, detected it in an Azores earthquake. Our data would agree with the existence of a discontinuous increase of velocity with depth, but Miss Lehmann's study of original seismograms seems to favour a continuous though rapid transition.

HAROLD JEFFREYS.

St. John's College,
Cambridge.

K. E. BULLEN.

Viscosity Measurements of Liquids by the Oscillating Disc Method

WITH reference to the advantage of this method described by A. van Itterbeck¹, it may be said² that another advantage it has over the capillary stream method lies in the insensitivity of the disc experiments to the presence of dust particles as compared with the sensitivity of the capillary method.

While, however, the disc method has its advantages in experiment, those who have used this method would probably agree that the accurate calculation of the absolute or relative viscosity of a liquid from the logarithmic decrement is not so satisfactory as the calculation from the capillary method.

Chemical Laboratory,
University of Sydney.

C. E. FAWSITT.

Nov. 11.

¹ NATURE, 130, 399, Sept. 10, 1932.

² Fawsitt Proc. Roy. Soc., A, 80, 290; 1908.

Research Items

Symbolism of the Maze. In *Antiquity* for December Mr. W. F. J. Knight offers the suggestion that the design of the pattern stone of Bryn Celli Ddu is an inaccurately rendered maze formation. He points out that this motive, or the cognate motive of the spiral, occurs on one of the upright stones, and is also the actual structural design of the monument itself. It is assumed that the best kind of explanation of this triple occurrence is some form of magic—a maze embodying the ideas of defence and exclusion and of penetration of the defence. Maze ritual can be identified in the history of the maze form. The Troia, or 'Trojan game', appears to have been a ritual ride of armed horsemen practised in early Italy. Mazes are generally called 'Troys' in northern Europe. Virgil compares the movements of the Trojan game to the intricacies of the labyrinth at Knossos. A maze ritual was connected with the Eleusinian mysteries, the underlying idea being the initiation that leads to perfection, or the penance that leads to Paradise. The maze is also a symbol of secrecy, as in the story of Fair Rosamund. The sacred dance of the Salii at Rome, a protective processional, has been called a 'Troia on foot'. Both Sallian dance and Troia emphasise the distinction between within and without. Thus a maze becomes a protective wall of great magical strength with an entrance difficult for the unauthorised. It would appear that the name Troia is not a literary association, but is connected with a Latin verb denoting some kind of active movement. Troy, therefore, may have taken its name from the game and not vice versa. The connexion between the sites and beliefs of classical antiquity and bronze age Britain is probably to be sought in the rites of the British tumulus folk around their tumuli.

Yuman Music. Miss Densmore's studies of the music of the American Indians have covered Indians of woodlands, plains, high plateau and desert cultures. The songs she has collected among the Yuman and Yaqui of the River Colorado and north-west Mexico (Bull. 110, Bur. American Ethnol.), by contrast, belong to a river culture, based upon a rude, but efficient, agriculture, without irrigation and supplemented by hunting, and a life in settled villages. Among the Yuman the characteristic musical form consists of cycles of songs which are interpreted in legends. Some of the legends can be related in about nine hours, while others are longer. The story is told in the common language, but that of the songs is old and cannot be understood by anyone, the songs being learnt with the music by rote. The songs are episodic to the narrative. There is dancing in a few, but not all, of the cycles. In the deer dance and the corn dance only of those described do the dancers encircle the musicians. The characteristic form of the songs is periodic with one, two, or occasionally three, long periods and one short period containing the most pleasing part of the melody. There are rules for the repetition of the periods, but they are not strictly observed, especially by a good singer. Often they are sung for a larger number of times than is prescribed by the rule. The accompaniment shows great variety in rhythm. The songs are accompanied by rattle and by basket drum and also by nasal grunting and the pounding of feet. The grunting was used especially in hunting songs.

There were two varieties of flute, and although there were no love songs, they were used by players standing in a group to attract the attention of the girls.

Measurement of Visual Acuity. In a report to the Medical Research Council (Special Rep. Ser., No. 173. London: H.M. Stationery Office. 1s. 6d. net) R. J. Lythgoe and Dorothy E. Corkill deal with the relation between visual acuity and illumination. Visual acuity, which in the wide sense includes the ability of the visual apparatus to appreciate contour differences, discrimination of two points, and legibility, is dependent upon physical, physiological and psychological factors. It is still widely held that visual acuity is at a maximum at an illumination of 3-4 foot-candles, and artificial illuminants giving more than 10 foot-candles are sometimes condemned. Values of more than a hundred times this figure are, however, frequently met with, and there is no doubt that acuity is considerably better under these high illuminations, though the rate of improvement is a constantly diminishing one with illuminations higher than 100 foot candles. High values of visual acuity are obtained only when the illumination falls on the periphery of the retina. The effect of glare was investigated; when the surrounds are dark, glare may increase visual acuity, but in an adequately illuminated room causes a fall. Another important aspect of the subject is dark adaptation; thus, the performance of a ship's outlook is defective if insufficient time elapses for dark adaptation or when there are bright lights in the field of vision. For accurate testing of visual acuity it is important to employ illuminations of more than 25 foot-candles, in a moderately light room. It is found that in commercial test-types the errors in the letter commonly exceed 10 per cent.

Forecasting the Herring Fishery off East Anglia. The readings of the annual rings upon the scales of herring and their correlation with the size of the fishes have given a clue to the sorting out of herring shoals in year groups. This in turn reveals the years which are prolific in young fish, and enables the fate of any year-group to be traced through succeeding years. Always provided that the sampling of the shoals provides a fair picture of the proportions of the year-groups and that the scientific analysis is accurate, these methods allow of an approximate forecast of the potentiality of the fishery for several years ahead. Dr. W. C. Hodgson summarises the results of his analysis of East Anglian herring shoals from 1923 until 1931, and shows how the data for 1923-30 were used to make a forecast of the 1931 season, the estimated result showing a close agreement with the actual catch (*J. Animal Ecology*, vol. 1, p. 108, 1932). Forecasting the herring stocks in the southern North Sea began in 1929, and, considering that the method is still in the experimental stage, have been reasonably accurate. But although the forecast can foretell the relative proportions of different year-groups, it cannot be taken as an accurate indication of the total amount of the catch, since this depends also upon extraneous factors, such as the suitability of the weather for fishing operations or the intensity with which the fishing is prosecuted, which in turn depends upon the potential demand for the catch.

Schistosomiasis in the Philippines. The occurrence of schistosomiasis japonica or katayama disease was recorded for the first time in the Philippines in 1906. The organism concerned is the Oriental blood fluke *Schistosoma japonicum*, but knowledge concerning its molluscan intermediate host in those islands has been greatly needed. In a recent paper (*Phil. J. Sci.*, 49, No. 2, 295-304; 1932) Mr. Marcos A. Tubangui discusses this subject and announces his discovery that the snail *Blanfordia quadrasi* has been found by him to be infected with cercariæ similar in every respect to those of *S. japonicum*. The snail occurs in moist places on the banks of small bodies of fresh-water, and samples of the mollusc, collected near houses occupied by persons suffering from the disease mentioned, were found to be naturally infected. When the cercariæ were successfully introduced into mice and other laboratory animals the adult flukes, into which they developed, were similar to those of *Schistosoma japonicum*. The snail was further proved to be the missing intermediate host of the blood fluke by successfully infecting it with the miracidia stage of the parasite.

Root Nodules and Nitrogen Fixation. As No. 5 in the University of Wisconsin Studies in Science has appeared a sumptuous volume upon the "Root Nodule Bacteria and Leguminous Plants", by E. B. Fred, I. L. Baldwin and Elizabeth McCoy. This monograph reviews critically and adequately the enormous literature dealing with this subject and contains also a very judicious summary of the attempts made upon a commercial scale to supply the causal organism of the nodules to farmers. It is interesting to read the conclusion that nitrogen fixation in pure cultures of the nodule organism outside the plant remains still unsatisfactorily established, though the gain in nitrogen from the air by the activity of the living contents of the nodule is beyond doubt. The authors point out that different types of nodule, with different distribution on the root system, may have very different values. They conclude that the best results are obtained when the nodules are relatively few in number and large in size and borne on the tap root and the main laterals. A commonly accepted theory that comes out badly from this critical study is the view that the nodule is to be regarded as an abortive branch root. At the same time, the authors give little indication of the manner in which the vascular tissue develops within the nodule. They review briefly work upon root nodules on plants outside the Leguminosæ and also upon the few cases where bacteria are reported as regularly associated as symbionts with leaves. In this review the root nodules of *Casuarina* receive very brief notice but Aldrich-Blake now publishes a note (*Oxford Forestry Memoirs*, No. 14, 1932) which would add *Casuarina equisetifolia* to the list of plants in which growth is materially improved when nodules are produced on the roots as the result of infection by a mixture of crushed nodules and soil.

Landslide at Toge, Japan. Two papers, by Prof. N. Nasu and Prof. N. Miyabe, have recently been published on this landslide (*Earthq. Res. Inst. Bull.*, 10, 674-693, 694-700; 1932). At the end of November 1931, it was found that at the village of Toge (about 12 miles south-east of Osaka), a land-block covering about eighty-one acres was slowly sliding downwards in a southerly direction. The block is bounded on all sides but the south-east by a zone of cracks, one on the west margin being a

trench 550 yd. long and 88 yd. wide. The slope of the sliding area is about 15°. The landslide is of interest, not so much for its size, though it is one of the largest known in Japan, as for the various modes in which its displacement is being measured. Prof. Matsuyama carried out triangulations and precise levellings over the whole area. At the beginning of last February, Prof. Nasu installed recording instruments at points on the northern margin nearly 200 yd. apart. The motion of the mass was found to be very rapid. On February 20, the western station descended 6 in. and the eastern 13 in. The records, though on the whole nearly straight lines, show minute fluctuations, that Prof. Nasu measured with a recorder magnifying 2,000 times. On February 18 and 28, observations were also made with dial gauges at eleven stations on the northern boundary, showing maximum displacements of 0.39 in. on the first day and 0.28 in. on the second. The tilting of the mass was measured by a pair of horizontal component seismographs erected in Toge and, on February 18, was found to be 6' to the south and nearly 4' to the east. At the time of writing (June 20), the landslide was still going on.

Size of Fog Droplets. A paper entitled "On the Size of Fog Droplets" (*Sci. Papers Inst. Phys. Chem. Res.*, Tokyo, No. 391) by M. Kinoshita and K. Uchiyama, contains some information of meteorological interest relating to the size of the water droplets in artificially produced fog. Frequency curves are given for the distribution of different diameters of droplet in fogs produced in three different ways, namely, (1) by condensing low-pressure steam in a metal tube 15 cm. in diameter and 200 cm. in length surrounded by a water jacket for cooling, (2) by mixing air at a temperature of about -50° C. with saturated air at room temperature, and (3) by using air of 70 per cent relative humidity instead of saturated air under the conditions of (2). It was found that type (1) gave a very scattered distribution, with many droplets between 2 μ and 9 μ in diameter. The other two types gave a pronounced peak of maximum frequency, at a little more than 3 μ in type (2) and slightly more than 2 μ in type (3). The authors point out that in experiments on the transmission of radiation through fog, experimenters would do well to study the best method of getting uniformity of size in the droplets. Their own experiments were made as a preliminary to the study of the transmission of infra-red rays through fog.

Internal Conversion of γ -rays. Two theoretical calculations of the probability of a γ -ray being photoelectrically absorbed in one of the electronic shells of the parent atom, have been published (*Proc. Roy. Soc.*, Dec.). In the first of these, by Hulme, the radiation field of the nucleus is taken as that of an oscillating dipole. The calculation differs from that of previous authors in that the accurate relativistic wave equation has been used for the planetary electron. The values obtained for some of the K -conversions of radium C agree well with the observations of Ellis and Aston. The paper by H. M. Taylor and Mott repeats Hulme's calculation for quadrupole radiation from the nucleus. It is found that many of the conversions for radium B and radium C fall either on the 'dipole' or the 'quadrupole' curves. This may be important for the theory of nuclear transitions, for it is shown that the dipole radiation corresponds to nuclear transitions in which the nuclear angular momentum changes by one quantum, while the radia-

tion is in general of quadrupole type for transitions in which $\Delta j = 0$ or ± 2 . The paper shows that it is impossible to draw a distinction between the absorption of a γ -ray quantum and a direct interaction between the nucleus and the planetary electron. For certain nuclear transitions, it is probable that radiation is forbidden and the interaction takes place entirely within the nucleus. This may explain the 'anomalous' complete conversion of the radium C γ -ray at 1.426×10^6 volts.

Crystal Structure of the Normal Paraffins. Dr. A. Müller has reported an investigation of the changes which take place in the crystal structure of the normal paraffins when the temperature is gradually changed (*Proc. Roy. Soc.*, Dec.). The specimens were contained in a thermostat maintaining any required temperature to one-tenth of a degree and they were examined by the reflection of copper radiation from a rotating anode tube, which allowed a reduction of the exposure time to about five minutes. Most of these substances crystallise at normal temperature with a long prismatic unit cell, but cells of lower symmetry are known for many of the hydrocarbons. When the substances are heated, the a and b axes expand much more than the chain axis of the cell. The relative lengths of these axes alter gradually in the case of the C_{21} and C_{23} hydrocarbons until the cell appears to become hexagonal. The members from

C_{24} to C_{49} show a sudden transition to a new structure which tends to become hexagonal as the temperature is further raised. A rough picture of the molecular changes is given on the assumption that the molecule behaves as a rigid chain. The gradual transition observed in C_{21} and C_{23} is explained by the increase in rotational energy about the chain axis as the temperature is raised, with consequent approximation to higher symmetry. The sudden transition is pictured as a sudden rotation of the zig-zag molecules about their long axes on account of the equilibrium between the directive forces due to the long-chain part of the molecules and those due to the end groups.

Sodium Sulphite in Photographic Developing Solutions. Sodium sulphite is commonly considered to be merely a preservative for photographic developing solutions, preventing the oxidation of the developing agent by the air and also preventing yellow or brown stains on the negatives. It is now reported by Messrs. G. Gopala Rao and Madhusudan Pandalai of the Andhra University (University College of Science and Technology, Waltair) in a communication addressed to the Editor, that the sulphite has also another function; it is said to regenerate the oxidised developing agent enabling the latter to reduce more than its equivalent amount of silver halide. It is also claimed that a mixture of quinone and sodium sulphite is capable of developing photographic plates.

Astronomical Topics

An Early Observation of the New Moon. The *Cape Times* of December 2 reports that the new moon of November 28 was seen with the naked eye in South Africa by Mr. A. W. Long and Capt. D. Cameron Swan 35 minutes after sunset, when its age was $17^h 31^m$. This is almost a record for South Africa; it was just beaten one Metonic cycle earlier on November 28, 1913; the age of the moon was then $16^h 39^m$. Observations of this kind have chronological importance, as many ancient nations began their months with the first observation of the lunar crescent, and it is important to determine the shortest interval after new moon that they would be likely to see it. The position of the moon's node is of importance in this connexion, and it will be noted that the Metonic cycle nearly reproduces this position, since the node completes its circuit of the ecliptic in 18 years 7 months.

Meteor Craters. Since the acceptance of the meteoric origin of 'Meteor Crater' in Arizona, many similar, but smaller, formations have been pointed out in different countries. Science Service for December 22 describes a paper by Prof. F. A. Melton and W. Schriever in which they ascribe a meteoric origin to a number of large holes in the Carolina States. They are elliptical in shape with their axes parallel; it is inferred that the masses producing them arrived from the north-west. Aeroplane photographs were used in tracing the outlines. The date of the impact is inferred to lie between the Pliocene and Pleistocene epochs, but cannot be fixed more closely.

Tables for Galactic Co-ordinates. Galactic co-ordinates are now of such frequent use in stellar problems that tables for conversion into them are welcome to astronomers. Prof. P. Emanuelli, of the Vatican Observatory, brought a volume out in 1929. Mr. John

Ohlsson has just published more extensive tables in the *Annals of Lund Observatory*, No. 3; they go to every degree of Right Ascension and declination, and give the galactic co-ordinates and the parallactic angle to hundredths of a degree. For economy of printing the tables are limited to half the sphere; the results for the other half are obtainable by adding 180° to longitude and changing the sign of the latitude. The galactic pole is assumed to be in R.A. $12^h 40^m$, N.Decl. 28° (1900). The zero of galactic longitude is taken as the intersection of the galactic plane with the equator of 1900. This is convenient for astronomers of the present day, but will cease to be so in the course of centuries; for this reason the International Astronomical Union, at the Leyden meeting in 1928, recommended reckoning from the star Alpha Cygni, which is very close to the galactic plane, and has a very small proper motion. However, it is easy to pass from one zero point to another; it merely requires the addition of a constant to the longitude. The constants required to reduce to several suggested zero points are given in the introduction.

In using the tables all Right Ascensions and declinations must be reduced to the equinox of 1900 before entering them. Since some workers may prefer to use another position of the galactic pole, formulæ of reduction are given to facilitate such a transformation. Since galactic co-ordinates to rough fractions of a degree are sufficiently exact for many purposes, a large diagram is published in the volume in which the circles for every ten degrees of each co-ordinate of equatorial and galactic systems are inserted, one set in continuous lines, the other in broken ones; resulting positions can be read off at sight. If a position comes near the edge of the diagram, it is more convenient to work with the antipodal position.

Recent Discoveries in Mexico and Guatemala

EXCAVATIONS on Monte Alban in the State of Oaxaca, Mexico, the site on which the rich grave treasure of gold and other ornaments was found in January of last year, were resumed at the end of October by Señor Alfonso Caso on an extended scale immediately the decision of the Supreme Court on the question of State jurisdiction over antiquities had been made known. By the end of November, according to progress reports for which we are indebted to Science Service (Washington, D.C.), some interesting results had been achieved, although in certain respects their exact bearing at present remains obscure.

Among the more striking of the finds is a tomb remarkable for its small size. It is less than 2 ft. wide, and not 7 ft. in length. It is lined with stone, and the door was closed with a corn-grinding stone. Immediately within the doorway was a headless skeleton; while at the back part of the tomb were a heap of human bones, four large dishes and animal bones. In addition, it contained two incense burners, two greenstone axes, jade, and a bird's skull. The most noteworthy feature of the discovery, however, is that on the front of the tomb, underneath the lintel and on the door jambs, as well as on the stone floor at the entrance, are paintings in red, green and yellow. If the culture is Zapotec, these are the first Zapotecan paintings to be recorded. It is concluded that they deal with the calendar, representing year- and day-names in the Mayan or Zapotecan calendar.

Outside the tomb were found a number of objects in pottery which have all the appearance of votive offerings—objects resembling ears of corn, human hands, a tiger's foot, etc., with the image of a corn god and another deity not identified.

Another find of a singular character is a series of human figures in eccentric postures. These were found as a border or frieze at the base of a stepped pyramid, or temple, which is now being excavated. This is known as the 'Temple of the Dancers' from figures on the walls of a stone-lined tunnel in the mound, which was penetrated a few years ago. Of the figures which have now been brought to light, some are shown as crawling or swimming, while others lie on their backs. One holds an object at his lips as if drinking. Others appear to be deformed. It is thought that the figures may represent a priestly orgiastic fertility rite such as was described by early Spanish writers. This view is supported by the emphasis laid on the sex of the figures—normally the priests were expected to be celibate.

A second tomb of almost identical dimensions, with a roof shaped as an inverted V, has been discovered. It contained parts of two skeletons with funerary furniture, possibly secondary interments.

It remains only to describe what is up to the present the most remarkable feature of the site, of which the purpose is at present obscure. This is a series of stone-lined tunnels too small to serve as emergency passages, as was at first suggested, and not apparently intended for drainage. The first was discovered at the close of last season's work, but its exploration left until this year. When it was entered on the resumption of work, it was found to be so small—20 in. high by 25 in. wide—that the explorers had to proceed stretched at full length on their backs and work their way along by elbows and toes. At

a distance of 195 ft. in the tunnel a skeleton was found, accompanied by an incense burner, funerary urns and ornaments of jade, stone and turquoise as well as a few pearls. Some yards further the tunnel was found to be blocked and had to be entered again by a shaft sunk from the surface 25 ft. above for the purpose. A second skeleton was found 320 ft. from the entrance, just before the tunnel terminated at the side of the north terrace. It was found that a number of even smaller tunnels, not more than a foot high, led into the larger tunnel. Of these one had tiny steps leading down to it.

Two further tunnels of similar character to the first were found, but packed with earth or clay. Finally, a complex of miniature tunnels was found to the east of the famous treasure tomb. All are stone-lined and some are less than a foot high. Some, but not all, have the inverted V roof. The application of a smoke test revealed a number of unexpected exits.

The Carnegie Institution of Washington has now issued particulars of the important discovery of Mayan pottery made in 1931 at Uaxactun, Guatemala, by one of its expeditions (*News Service Bull.*, vol. 2, No. 36). This discovery was remarkable not only as an indication of the high standard attained in ceramics by the Maya at an early date, but also as the first example of a Maya date inscribed on any material other than stone or stucco.

The pottery was discovered in two burial vaults at the top of a pyramid in Group A in the so-called acropolis. This pyramid is the third in a series of five built one on top of the other in accordance with Maya practice.

Vault 1 is 7½ ft. long, 1¾ ft. wide and 2 ft. high, with walls of roughly-cut stone and six limestone slabs superimposed, as a cover. It contained the skeleton of an adult male with funerary furniture, offerings, ornaments, etc., among which was a remarkable polychrome vase. The second vault was approximately of the same size, though slightly shorter. It contained the remains of several skeletons and seven polychrome vases. Between the two vaults were two more polychrome bowls which had probably accompanied a secondary burial.

Of the polychrome vessels, which are painted in red, orange and black, all are sufficiently noteworthy; but three in particular stand out. A shallow bowl 14 in. in diameter, a flanged tripod dish and the cylindrical jar found in the first vault. All are painted with representations of one or more human figures. The most elaborate shows among other figures a naked man hanging head downward with two jaguars apparently about to spring on him. He is evidently the victim of a human sacrifice. The design is divided into two fields by the figure of a serpent across the vessel. The scene shown on the cylindrical jar is complicated; but it is thought to represent the reception of a deputation or embassy by a dignitary who is seated on a dais. The date, to which reference is made above, is shown in sixteen calendrical glyphs which have been interpreted by Dr. S. P. Morley, after a slight emendation, as giving the date 120 B.C. or A.D. 140 according to the chronological system employed in interpretation. This, however, is not the date of the vase; the painting is taken to be a record of an event long past.

Band Spectra of Diatomic Molecules*

DURING the last ten years, few branches of physical inquiry have called forth a greater output of published work than that of molecular spectra. Many reasons may doubtless be adduced to account for this. On the theoretical side, it is generally recognised that the anharmonic vibrating-rotating molecule with its complex magnetic couplings, and the interaction of these energy types with each other and with the electronic energy, provides one of the most fascinating applications of the quantum theory. On the experimental side, aesthetic considerations (and the interest of unravelling and ordering what is often a very complex system of spectral lines) must be given no little weight. Whatever may be the impressions given by a reading of the theory, the experimentalist is well aware that scarcely any band system is really typical or without peculiarities of particular significance for the structure of the emitting molecule.

Further reasons are found also in the variety of other fields of physical inquiry with which this subject has become closely related. The determination of the heats of dissociation of molecules from their spectral data is a well known possibility. The method is applicable to molecular ions and other diatomic molecules incapable of direct thermo-chemical investigation. In another field—that of isotopy—the discovery and quantitative estimation of comparatively rare isotopes of several common elements are well known. The prolific output of work on the spectrum of light scattered by molecules—the Raman effect—has among other things provided a new weapon for studying the solid and liquid states and the vibrations of complex molecular groupings. Molecular spectra have also made a definite contri-

bution to astrophysical knowledge, while photochemical investigation stands clearly in a very close relationship to the subject. The nature of valency and of related topics, which has been clarified in recent years by the work of Heitler, London, and others, provides another link with chemistry.

For a subject with such wide associations, the collected literature has been remarkably scanty, even when we make due allowance for the difficulty of providing it during a period of rapid development. The present writer, faced with the problem of advising men wishing to undertake post-graduate research in this subject as to their reading, has found the answer one of perennial difficulty. The advice given has usually been: "Read certain sections of the National Research Council Bulletin on 'Molecular Spectra' and afterwards follow the original papers of some leading worker in this field, tracing the development of his thought in recent years". With the publication of the eminently readable report by the Physical Society referred to below, this difficulty should be resolved for many years.

Dr. W. Jevons is to be congratulated on the completion of a valuable piece of work. He has produced a model report, subsuming on the part of the general reader no previous specialised knowledge of the subject and yet providing for the expert a most useful compilation of data. Within the limits which Dr. Jevons has prescribed for himself, he has written a clear and well arranged account of the subject for which physicists and chemists alike will wish to thank him; research workers will do so more especially for the valuable appendices he has included. Through the tables and classified bibliography given here there is now provided a rapid and reliable approach to the literature of almost all known band spectra of diatomic molecules.

R. C. JOHNSON.

* The Physical Society. "Report on Band-Spectra of Diatomic Molecules". By Dr. W. Jevons. Pp. vi+308. (London: Physical Society, 1932.) 17s. 6d. net.

International Auxiliary Languages*

IN the pamphlets referred to below, Dr. Ritter gives us an excellent survey, with statistics, of the language situation of the world, and of the cogent reasons in favour of the adoption, by formal agreement, of some easily learned international language.

The complacent assurance, once almost universal, that the 'blessings' of industrial civilisation, and of 'English, well and clearly spoken', would rapidly extend to the whole of humanity, has given place to a sceptical attitude towards our own culture. A powerful reverse current has set in; many of our own eminent thinkers set the highest value upon a multitude of cultures, upon competition rather than fusion between them, even upon war itself. Innumerable students all over the world are being educated in languages, sometimes limited to one or two millions of people, which give them no access to English, French, and German literature. Those who are very good natural linguists may acquire all three of these, but the majority will acquire only one, and many, ungifted as linguists, will never

read easily in any but their mother tongue. A point worthy of strong emphasis is the fact that inability to acquire foreign languages is in no way a sign of mental inferiority generally.

Dr. Ritter points out that the above facts limit the field of selection for persons who are to assist in international co-operation, as in the League of Nations. It is obvious that discussions carried on through interpreters are severely handicapped. The same argument applies, of course, over much wider fields. Dr. Ritter pleads for the formation by the League of a commission to study the problem, and hopes for the endowment out of private funds of an institute as well. He also puts forward his own suggestions for a world language; a phonetic, orthographic, and grammatical simplification of Mr. Ogden's "Basic English". It is much altered, but readily intelligible to an English reader, as soon as the rules of simplification are grasped. It is somehow less of a shock than the efforts of our own more advanced spelling reformers, or Prof. Zacharisson's "Anglic". Those whose hearts are set upon the retention of stylistic elegancies, even in the statement of pure matters of fact, will not like it any better than Mr. Ogden's "Basic".

* "Die Sprache im internationalen Verkehr" (2nd ed., pp. 48) and "Die Weltverkehrssprache" (pp. 12), by Dr. Erwin Ritter, of the International Labour Bureau, Geneva. Printed as MS., 1932.

Dr. Ritter is concerned solely with the necessity for an officially recognised international language. He believes that no living language stands a chance of adoption owing to jealousy, and also to more realistic considerations of commercial competition. Further progress along the lines of Esperanto and Ido seems unlikely; all the signs point to Basic English competing with them successfully on account of its superior simplicity and practicality, wherever these qualities are called for. Also, the fact that to learn it is to make a good beginning with learning standard English tells enormously in its favour.

Dr. Ritter's language (he has not named it) is somewhat easier to learn, since it has only 17 letters, three pronouns, and no irregularities; but learning it means learning English wrongly, and that will operate against it. But Dr. Ritter believes that only so, as an invented language, would it stand a chance of adoption by the League.

Edison's first invention was an electric vote recorder for Congress, designed to expedite business. It was gently but firmly explained to him that this is the last thing in the world that politicians desire.

H. S. H.

New Applications of the Cathode Ray Oscillograph

THE modern cathode ray oscillograph has now become a well-established tool of the physicist and electrical engineer for the experimental study of electromotive forces varying with time. In addition to its normal oscillographic use for the investigation of the wave-form of periodic electromotive forces, it has been extensively used for the study of transient or non-recurring phenomena, such as, for example, the reception of an atmospheric in a wireless aerial.

The electromotive force which operates the oscillograph may not, however, be the ultimate object of study; this force may be produced or derived in some manner from the phenomena which it is desired to investigate. It is well-known that certain reactions taking place in the human body, such as the beating of the heart, may be made to produce changes in the flow of current in an electrical circuit connected to the body in a suitable manner. The vibrating string galvanometer has been used extensively for this purpose in the past. It is quite probable, however, that the cathode ray oscillograph will find a useful application in this field shortly, since it has an advantage over the galvanometer in that it provides a continuously visible image of the derived electrical variations and the results of various experimental operations may be seen immediately on the oscillograph screen.

One of the difficulties accompanying the use of the cathode ray oscillograph in the past has been that of providing a suitable time-base for the spot

of light forming the image on the fluorescent screen. In the June 1932 issue of the *Journal of the Institution of Electrical Engineers*, a description is given of a method of producing a circular time base as developed by the staff of the Radio Research Station, Slough. In this method, sine wave alternating voltages are applied in phase quadrature to the deflecting plates of the cathode ray oscillograph, with the result that a circular motion is imparted to the spot on the screen, the time of rotation of the spot being equal to the period of the alternating current supply. The electromotive force to be studied is introduced at a suitable point in the circuit and produces radial deflections of the spot from its circular path, without affecting the intensity or definition of the image. The time of recurrence or duration of the phenomenon under observation can be estimated from angular measurements on the screen, while the amplitude of the electromotive force is measured radially.

The paper referred to above mentions the possible application of the method to the comparison of high-order harmonic frequencies, and to the checking of the period of a seconds pendulum against an alternating current supply of accurately controlled frequency. In the latter case a rate of the pendulum corresponding to about $2\frac{1}{2}$ seconds a day can be determined in a few seconds, while any departure from uniformity of the pendulum swing may be quickly studied.

Heavy Current Circuit-Breakers

IN most countries of the world the supply of towns and industrial districts with electrical energy is a matter of the greatest importance. The increasing size of central power stations and the extensive interconnexion of high tension networks, which in some cases spreads over the political frontiers of individual countries, makes the proper choice of protective apparatus essential to the safety of the system. One of the most troublesome faults arises when there is a short circuit in some part of the network. To counteract its effects apparatus to break the circuit, 'circuit-breakers', must be used in connexion with suitable relays. These must be capable of opening and closing on a short circuit several times consecutively without danger.

In the *Brown Boveri Review* for June last, H. Thommen describes the plant used in the Brown Boveri works in Baden for testing circuit-breakers. Prior to 1897, knife-switches with air-breaks were

employed to break the circuit, but they were unsuitable as they produced very long arcs even at low pressures. C. E. L. Brown was the first to break the arc under oil and it was thought that this would give the perfect solution. It was found when breaking high power that oil circuit-breakers occasionally gave rise to serious disturbances. Sometimes the mechanical strength proved insufficient, or the opening distance of the contacts was too small so that flash overs to the casing resulted. Unsuitable contacts on heavy currents sometimes welded together and ruined the apparatus.

The very thorough tests carried out by the Brown Boveri Co. have cleared up many of the difficulties which lay in the way of designers. By means of slow-motion cinematography, they demonstrated the oil piston theory. According to this theory, rapidly growing bubbles form around the arc at rupture in the oil. The oil above the break is projected like a

piston against the cover. When this happens a high pressure is rapidly developed and the current is broken. The total amount of gas produced depends on the energy dissipated in the arc and formulæ to determine this energy are given.

Recently there has been a revival of interest in water circuit-breakers. They have the advantage of not using an inflammable liquid but they do not eliminate the danger of explosion, since if the arc is not broken quickly enough, steam is produced in such quantities that the breaker blows up.

The compressed air breaker works satisfactorily as the pressure does not exceed a definite value, but a compressed air plant is necessary to operate it. Breakers without oil based on the principle of the action of a magnetic field on the arc have many advantages but on account of difficulties in insulation they cannot be used in practice with high voltages. Oscillograms are shown of how the current varies when different kinds of experimental breakers are in action.

Climate of Hong-Kong

"THE Climate of Hong-Kong", by T. F. Claxton, published by the Royal Observatory, Hong-Kong, as an appendix to the ordinary annual summary of Hong-Kong observations for 1931, is one of the most complete accounts of the climate of a station in the Far East. It summarises and discusses the observations made from 1884 to 1929. Most of the tables are in the form in which the mean value of a meteorological element, for example, atmospheric pressure, temperature, etc., for each hour is shown for each calendar month, the minimum hourly value of each element being taken as zero while the other values are expressed as departures therefrom in the customary units. A collection of tables of this kind makes a very indigestible meal for all except the expert meteorologist and for this reason the explanatory discussion is very welcome, particularly the general discussion of the seasons.

The seasonal rhythm in Hong-Kong is, of course, greatly influenced by the Asiatic monsoon. Lying practically on the Tropic of Cancer, the north-east monsoon in the winter does not give rise to much cold weather; a minimum temperature of 45° is reckoned a low one, while an afternoon maximum of 75°, for which in England one sometimes must wait until nearly the middle of the summer, is not rare in January. Mist and fog are of common occurrence in the period of rapidly rising temperature around March, generally when pressure is falling over China and the north-east monsoon is weakening; much of it is due to dynamical cooling of advancing damp southerly winds. The summer, with its mean temperature of 82° F., is characterised by unsteady winds, rather frequent thunder storms and heavy rain; the destructive effects of a typhoon are occasionally felt, more especially in late August. October brings back the north-east monsoon, and, generally, fine dry weather leading back through a quickly falling temperature to the winter.

There is a considerable section devoted to the discussion of typhoons, containing a number of important statistical tables, and the non-tabular part of the work ends with an interesting item seldom to be found in works of this kind—an account of the principal empirical rules of weather forecasting for the region under discussion.

University and Educational Intelligence

LONDON.—The Clothworkers' Company, the Grocers' Company, the Drapers' Company and the Skinners' Company has each decided to make very generous grants to the University in the shape of annual payments extending over a series of years. These grants will amount in all to £20,000 from the Clothworkers' Company, £10,000 from the Grocers' Company, £5,000 from the Drapers' Company, to whose munificent help for East London College the University is already greatly indebted, and £5,000 from the Skinners' Company. As in the case of the grants already announced from the Corporation of the City of London, from the Mercers' Company and from the Fishmongers' Company, these benefactions will be applied towards meeting the cost of the new Ceremonial Hall to be erected on the University's site in Bloomsbury.

A COURSE of ten lectures on alternating currents and electrical oscillations will be given by Dr. D. Owen, head of the Department of Physics and Mathematics of the Sir John Cass Technical Institute, at the Institute, Jewry Street, Aldgate, London, E.C.3, on Tuesday evenings commencing on January 31. The lectures will be accompanied by practical demonstrations. Further information can be obtained from Dr. Owen at the Institute.

THE school magazine coming from Stowe School, entitled the *Stoic*, is a sumptuously printed and illustrated record of extra-curricular activities among which film exhibitions have an important place. The school was one of the first to have a full-size silent projector and to change over to sound. Its recently founded Film Society aims at contributing towards the development of the art of the cinema by helping to prepare (in the words of the headmaster's inaugural speech) a forward-looking and active-minded public waiting to welcome the work of exploration through this medium of undiscovered territory of the mind. It is worthy of note that, in the list of films exhibited during last term, there are none of the professedly instructional type.

STATISTICS of secondary schools in the United States, published in a recent bulletin of the Office of Education, Washington, show an aggregate enrolment in 1930 of more than five million—roughly half of the population of secondary school age. The schools tend to increase in size, the average enrolment having increased from 211 in 1926 to 234 in 1930. Five per cent of them had, in the latter year, more than 1,000 pupils; 27 in New York and Chicago had more than 5,000, the largest of all having more than 10,000 pupils. Re-organisations, involving the incorporation in the secondary school scheme of some of the years previously covered by elementary school courses, have made considerable headway in recent years, especially in schools with from 300 to 2,500 pupils, two-thirds of which have now been re-organised. The proportion of men to women teachers in secondary schools, except in those for negroes, shows a tendency to increase. School libraries have increased in size steadily; the average number of volumes has risen from 1,652 in 1926 to 2,000 in 1930.

Calendar of Nature Topics

Tempora mutantur

1859, January 21.—The celebrated Eland dinner was held at the London Tavern, Prof. Owen in the chair. This dinner set on foot a movement for the acclimatisation of foreign animals, and the following year an Acclimatisation Society was formed with F. T. Buckland as organising secretary. By this time the Paris Société d'Acclimatation was in active operation. In 1857 it had offered a series of prizes "for the introduction into France, and her colonies, of various beasts, birds, fish, insects and plants". (Buckland's Life.)

1932—"Destructive Imported Animals Act," passed by the Parliament of Great Britain and Northern Ireland, placing restrictions upon the importation of foreign animals.

Skylark's First Song of the Year

Few naturalists' calendars fail to record the first singing of the skylark (*Alauda arvensis*) and most place it in the latter half of January or early days of February. At Selborne, Gilbert White heard it on January 21, and about the same period Markwick, at Catsfield in Sussex, places his earliest record on January 12 and his latest on February 27. Half a century later Leonard Blomefield (or Jenyns) gives his first record, at Swaffham Bulbeck in Cambridgeshire, as January 7, his latest as February 21, and the mean of his seventeen years' observations (1820-31, 1845-49) places the first singing on January 22. On the other hand, a twelve years' average in recent years, from data in the annual Phenological Report of the Royal Meteorological Society, fixes the date at February 11. Is the skylark really beginning its song season later in the new year than it used to begin?

Duration of the Skylark's Song

There is a tendency to exaggerate the duration of the skylark's song; a quarter of an hour is a common estimate, half an hour has been recorded, and an hour has been suggested as the maximum duration. But an accurate timing of more than a thousand songs, not reckoning those which failed to last half a minute, reveals a standard quite different. During three years, Noble Rollin timed morning songs in a particular locality (on the outskirts of South Shields) and found that the average duration of 549 songs was but 2.22 minutes. The yearly averages were remarkably consistent: 1927, 2.19 minutes; 1928, 2.30; 1929, 2.20 (*Scot. Nat.*, 1931, pp. 47-54). Naturally, the song is not equally long throughout the year. It falls into two distinct periods, a spring period beginning in January or February, reaching a climax in May and June (average 2.7 minutes) and ending in the silence of August, and an autumn period beginning lustily in September (average slightly exceeding 3 minutes) and ceasing in November. A curious fall in the average length of the song which occurs in April, is suggested by Rollin to be possibly due to the late beginning of the younger birds, and their less practised singing; but it is noteworthy that all the songs of 8 minutes and more fall within the spring or breeding period. The length of the song seems to be an individual characteristic, for the times of two special birds were found to be fairly consistent, all the recorded songs of one

lasting, in minutes, 19, 17, 16, 29, 12, and of the other, 10½, 10½, 19½, 1, 6. Moreover, it was noticed that the long singers kept together in one field, the short singers in another; and since there is no suggestion of a selected chorus amongst skylarks, this curious fact seems to point to length of song being, in part at any rate, a function of age and practice, and to imply a certain amount of age segregation, the older and more practised larks separating into a colony distinct from the younger and less practised.

Arctic Ice passes Cape Farewell

January 25.—In the Arctic Ocean there is an almost continuous drift of ice from the sea north of Bering Strait towards the north of Greenland. During the winter, this floating ice-cap is firmly frozen, but in summer it breaks up, especially on the edges, and large masses of drift ice enter the ocean between Spitsbergen and Greenland, whence the East Greenland Current carries them southwards. The first ice-floes pass Angmagsalik in East Greenland about November 6, and reach Cape Farewell early in the following year, the average date being January 25. Rounding Cape Farewell, they travel northwards along the west coast of Greenland, reaching Godthaab early in May, after which the ice-masses decrease under the influence of summer melting. These remarkable movements of the arctic ice have important effects on the weather of the northern parts of the North Atlantic Ocean, as well as on the seal fisheries and the navigability of the northern seas.

Metamorphosis of *Calanus*

The small copepod crustacean *Calanus finmarchicus*, the numbers of which make it an important food supply of many marine organisms and so a link in the conversion of inorganic matter in the sea into human food, is now entering the last of its many stages. During January and sometimes even in the last days of December, it moults its final juvenile coat and becomes an adult, at any rate in the Firth of Clyde, for the change is not synchronous in different areas. This is the last of a series of twelve stages of development, six larval nauplius stages and five post-larval copepodid stages preceding the adult stage, and each stage leads to the next by way of a moult. The survivors of the hordes of the previous summer live through the autumn and winter, from September or October onwards, in the final copepodid stage, Stage 5; their development seems to be checked, only to be resumed with the January moult. During this month males predominate in the catches, but in February and thereafter females are more numerous, and this is true not only for the Firth of Clyde, but also in the English Channel, off the west coast of Ireland, and off the Norwegian coast.

What is the stimulus which breaks the autumn-winter condition and induces more rapid development and the final moult? The scientific workers at Millport Marine Station have tested temperature. If the autumn stages are kept in the laboratory instead of the open sea, they moult in about three weeks. Low temperature definitely retards moulting; but since the sea keeps getting colder until March, rising temperature can scarcely be the natural stimulus. Similarly light and food have been tested but neither seems to hasten the final moult; there is no definite change in the sea that they know of which would provide the wanted stimulus.

Societies and Academies

DUBLIN

Royal Irish Academy, Dec. 12. J. J. NOLAN and J. G. O'KEEFFE: Multiply-charged large ions. Atmospheric condensation nuclei can be charged up so as to carry several thousand electronic charges. The mobilities appear to be unaltered. Spray ions have charges of the order of a hundred electrons. The existence of definite mobility groups for these ions is again demonstrated. R. W. DITCHBURN: (1) The frequency distribution of resonance radiation. This paper discusses the frequency distribution of light emitted by an atom excited by the absorption of radiation the frequency of which is not exactly equal to the atomic resonance frequency. A recent experiment by Korff (*Phys. Rev.*, 41, 538; 1932) is criticised and it is suggested that this type of experiment cannot give any information on this question. (2) The possibility of separating isotopes by the use of resonance radiation. Photochemical reactions involving the use of resonance radiation are suggested.

PARIS

Academy of Sciences, Nov. 28 (vol. 195, pp. 985-1048). CH. MAURAIN and J. DEVAUX: Study on the total calorific radiation in Greenland. The solar radiation in the polar regions is relatively considerable. Comparisons are made with the corresponding figures obtained at the Parc Saint-Maur Observatory, near Paris. EMILE COTTON: The non-rotational movement of a liquid limited by mobile, indeformable walls. AYMAR DE LA BAUME PLUVINEL was elected a member of the Section of Astronomy in succession to the late G. Bigourdan. N. BOTEÁ: Some partial differential equations. C. DESAINT: The transformation of the $(p+q)$ th species for the domains of existence. JULIUS WOLFF and BASTIAN GROOTENBERG. A property of a derivative of a function with a real positive part. D. RIABOUCHINSKY: The hydraulic analogue of the movements of a compressible fluid.—L. GOLDSTEIN: The conservation of momentum in electron collisions.—VACLAV BUBENIK: The theory of electric filters. W. KEMULA and ST. MRAZEK: Measurements of the absorption of ultra-violet rays by methane, ethane and normal butane in the gaseous condition. Measurements were made of the absorption between the wave-lengths 6000 Å. and 1965 Å. Within this range, no radiation is absorbed by the three pure gases. A. WITT: Starting oscillations of very high frequency. P. DONZELOT and J. DIVOUX: A method of compensating plate currents. Instead of the usual compensation making use of accumulators, to compensate the normal plate current of a valve, use is made of an identical valve, the same high-tension battery feeding both valves. Greater stability can be obtained. TH. V. IONESCU and C. MIHUL: Ionised gases in the magnetic field: pressures greater than 0.001 mm. of mercury. The results of experiments on hydrogen and nitrogen are given graphically, showing the conductivity as a function of the wave-length, magnetic field, and pressure.—J. JANIN: The spark spectrum of rubidium in the extreme ultra-violet. PAPANAYANNO: The influence of time on the conductivity of colloids measured at two different levels. E. VELLINGER: The superficial affinity of caoutchouc for the loading. J. P. MATHIEU: The compounds of tartaric acid and chromium. Chromium hydroxide dissolves in

solutions of tartaric acid giving a normal tartrate and this is transformed in solution into a complex compound not giving the usual chromium reactions. This compound cannot be isolated in the crystalline state but its composition has been studied by physico-chemical methods, acidity, conductivity, rotatory power and light absorption. These give it a formula of $H_2(TCr)$. ROBERT BERTHON: The heats of moistening silica gel with various liquids. The experimental results are not in agreement with the hypothesis of Patrick and Grimm. Any purely thermodynamic theory of the heat of moistening of silica gel is incomplete because it neglects the geometric factors of the surface. JEAN GALIBOURG: The influence of the value of the elongation realised in the course of successive extensions, followed by ageing, on the elastic limit and Young's modulus of a mild steel. ANDRÉ KLING and ALFRED SOULIER: The accidental ignition of vapours of petrols by electric sparks. The author considers that sparks produced by the friction of insulated bodies, such as pulleys in motion, are incapable of igniting mixtures of air and petrol. PIERRE JOLIBOIS and LOUIS CLOUTIER: The existence of basic phosphates. The existence of basic phosphates prepared in the wet way is doubtful. W. S. REICH: Glycogen triacetate. Under the conditions laid down, it is possible to acetylate glycogen, forming the triacetate and regenerate glycogen identical in all respects with the original glycogen. JACQUES BURCART: The marine Pliocene of Morocco. An attempt at the history of the Moroccan Atlantic. P. GEOFFROY: Contributions to the geological study of the neighbourhood of Oran (Algeria). PAUL GUÉRIN: Hydrocyanic acid in *Glyceria aquatica*. With the exception of the fruit, all the organs of *Glyceria aquatica* give hydrocyanic acid, the young leaves and the flowers showing the highest proportion. HENRI COUPIN: The determinism of the formation of sporangia and zygospores in *Sporodinia grandis*. PIERRE GAUDAUD: Some observations concerning the physical structure of the cytoplasm of a hemi-ascomyete fungus, *Ascoidea rubescens*. M. DZUNG TSUNG WANG: Cytological observations on *Ustilago hordei*. CHARLES PÉREZ: Differential characters of the sexes in hermit crabs of the genus *Diogenes*. ANDRÉ BONOT: The modification of the seric proteins isolated by the acetone method and myxoprotein. A criticism of the acetone method of Piettre and Vila. The author does not regard the fraction isolated and studied by Piettre, Achard and Arcand under the name of myxoprotein as a definite homogeneous fraction.

MELBOURNE

Royal Society of Victoria, Nov. 10. ELIZABETH A. RIPPER: The stromatoporoids of the Lilydale limestone. (1) *Actinostroma* and *Clathrodictyon*. The Silurian (Yoringian) limestone of Lilydale, Victoria, contains a rich stromatoporoid fauna. Four new species and one subspecies are described. *Actinostroma compactum* is closely related to *A. clathratum* Nich. of the British and German Devonian; *A. altum* to the Wenlock form *A. intertectum* Nich., while *A. verrucosum*, Goldfuss, is a typically Middle Devonian species. The species of *Clathrodictyon* are related to Silurian forms: *C. regulare cylindrifera* differs only from the European form *C. regulare*, Rosen, in the possession of astrorhizal cylinders; *C. calamosum* is of the type of *C. striatellum*, d'Orbigny, while *C. chapmani* is apparently distinct from all other species of

Clathrodictyon. JEAN HEYWARD: Two species of *Ophiocytium Nageli* in Victoria, *O. terrestris* n.s. and *O. arbuscula* Rabenhorst. Two further species of *Ophiocytium Nageli* are recorded for Victoria. One, which was isolated from the soil, proved to be a new species and was named *Ophiocytium terrestris*. This is the first record of this genus from the soil. The second species, *Ophiocytium arbuscula* Rabenhorst, was found in a pool at Royal Park, Melbourne, attached to filaments of *Ædogonium* species. EILEEN E. FISHER: The 'sooty moulds' of some Australian plants. Fungal forms have been isolated from 'sooty moulds' occurring naturally on the following hosts—*Bursaria spinosa*, *Leptospermum scoparium*, *L. laevigatum*, *Myoporum insulare*, *Melaleuca* sp. The composite character of the 'sooty moulds' is demonstrated. *Caphodidium walteri* Sacc. on *Bursaria spinosa* has been shown by direct observation and cultural work to be *Teichospora salicina*, Mont., Gau. and demonstrates the cosmopolitan distribution of the type form of the genus. *Capnodium citricolum* McAlp, is synonymous with *Teichospora salicina*. *Teichospora australe* (Mont.) Arnaud is recorded on *Leptospermum scoparium*, as the common perfect form found on this host. *Teichospora australe* has been recorded previously on conifers in Australia, and the same fungus appears in the unpublished records of the Mycological Herbarium, Department of Agriculture, Victoria, under the name *Limacinia melaleucas* (nomen nudum) on 'tea-tree'. *Limacinia fuliginodes* is recorded on *Melaleuca* species and is the first record of this fungus for Australia.

ROME

Royal National Academy of the Lincei: Communications received during the vacation. Q. MAJORANA: Further results of a new photoelectric experiment. As regards the increased electrical resistance exhibited by certain thin metal foil under the influence of intense pulsating radiation, different metals show markedly varying behaviour. Silver displays characteristic sensitivity towards ultra-violet rays, but aluminium and possibly zinc also are insensitive to such rays. With other radiations the various metals examined exhibit the effect in greater or less degree.—E. FERMI: Oscillation and rotation bands of ammonia. N. PARRAVANO and O. D'AGOSTINO: Velocity of dissolution of industrial aluminas in fused cryolite. Three samples of alumina, prepared in different ways, were found to vary in the rate at which they dissolved in molten cryolite. G. ROVERETO: A tectonic interpretation of the western promontory of the Gulf of Spezia. M. GHERMANESCO: Orthogonal polynomials with two variables. Based on the property of orthogonality, a systematic theory of these polynomials is projected. The first results obtained are here detailed. HANS HAMBURGER: Ribaucour's transformation and spherical representation (2): applications of the transformation to spherical representation. V. HLAVATÝ: Further results on the differential projective invariants of a curve in the projective space P_{n-1} ($n=$ or >3). L. LABOCETTA: The effective integration of discontinuous functions (3): periodic functions. MARIA PASTORI: Conjugated hemisymmetric tensors. E. VOLTERRA: 'Linked' elasticity and its mathematical representation. A new method of studying the deformations of elastic solids is developed which appears to be of practical value, as it allows various problems in elastic statics to be solved in a systematic and simple manner. M. CIMINO: The Einsteinian correction of time in a

planetary motion. Utilising the principle of equivalence of Levi-Civita previously applied, the author deduces a law of cosmic time and the anomalistic and sidereal periods of revolution for an Einsteinian motion in ordinary Euclidean space. M. KIVELIOVITCH: Regularisation of two body impacts for forces inversely proportional to any power of the distance. E. MARTIN: Method (2) for calculating the orbit of a visual binary. A. PROVIERO: Further considerations on the extinction of seismographs. E. GUERRIERI: Periodicity in the progressive course of the rainfall at Capodimonte during 1833–1931. The data given reveal a distinct periodicity of fifteen years in the rainfall. The mean duration of the change from a maximum to the next minimum is 9.33 years and that of the succeeding rise to a maximum, 6.00 years. M. BACCAREDDA: The structure of sphero-cobaltite. A. BARONI: Diselenomesoxanilides and oxyselenanilides. When treated with selenium monochloride, malonanilide yields diselenomesoxanilide, M.P. 209°–210°, and malono-*p*-toluidine, diselenomesoxi-*p*-toluidine, M.P. 211°. Oxyselenanilide, B.P. 111° at 26 mm. pressure, and oxyseleno-*o*-toluidine, B.P. 130° at 26 mm., are obtained by the action of selenium oxychloride on aniline and *o*-toluidine respectively. When heated with aniline or diphenylamine in presence of zinc chloride, these two compounds yield greenish-blue dyes and thus behave similarly to the thionylamines. G. CHARRIER and ELISA GHIGI: (1) Action of alkylmagnesium iodides on (1:9)-benzanthrone-(10). The action of magnesium methyl iodide on anthraquinone or anthrone or one of their homologues gives rise to the corresponding carbinols, but, under similar treatment, benzanthrone yields, not the methylcarbinol, but 4-methylbenzanthrone and 10-methylene-3:4-dihydrobenzanthrene; the latter readily loses two atoms of hydrogen, to form 10-methylenebenzanthrene. From magnesium ethyl iodide and benzanthrone, only 4-ethylbenzanthrone could be obtained. (2) Action of ammonia on acenaphthenequinone. This action yields acenaphthazine and naphthalimide, and other orthoquinones give analogous products. G. NATTA and R. PIRANI: Solid solutions by precipitation, and isomorphism between complexes of platinum and of quadrivalent tellurium (2): Examination of caesium chlorotellurite and of the systems, $CsPtCl_6-CsTeCl_6$ and $Rb_2PtCl_6-Cs_2PtCl_6$. Strict isomorphism exists between caesium chlorotellurite and the chloroplatinates of caesium and rubidium. The precipitation method of preparing solid solutions appears to be of general applicability. E. PARISI and G. DE VITO: Distribution of nitrates and 'organisation' of nitrogen in the leaves of green plants. While the laminae of the sunflower are comparatively poor in nitrates, the petioles and veins are rich in these salts and often contain more than any other organ, even than the root. It is, therefore, probable that the nitric acid undergoes organisation on passing into the lamina. This conclusion is supported by the results of analysis of leaves of wheat and beet. Both the laminae and the petioles contain more amino nitrogen in the afternoon than in the early hours of the morning, so that, in the green parts of the plant at least, sunlight exerts an appreciable influence on the formation of amino compounds. V. FAMIANI: The nutritive value of wheat embryos. Addition of wheat embryos to the diet of rats fed on wheat alone—which limited their growth and greatly lowered their powers of resistance—produces some improvement in growth and resistance, and the further addition of a saline mixture renders growth

and reproduction almost normal. V. ZAGAMI: Nutrition with leguminous seeds, and reproduction. A diet of leguminous seeds inhibits the reproductive functions owing, not to any specific effect on the genital apparatus, but to retardation of the general development of the organism. This effect is due mainly to deficiency of mineral salts and, to a less extent, to lack of the lipo-soluble factors A and D.

Forthcoming Events

Saturday, Jan. 21

BRITISH MYCOLOGICAL SOCIETY, at 11—(at the Botanical Department, University College, Gower Street, W.C.1). Symposium and Discussion on "The Measurement of Disease Intensity".

Monday, Jan. 23

UNIVERSITY OF LEEDS, at 5.15.—Prof. A. H. Sturtevant: "The Determination of Sex in Animals".

ROYAL SOCIETY OF ARTS, at 8—(Howard Lectures).—Dr. Ezer Griffiths: "Thermal Insulation" (succeeding lectures on Jan. 30 and Feb. 6).

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Capt. G. N. Humphreys: "Climbs and Flights in the Ruwenzori Range".

Tuesday, Jan. 24

UNIVERSITY COLLEGE, LONDON, at 5.30.—F. J. Richards: "An Introduction to Indian Archaeology" (succeeding lectures on Jan. 31, Feb. 7 and 14).

Wednesday, Jan. 25

ROYAL ASTRONOMICAL SOCIETY, at 5.30.—(Joint Meeting with the Geological Society).—Discussion on "The Development of Fractures in the Earth's Crust".

INSTITUTION OF CHEMICAL ENGINEERS, at 5.30.—"Sewage Disposal". Papers to be read by H. C. Whitehead and F. R. O'Shaughnessy, L. R. Howson, and Dr. Karl Imhoff.

INSTITUTION OF MINING ENGINEERS, at 11—(at the Institution of Mechanical Engineers, Storey's Gate, Westminster, London, S.W.1).—Annual General Meeting.

UNIVERSITY COLLEGE, LONDON, at 5.30.—H. J. Helweg: "Popular Education in Denmark: The Folk High School" (succeeding lectures on Feb. 1 and 8).

Thursday, Jan. 26

BEDFORD COLLEGE, LONDON, at 5.15.—"Contemporary Developments in Science." Lord Rutherford: "The Transmutation of Matter".

UNIVERSITY OF LONDON, at 5.30—(at St. Thomas's Hospital Medical School).—Prof. E. Mellanby: "Iodine and the Thyroid Gland" (succeeding lecture on Jan. 27).

MINERALOGICAL SOCIETY, at 5.30.—Dr. L. J. Spencer: "Meteoritic Irons and Silica-Glass from the Meteorite Craters of Henbury (Central Australia) and Wabar (Arabia)".

Friday, Jan. 27

CHEMICAL SOCIETY, at 6.—(Ostwald Memorial Lecture in the Chemistry Lecture Theatre, University of Liverpool). Prof. F. G. Donnan.

ROYAL INSTITUTION, at 9.—Sir Charles Peers: "The Ancient Monuments of England".

Saturday, Jan. 28

BRITISH MYCOLOGICAL SOCIETY, at 11—(at the Botanical Department, University College, Gower Street, W.C.1).—Symposium and Discussion on "The Measurement of Disease Intensity".

Official Publications Received

GREAT BRITAIN AND IRELAND

The Journal of the Institute of Metals. Vol. 49. Edited by G. Shaw Scott. Pp. 416. (London: Institute of Metals.) 31s. 6d.
Air Ministry: Aeronautical Research Committee: Reports and Memoranda. No. 1479 (T.3237): Wheels, Fairings and Mudguards. By F. B. Bradfield and G. F. Midwood. Pp. 14+13 plates. 1s. net. No. 1485 (I.C.E.838, 838a and 839): Radial Engine tested at Reduced Mixture Strength and with Variable Ignition Timing. By J. Swan and A. W. Morley. Pp. 12+15 plates. 9d. net. No. 1489 (T.3279): Lift and Drag measured in a Velocity Gradient. By F. B. Bradfield and J. Cohen. Pp. 4+4 plates. 4d. net. (London: H.M. Stationery Office.)

London School of Hygiene and Tropical Medicine (University of London). Report by the Dean on the Work of the School for the Year ended July 31st, 1932. Pp. 50. Eighth Annual Report to the Court of Governors, 1931-32. Pp. 14. Post-Graduate Instruction in Preventive Medicine. Pp. 32. (London.)

Proceedings of the Royal Society. Series A. Vol. 139, No. A837, January 2. Pp. 236. (London: Harrison and Sons, Ltd.) 12s.

Rubber. By W. A. Williams. (Streatfeild Memorial Lecture, 1932.) Pp. 23. (London: Institute of Chemistry.)

OTHER COUNTRIES

Zprávy komise na přírodovědecký výzkum Moravy a Slezska v Brně. Oddělení botanické. Čís. 7: Nový druh rodu *Gloeocapsa*, *Gloeocapsa Dvořáki* Nov. (spec. nova). By R. N. C. Frant. Nováček. Pp. 12+2 plates. 8 Kč. Čís. 8: Studie o zeměpisném rozšíření rostlin v úvale tísňovském. By Jan Šmarda. Pp. 58. 16 Kč. Čís. 9: Výsledky bryologického výzkumu Moravy za léta 1923-1931. By Josef Podpěra. Pp. 22. 8 Kč. Oddělení geologické. Čís. 11: Geologické poměry lázní Luhačovice a okolí se zvláštním zřetelom k minerálním pramenům. By Dr. Karel Zapletal. Pp. 21. Oddělení mineralogické. Čís. 3: Biotitický a pyroxenický syenit jihlavský. By Prof. Dr. Jos. Štěpánek. Pp. 38. 16 Kč. Čís. 4: Dva andesity z okolí Nezdické (jihových. Morava). By Prof. Dr. V. Rosický. Pp. 39. 16 Kč. Čís. 5: Krystalická kalcitu z karbonu páneve rosicko-oslavanské. By Jiří Novák. Pp. 31+3 plates. 20 Kč. Oddělení zoologické. Čís. 17: Moravské Hálky (*Zooecidia*). By Prof. Emil Bayer. Pp. 180+4 plates. 25 Kč. Čís. 18: Larvy a kukly pakomárů (*Chironomidae*). By Z. Zavřel. Pp. 52. 16 Kč. Čís. 19: Mravenci "Hádů", jižního výběžku Moravského Krasu (Faunistický rozbor). By Dr. Štěpán Soudek. Pp. 30. Čís. 20: Collembola z území rybníků Lednických. By Mirko Kseneman. Pp. 34. (Brno: A. Piša.)

Le calcul des variations, son évolution et ses progrès, son rôle dans la physique mathématique. By Vito Volterra. (Conférences faites en 1931 à la Faculté des Sciences de l'Université Charles à Praha et à la Faculté des Sciences de l'Université Masaryk à Brno.) Pp. 54. (Praha: Université Charles; Brno: Université Masaryk.)

Bulletin of the Geological Society of America, Vol. 43. Pleistocene Mazouna Stage in Western Algeria containing Artifacts. By Robert Van V. Anderson. Pp. 847-874+plates 22-23. (New York City.)

Methods and Problems of Medical Education. (Twenty-first Series.) Pp. iv+226. (New York: The Rockefeller Foundation.)

U.S. Department of the Interior: Office of Education. Pamphlet No. 33: Religious Education Bibliography, January-December, 1931. Pp. vi+30. (Washington, D.C.: Government Printing Office.) 5 cents.

Cornell University: Agricultural Experiment Station. Bulletin 540: The Effect of Different Planes of Protein Intake upon Milk Production. By E. S. Harrison and E. S. Savage. Pp. 24. Bulletin 543: The Influence of Different Levels of Fat Intake upon Milk Secretion. By L. A. Maynard and C. M. McCay. Pp. 40. Bulletin 547: Population Trends in New York State, 1900 to 1930. By W. A. Anderson. Pp. 60. (Ithaca, N.Y.)

The Observer's Handbook for 1933. Edited by C. A. Chant. (Twenty-fifth Year of Publication.) Pp. 72. (Toronto: The Royal Astronomical Society of Canada.)

Journal of the Imperial Agricultural Experiment Station, Nishigahara. Vol. 2, No. 1, March. Pp. 128. (Tōkyō.)

Memoirs of the College of Science, Kyoto Imperial University. Series A, Vol. 15, No. 5, September. Pp. 293-349. (Tokyo and Kyoto: Maruzen Co., Ltd.) 1.30 yen.

Southern Rhodesia: Geological Survey. Bulletin No. 21: The Geology of the Antelope Gold Belt. By A. E. Phaup. Pp. 119+6 plates. (Salisbury, Southern Rhodesia.) 3s. 3d.

Department of Agriculture: Straits Settlements and Federated Malay States. Supplement to Bulletin No. 38: A Preliminary List of Food-Plants of some Malayan Insects. By N. C. E. Miller. Pp. 54. (Kuala Lumpur.)

CATALOGUES

The Medicinal and Dietetic Value of Marmite (Yeast Extract). Pp. 15. (London: The Marmite Food Extract Co., Ltd.)

Increasing the Quantitative Accuracy of a Spectroscope. (Publication No. 175/2.) Pp. 4. (London: Adam Hilger, Ltd.)

The Cambridge School-Book Bulletin. No. 3. Pp. 24+8 plates. (London: Cambridge University Press.)

Radiostoleum, Radio-Malt, Radiostol, Avoleum: their Application in General Science. Pp. 20. Spironine (Syn. Elixir Anti-asthmaticum). Pp. 4. (London: The British Drug Houses, Ltd.)

Editorial and Publishing Offices:

MACMILLAN & CO., LTD.

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

Telephone Number: WHITEHALL 8831

Telegraphic Address: PHUSIS, LESQUARE, LONDON