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## CONTENTS



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## The Chemist in Industry

DR. H. LEVINSTEIN, a past president of the Society of Chemical Industry, recently delivered before the Institute of Chemistry a discourse entitled "The Chemist as a Directing Force in Industry". While emphasising that there are other branches of special knowledge besides chemistry which are necessary to business, Dr. Levinstein declared that there can be no better training for industry in general—not alone for the chemical industry—than a sound training in science. Too few in Great Britain have had such a training; too few of our business men, our politicians and our very able civil servants. Yet mere knowledge or talent is not enough; "it is the man that matters". It is not necessary to be a chemist to control even a dyestuff manufacturing business; it is merely a great advantage to be one. Chemists must not be regarded as one class, or as a class apart. Chemical training is varied, but it cannot be more than an excellent preparation; what can eventually be accomplished depends on the individual or upon the opportunities which he can find or make.

An increasing number of people who have had such training is being employed in administration in the big chemical and other industries, but there is no indication that politicians, financiers and bankers are making the slightest progress in this direction. Finance houses and banks might well employ, as a routine procedure, men thoroughly trained in chemical industry. In Great Britain we have too little 'educated money'; too little realisation of the value and applicability of the technologist's training and methods. Inventions are too often regarded as accidental, whereas they are in truth created by researches directed to a specific purpose by trained minds. Moreover, it is sometimes forgotten that the amount of a substance produced is not an accident, but is determined by the demands of trade, by the capital available, by the profits to be made, and often by the supply of raw material.

As an example of the serious results of neglect of such considerations by those in authority, Dr. Levinstein quoted the payment of gold to the United States of America on account of war debts. Like every other industry, the gold mines of South Africa regulate their production of gold according to the demand which they can profitably supply. The cost of raising capital, economical and prudent working, and the world's requirements for their

products are naturally their principal considerations. The gold which we agreed to pay America—some 220 metric tons annually—is taken from stock. No effort is made to manufacture the extra quantity required from the raw material available in plenty, to earmark any portion of the new production of gold for debt payment, or to limit in any way the use of gold for unnecessary purposes. In every particular we fail to take the elementary precautions which a trained technologist would have taken, had he been called upon to advise. What should we think in business of a sales department which made contracts to deliver without consulting the manufacturing side or even the research department; which neglected to do every one of those things that are elementary in any properly conducted business? During the years that currencies were being debauched in order to ship gold to America, India was taking almost as much gold as America, because our policy made it attractive. Since Great Britain went off the gold standard, most of the gold which we shipped to India has come back, but after causing misery and poverty, undeserved and unnecessary, in every social class in half the world.

Speaking of the relations between industry and the State, Dr. Levinstein referred to changes wrought by the War in many countries, and said that industrial history is being made very rapidly. All political or social changes in one nation react remarkably quickly on all others. Apart from the spread of new social theories, there is the fact that if the industries of one or two important States can act as a unit, a similar concentration or simplification in some form or other will be forced upon us. We already have compulsory quota and compulsory marketing methods, and trade agreements with other countries are likely to lead to novel restrictions on the construction of new plants. Whereas up to now any person making an invention has been free to erect a plant to carry out his invention, it may in future be necessary for inventors or enterprising individuals who wish to be their own masters to obtain a permit before they can be allowed to build.

The latter part of Dr. Levinstein's discourse was devoted to an examination of the close relations between science and industry in Japan, and had special reference to the dependence of the pearl industry on scientific investigation and application. Until a few years ago, the pearl industry of the East was as big a gamble as that of gold-mining before the introduction of the Forrest-MacArthur cyanide process; the pearl oyster was scarce, and the yield of good pearls was entirely a matter of chance. Now the breeding of oysters for pearls in Japan has become an industry analogous to the breeding of silk worms; the cultivation of the pearl oyster is recognised in Japan as a matter of national importance, and—this with reference to Mr. Mikimoto, by whom the industry has been methodically built up—people who do things of national importance industrially in Japan are encouraged and honoured by those in high places. The production of culture pearls, a delicate and lengthy operation described by Dr. Levinstein, is, as he said, truly a romance of science and industry in a novel form.

Another great technical achievement is the development of the Japanese artificial silk industry. In fact, every industry which one looks at in Japan shows the same highly skilled planning, both on the technical and on the commercial sides. Important technical results accrue from the work of the Institute of Physical and Chemical Research, which was founded in 1917, and has a trained research staff of four hundred. Japanese industry is to-day armed with every weapon of the modern industrial armoury, and its competition is of importance to British chemical industry not only because Japan is a diminishing customer for chemicals, but also because the outlet for our inventions is half choked if the flow of orders from the great bleach works, dye-houses, and calico-printing works of Lancashire and Yorkshire is checked. The intimate connexion between industry and the State is apparent; lost orders rapidly become matters of political importance. The problems involved call for the man of knowledge and action, and we agree with Dr. Levinstein that training in science, particularly if followed by works practice, gives that unique experience which aids in every type of constructive work.

## Everyman's Guide to the Plant Viruses

*Recent Advances in the Study of Plant Viruses.* By Dr. Kenneth M. Smith. Pp. xii+423. (London: J. and A. Churchill, 1933.) 15*s*.

DR. KENNETH SMITH is to be congratulated heartily on producing a succinct, clear, readable and excellently illustrated account of the present state of knowledge concerning the plant viruses. In view of his many other activities the achievement is a remarkable one. The book will be of the greatest service not only to virus workers, but even

more so to those in the related fields of botany, bacteriology and agriculture, to whom, for the first time, it presents a coherent account of the subject free from the minutiæ of technical papers.

Beginning with an introductory chapter, the author passes to a consideration of symptomatology, which is a difficult and debatable subject, and then proceeds to a good account of pathological histology, including a useful comparison with animal virus diseases. Two chapters are devoted to an excellent treatment of the physical properties of viruses, including practical directions for the preparation and use of graded collodion ultrafilters following Elford's method.

The next three chapters deal with insects in relation to viruses, and they are, as would be expected, excellent. It is interesting to note that only three of the twenty-three orders of insects are implicated in the spread of plant viruses, and that the sub-order Homoptera contains about 90 per cent of all known vectors. The evidence is presented *pro* and *con* on the unsettled question of the relationship between virus and insect, whether an obligate one and therefore leading to the presumption of a development cycle of the virus within its vector, or a casual physico-mechanical relationship. The latter would appear to be favoured by the gradually accumulating evidence, notably the author's transmission of spotted wilt by means of *Thrips tabaci* in England, while it is associated with *Frankinella insularis* in Australia (which parallels the more doubtful case of curly top of sugar beet), the recently accomplished needle-transmission of the latter virus, and generally the discovery of multiple vectors for so many diseases, such as leaf-roll. Further advances are likely to follow from Storey's delicate gut-puncturing operation on leaf-hoppers, whereby the virus gains access to the body fluids, as a result of which hoppers previously 'inactive' become vectors of streak.

Four chapters are devoted to the transmission of virus diseases by other means, to the physiology of diseased plants (a good account largely following Henderson Smith) and to general aspects of virus diseases, such as carriers, recovery, immunity, variations in virulence, virus adaptation, composite virus diseases and the separation of virus mixtures, all of which are succinctly and excellently treated.

The last three chapters are made up of short descriptive lists, which are not exhaustive, of the virus diseases of plants. This is one of the least satisfactory parts of the book. Few will accept the author's grouping of the potato virus diseases, and it is remarkable that in the case of this crop alone does he confuse a virus with a virosis—a useful word which is rejected. An attitude more detached and judicial would have led to a better treatment. Those who are familiar with the author's papers will have some difficulty in recognising his best-known theories in their present form, but it is impossible to discuss this matter here. In any future edition it would be well to treat of crop losses and economic applications much more fully.

Taking the book as a whole, the outstanding features are the co-ordination of work on the animal and plant viruses, which workers in both fields will find stimulating, and the excellent bibliographies, brought down actually to the middle of 1933, for which alone the book would be worth its price. These are appended to most chapters, and are not merely lists of titles, but are discussed so far as space permits. One or two notable omissions may be referred to, such as the original discovery of the insect transmission of leaf-roll by Oortwijn Botjes in 1920, that of potato carriers by Atanasoff in 1925, and the finding of the *A*-chlorosis and *B*-chlorosis of the Malvaceæ by Hertzsch in 1927, whereby he reconciled the work of Lindemuth and Baur. The book closes with an author and subject index, except for 16 pages of disfiguring publisher's announcements at the end.

In a discipline so young, it may be asked which are the recent advances and which the older? It will surprise most people to learn that potato mosaic was first seen by Orton, an American, in a German field in 1911, the irony of this being that not a single commercial American potato plant has since been found which is free from mosaic. To this author's classical bulletin of 1914 we owe the specific name leaf-roll (philologically preferable to 'leaf roll') and the first mention of potato mosaic and streak. With whom shall we begin the modern period? With Orton, or Appel who inspired him, or Allard who conveyed the classical tobacco mosaic to potato in 1912, or Quanjer who discovered the infectious nature of leaf-roll in 1916? None of these papers is mentioned. The reviewer would say that the 'recent' period begins with Quanjer's paper of 1916, and he would like a student approaching the subject to do so in a filial and historical spirit, contrasting the trackless jungle of degeneration theories, from Parmentier downwards, which existed before

1916, with the path which was then so magically opened through it. Or if 1916 is too remote, then he would say that the modern period begins with the general adoption about 1923 of the Wageningen greenhouse equipment and methods, which every country has copied, for all results of value have flowed from them.

A striking feature of the bibliography is the immense preponderance of work in the English language. Even if one were to admit that some of the other languages have not been gleaned so thoroughly, yet it is true that practically all the creative work (work in Dutch excluded) has appeared in English, and to this all the English-speaking countries have made first-class contributions, including besides Great Britain, Ireland and the United States, Australia, Africa, India and Canada.

Virus workers—how long must we wait for 'virologists' ?—have a gratifying esoteric feeling of working in a new medium in which anything may happen because it transcends the ordinary laws. For this reason they have not been popular with their fellows, who have failed to understand what they are doing, if anything, except squabbling incomprehensively. The present book removes this reproach, and virus workers themselves may, looking back over the labours of the last seventeen years, congratulate themselves *se valde profecisse*. They have compiled a body of learning which fits the facts of Nature, explaining what was previously inexplicable, and their theories are still fruitful. There is no other criterion of the truth.

PAUL A. MURPHY.

## The Intimate Structure of Fibres

*Fundamentals of Fibre Structure.* By W. T. Astbury. Pp. x+187. (London: Oxford University Press, 1933.) 8*s*. 6*d*. net.

IT is a not uncommon complaint that the trend of thought in modern physics has been in such a direction as to make it almost impossible to devise an extended course of lectures suitable for extra-mural students. The study of quantum theory, wave mechanics, potential barriers and the like demands a mathematical equipment and a technical knowledge quite beyond the compass of those whose training, in mathematics especially, has not been regular and systematic.

That there is something in the complaint is seen in the practical fact that physical subjects do not bulk largely in adult educational syllabuses. Here and there, swimming rare in the vast whirlpool of courses on economics, music, and all possible cultural aspects of literature, may be found a lonely set of lectures on the history of the physical sciences or on some astronomical topic; but on the whole, physical subjects are poorly represented in such syllabuses—a very different state of affairs from that which held fifty or sixty years ago when, to hear Tyndall, crowds queued up at the Free Trade Hall as at a theatre. The fault may be in the subject, or may be in the teacher.

Mr. Astbury's admirable lectures seem to show that, given an enthusiastic and clear-headed teacher, who speaks of what he really knows from first-hand acquaintance with the subject, an elucidation of some of the most recondite problems of modern physics may be satisfactorily presented to a lay audience.

X-ray analysis, of course, lends itself specially to exposition by means of models—using that word in a very wide sense—and Mr. Astbury has not been slow to avail himself of such assistance as models can afford. He has not been afraid to begin at the beginning, and by means of happy analogy and illustration has built up an atomic and molecular world in which his hearers, almost without realising the complexities with which they have to deal, are led from a molecule of hydrogen to those of methane and of benzene and, in a very little time, are finding structures such as that of tri-olein no more difficult to handle than that of ethyl alcohol.

The story of the X-ray analysis which has unfolded the crystalline structure of fibres is one of the most fascinating of the tales that applied science has to tell, and the story loses none of its fascination in the skilled hands of Mr. Astbury. It is clearly and authoritatively told by one who has played a large part in its development. The titles of his successive lectures—the fundamental nature of matter and radiation; the invisible fibres of the world of molecules; how atoms and molecules make patterns in space; an X-ray view of the inside of a textile fibre; the fundamental structural difference between wool and other fibres; and some inside information about the properties of the wool fibre—show sufficiently well the lines along which Mr. Astbury has developed his thesis.

The textile students of Cleckheaton are to be congratulated on their privilege of hearing these lectures which, in their present form, should appeal to a very wide audience.

ALLAN FERGUSON.

## Compression-Ignition Engines

*High Speed Diesel Engines, with Special Reference to Automobile and Aircraft Types: an Elementary Textbook for Engineers, Students and Operators.* By Arthur W. Judge. Pp. viii + 248 + 35 plates. (London: Chapman and Hall, Ltd., 1933.) 10*s.* 6*d.* net.

MR. JUDGE set himself a difficult task when he decided to compress into less than 250 pages an account of high-speed Diesel engines, which (as he hopes in the preface) will be equally suitable for engineers, students and operators. The needs of the second and third of these groups, if not almost mutually exclusive, are at least difficult to harmonise: the operator must think chiefly of details whilst the student's essential need is to grasp general principles and view the subject as an articulated whole. Nonetheless, the author has achieved his aim in a remarkable degree, and no one who professes, or desires to profess, a close acquaintanceship with this type of engine can afford to ignore Mr. Judge's contribution. The title chosen for the book may be questioned, though the author makes some defence of his choice in urging that the name Diesel engine is more readily recognisable than compression-ignition engine. There we think he is wrong; the latter name is already well enough known to those for whom he writes even if not to the world of the "Press and General Public" to suit which his choice of title was, he admits, mainly selected.

One of the chief uses of this engine is found in road transport. In the sixteen different makes on the road there are very varying standards of performance, but it is understood that more than one hundred motor vehicles using one of these engines are now on the road in London alone, and any criticism of their performance arises not because of failure in thermodynamic efficiency but mainly because, owing to the youthfulness of design, maintenance troubles loom rather large.

Another important field is that of aviation. Here the great potential gains are the lessening of fire risk on crash, and the elimination of radio interference from ignition gear. Both of these are of first-rate importance and the former can scarcely be over-emphasised, especially for civil air transport.

On p. 196, the author gives an illustration of the rather complex Jumo engine which is a triumph of the illustrator's art: the credit for this he gives to our contemporary, the *Mechanical World*. The illustrating work throughout is of a high level, and we think the author is to be congratulated upon the care he has taken to attain a high level in this regard. Furthermore, his book gives the best short account we have seen of the various cylinder combustion-heads which have been tried, and of the important aim and purpose which lies behind them. We have no hesitation in recommending this book as a valuable addition to any engineer's library.

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## Problems in Mental Deficiency

*Stoke Park Monographs on Mental Deficiency and other Problems of the Human Brain and Mind.* No. 1: *The Burden Memorial Volume.* Dedicated to the Memory of the late Rev. Harold Nelson Burden. Edited on behalf of the Medical and Consultant Staff of Stoke Park Colony, Stapleton, Bristol, by Dr. Richard J. A. Berry. Pp. xix + 249 + 29 plates. (London: Macmillan and Co., Ltd., 1933.) 10*s.* 6*d.* net.

IN this volume there is collected together a series of papers, dealing with the problems of mental deficiency, by a variety of authors, most of whom are members of the medical staff of Stoke Park Colony. Two thirds of the articles have been previously published though they appear in this collection in slightly modified form.

The first paper, which is the longest in the series, concerns the detection of potential 'social inefficiency' by physical and mental measurements, and was originally published in 1920. It contains a comprehensive table giving norms of the brain capacity of Australian children, calculated by one of Lee's formulæ. The writer of the article, Prof. R. J. A. Berry, holds that there is a fairly constant relationship between head volume and intelligence, and he applies this hypothesis to the diagnosis of mental subnormality. He attributes the relatively small size of the heads of some delinquent and defective children to the incomplete development of the cerebral cortex. The proportion of mentally subnormal individuals who have head measurements which do not deviate significantly from the normal is not indicated and without this knowledge it is difficult to see how cranial capacity can be of much diagnostic importance in a given case. The diagram shown on p. 26, apparently showing the

relationship between mental age and cranial capacity, is misleading. The correlation between these two variates is weak and many mental defectives of imbecile and idiot grades have heads of normal dimensions.

One of the new papers gives a detailed analysis of cellular changes found in the brains of three defectives. It is concluded that the more severe the grade of defect, the more disorganised is the histological picture of the cerebral cortex. Another original article, by R. M. Norman, seeks to demonstrate a relationship between these cellular deficiencies in the cortex and neurological abnormalities which are to be found among mentally defective patients.

In a short paper, published for the first time, R. M. Bates describes three rare developmental abnormalities which have been found in association with mental retardation. This article is particularly good and it is well illustrated. It records a case of anomalous cervical vertebræ, a case of bilateral facial palsy with club-feet and an example of what is clearly acrocephalosyndactyly.

Though there are many statements in this book concerning which research workers in mental deficiency and related problems will disagree, they will find it convenient to have the essays collected in a single and well-printed volume.

## Short Reviews

*Edwardian England A.D. 1901–1910* : *a Series of Lectures delivered at King's College, University of London, during the Session 1932–3.* Edited by Prof. F. J. C. Hearnshaw. Pp. 285. (London : Ernest Benn, Ltd., 1933.) 10*s.* 6*d.* net.

THIS book contains the latest of the well-known series of public lectures arranged by the History Department of King's College, London. "Edwardian England" may be said to include the first decade of the century, but there would be only a verbal incorrectness in extending it to the outbreak of the War. Edward VII's two main interests were society and foreign policy. With regard to these two aspects of public life in England, there really was an Edwardian period. But the same remark can scarcely be made of, for example, literature and science.

Still, as Prof. H. Levy shows, in his illuminating lecture on the advance of science during the period, any link in the chain may be isolated for special study. He rightly insists that it was appropriate in this lecture to regard science, not merely in an abstract sense, but also as permeating the social life of the time. It was the Edwardian period, for example, which saw the transition from dimly to brilliantly lighted streets and buildings, with consequent changes, on a great scale, in the uses of leisure. Passing from the effects of applied science upon social practice, Prof. Levy refers at some length to the experimental and theoretical investigations that were maturing during the period. Here, what he has to say about relativity seems to us as clear as any popular explanation that we have encountered. Naturally Prof. Levy's references to biology are briefer, but he explains how during the Edwardian period evolutionary theory advanced from a qualitative to a quantitative and measurable stage. Both in scope and in treatment the lecture is a fitting contribution to the volume in which it now appears.

*Annals of the Royal Botanic Garden, Calcutta.* Vol. 13 : *Asiatic Palms—Corypheæ.* Posthumous Work by Dr. Odoardo Beccari. Revised and edited by Prof. Ugolino Martelli. Pp. vii+356. 50 rupees ; 75*s.* Plates. Pp. v+102 plates. 26.8 rupees ; 40*s.* 6*d.* (Calcutta : Bengal Secretariat Book Depot, 1931.)

FEW groups of plants are more difficult to comprehend systematically than the palms, and this is mainly due to the bulkiness of adequate specimens causing them to be largely neglected by explorers, so that we welcome the continuation of this great work on Asiatic palms by the late Prof. O. Beccari, published posthumously by Prof. U. Martelli. No eastern botanist ever possessed the knowledge of Asiatic palms which Beccari in his travels in Malaya, one of the richest palm areas in the world, had accumulated. The Corypheæ are especially interesting as they appear to be the oldest known group occurring in the Eocene, and almost the only palms found in temperate regions, the unique European palm *Chamærops* being one of them.

Besides full descriptions of the Asiatic species, illustrated by photographs of specimens, the author has added a very useful list with localities and diagnoses of those of the New World, with anatomical drawings of flowers and fruits. All that now remains of Beccari's manuscripts in the capable hands of Prof. Martelli and awaiting publication, are those dealing with the Arecineæ, for the Lepidocaryinæ and Borassineæ were published in the Calcutta *Annals* before Beccari's death and the Phœnicineæ (dates) in Malesia. With the publication of the remaining portion the whole work will stand for ever as a worthy monument to one of Italy's greatest botanists, and this we hope will be carried out by Prof. Martelli, who is much to be congratulated on the work of revision and publication of the present volume.

H. N. R.

*Marie Stopes: her Work and Play.* By Aylmer Maude. Authorised edition. Pp. 299+8 plates. (London: Peter Davies, Ltd., 1933.) 8*s.* 6*d.* net.

DR. MARIE STOPES is a remarkable woman; and if she were unaware of the significance of her work and influence, Mr. Aylmer Maude's book could not fail to enlighten her. It is not given to many workers in the realm of science—natural or social—to have their biographies published during their lifetime; so that Dr. Marie Stopes is fortunate in this respect and also in her biographer, whose literary gifts enable him to present a pleasing portrait of his subject.

Dr. Stopes's scientific work in palæobotany, the composition and structure of coal, and related subjects, belongs to the first rank and has both scientific interest and practical value. The general public knows nothing of her eminence in these fields and associates her name only with the subjects of birth control and problems of sex. For the enlightened view now taken of these matters by most people, the chief thanks are due to Dr. Stopes, whose work marks a new epoch in the life of the community. Mr. Maude is evidently an ardent disciple of this pioneer of social hygiene and intelligent reproduction of the human species; and on this account we ought perhaps to overlook the exalted position in which he sometimes places her. Several of the chapters might have been abridged with advantage, but on the whole the book is a faithful record of Dr. Stopes's activities in many directions.

*Elements of Optical Mineralogy: an Introduction to Microscopic Petrography.* By Prof. Alexander N. Winchell. Third edition. Part 2: *Descriptions of Minerals, with Special Reference to their Optic and Microscopic Characters.* Pp. xviii+459. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1933.) 37*s.* 6*d.* net.

THE general arrangement of the third edition of Pt. 2 of Winchell's "Elements" remains broadly the same as in earlier editions. Advances in knowledge of the relations between the optical properties and chemical composition of crystals, especially those affecting the amphibole group, have been incorporated in the text.

An important change has, however, been made in the chapter on the silicates, which occupies more than half of the book. This large group of minerals has been re-classified, so far as is at present possible, on the basis of the results obtained in recent years from X-ray crystal analysis. This change-over, with its subordination of chemical composition to crystal structure, is of the greatest theoretical interest. In effect it summarises the results of all the work done on the silicates in recent years.

This is an invaluable work for students and research workers in mineralogy and petrography. It is therefore unfortunate that the slight increase in size of the latest edition should be accompanied by so very considerable an increase in price.

*The Official Year-Book of the Scientific and Learned Societies of Great Britain and Ireland: with a Record of Publications issued during Session 1932–1933.* Compiled from Official Sources: Fiftieth Annual Issue. Pp. viii+171. (London: Charles Griffin and Co., Ltd., 1933.) 10*s.* net.

THE publishers of this Year-Book are to be congratulated on their enterprise, for the present year marks the jubilee of its issue. There can be no question that the existence of such an annual volume has promoted the interests of science generally and of the societies with which it deals, by providing accurate details of the numerous scientific bodies in the British Isles. The present issue is on the usual lines; the various societies are classified into 14 groups. The officers, membership, dates of meetings, and publications of each society, institute, etc., are given, and in many cases further details, such as the objects of the society, are appended. A good index, and a logical grouping of the societies make it quite easy to refer to any society. All information incorporated in the volume is compiled from official sources; it is, indeed, a work of ready reference, worthy of support by scientific societies.

*Modern Theories of Development: an Introduction to Theoretical Biology.* By Ludwig von Bertalanffy. Translated and adapted by J. H. Woodger. Pp. x+204. (London: Oxford University Press, 1933.) 8*s.* 6*d.* net.

THIS important introduction to theoretical embryology is well-known to all those interested in the subject. The English translation and adaptation by Dr. Woodger will make it available to a wider circle of readers. The author proposes as a solution to the crisis of present-day biology, the constitution of a purified science which would relate and explain the accumulated facts pertaining to the study of living organisms. As a synthetic principle of this science, the author proposes an organismic theory which would aim at the establishment of the laws of biological systems based on experimental data and on the possible use of mathematical logic.

*Examination of McTaggart's Philosophy.* Vol. 1. By Dr. C. D. Broad. Pp. lvi+460. (Cambridge: At the University Press, 1933.) 21*s.* net.

ONE cannot do justice in a few sentences to this excellent commentary of McTaggart's philosophy. Not only is McTaggart himself a great philosophical mind, but Dr. Broad, his commentator, compels the attention of his readers whenever he writes about philosophy. McTaggart's "Nature of Existence" is a difficult book to study. But its reading will perhaps become easier after perusal of the present commentary. With a wealth of detail and a great ingenuity of thought, Dr. Broad shows us how McTaggart's analysis of existence and reality led him to the formulation of the principle of determining correspondence, and what masterly use he made of this principle in the explanation of metaphysical values. T. G.

# Fluorescence and Its Use as a Method of Testing and Analysis

By DR. JULIUS GRANT

ONE of the results of the increasing popularity in recent years of so-called 'sun-ray' treatment has been the rapid development of improved methods of generating ultra-violet rays. This has placed in the hands of the scientific worker very efficient sources of such radiation, and it is therefore not surprising that other uses of this region of the spectrum should have followed in the wake of the above developments. One of the most interesting is the generation of a characteristic fluorescence in numerous substances, and this is now widely employed as a method of testing and analysis.

The range of ultra-violet radiation is usually considered to extend from about 136 A. to 4000 A., but the principal rays used for obtaining fluorescence effects are confined to wave-lengths between about 2500 A. and 3700 A., and there is ample evidence that individual rays in this range are particularly effective. Similar selectivity is, of course, well known in connexion with work on ultra-violet therapy and on the photochemical activity of ultra-violet light.


FIG. 1. Fluorescence photograph of a forged document. Arrows indicate original wording, which is not visible in daylight.

## GENERATION OF ULTRA-VIOLET LIGHT

Methods of generating ultra-violet light are fully treated in works on light-therapy, and it is necessary here only to indicate some of the special requirements of fluorescence analysis.

Carbon and mercury arcs have both been used, but whilst the former is best adapted for fading tests on account of the similarity of its spectrum to that of sunlight, the latter has proved more popular where an intense ultra-violet radiation is required with a minimum of visible rays. The character of the actual radiation emitted depends, however, on the type of lamp and on the working conditions. As is well known, the principle of the method is the production of an electric arc in the mercury vapour produced between two heated mercury electrodes. Mercury lamps vary considerably in design; some give a point-source and are particularly useful for spectroscopy and fluorescence microscopy, whilst others are designed to give a maximum luminous area. The unstable open forms of U- or H-tubes have now largely been replaced by completely enclosed types, one of the latest of which takes the form of an ordinary electric-lighting bulb containing a globule of mercury and two tungsten electrodes which serve both to heat the mercury and to carry the arc.

There are also rival claims between lamps operating in a vacuum and at atmospheric pressure. The latter have a great advantage in that they can be opened and cleaned, but on the other hand, with the former there is less necessity for such cleaning, owing to the absence of air. One well-known design consists of an evacuated quartz tube, with a reservoir of mercury at each end, into which protrude metallic leads connected to the electricity mains. When the lamp is tilted, the mercury runs across the floor of the vessel and short-circuits the two leads; the heat so generated produces mercury vapour and the arc then strikes.

Such lamps were at one time expensive and deteriorated rapidly, but recent models are cheaper both to buy and to run, and can eventually be regenerated. The changes which occur on ageing often produce alterations in the spectral distribution of the radiation, and if these are not controlled from time to time discordant fluorescence results may be obtained.

During the last year or so, several 'lamps' which utilise the ultra-violet constituents of daylight have appeared. They are essentially darkened boxes fitted with a filter to remove visible rays, and are necessarily relatively inefficient. However, they are portable and comparatively cheap, and for some purposes are adequate.

## TECHNIQUE

The lamp is usually housed in a box, provision being made for viewing objects either by reflected or transmitted light through a filter which removes visible rays, the brilliance of which would obviously mask any fluorescence. Filters may be solutions of dyestuffs or coloured or coated glasses, and may be chosen so as to isolate almost any given range

of wave-lengths; nickel oxide glass ('Wood's glass') is, however, the best for most purposes. As already indicated, it is important to keep a control over both the quality and quantity of the radiations, and here again there is a wide choice of methods, of which the photoelectric cell and the use of the selective photochemical action of the rays on certain chemical reactions are the most promising.

The procedure depends to a great degree on the nature of the sample. Useful information is often obtained if a little powder is blown on to moist filter-papers which have been treated with reagents, whilst solids in the mass are usually exposed on a fresh fracture which also may be spotted with reagents. Liquids are examined in non-fluorescent containers, preferably in open Petri dishes or in quartz test-tubes, and it is often an advantage with solutions to use a variety of solvents and dilutions. Capillary analysis, in which the 'zones' produced on a strip of filter paper suspended in the liquid or solution are examined in ultra-violet light, has proved very useful, notably in connexion with mixtures of alkaloids and dyes, and Danckwortt and Pfau[1] have even obtained semi-quantitative results in this way.

When, however, it is required to determine the composition of a mixture containing a fluorescent ingredient, the usual procedure is to match it against one of a series of known mixtures. The importance of working under strictly standardised conditions in all this work cannot be emphasised too strongly. The type of lamp, its age, the time which elapses after striking the arc, the filter, the temperature and humidity, etc., all determine the actual appearance of the fluorescence, and it is essential that each worker should evolve and adhere to his own conditions if apparent anomalies are to be avoided.

The use of fluorescent compounds as stains in microscopy and as indicators in titration work has greatly widened the range of application of the method. In the former case it is often possible to bring out fine details, for example, of plant structure, which are invisible in daylight, whilst the latter method may be used for coloured fluids, for example, for the titration of quinine[2] and of the acidity of wines, and for neutralisation titrations in extremely dilute solutions. Photographic methods require special technique and their applications are limited by the difficulty of reproducing colour effects. They are, however, greatly used in criminological and museum work, for example, to provide evidence of falsification of documents (Fig. 1 is a photograph of a falsified document taken in ultra-violet light, in which the original writing is plainly visible, although not apparent in daylight).

## Applications

The applications of fluorescence are numerous and varied, and can only be briefly indicated here; they are discussed fully elsewhere[3].

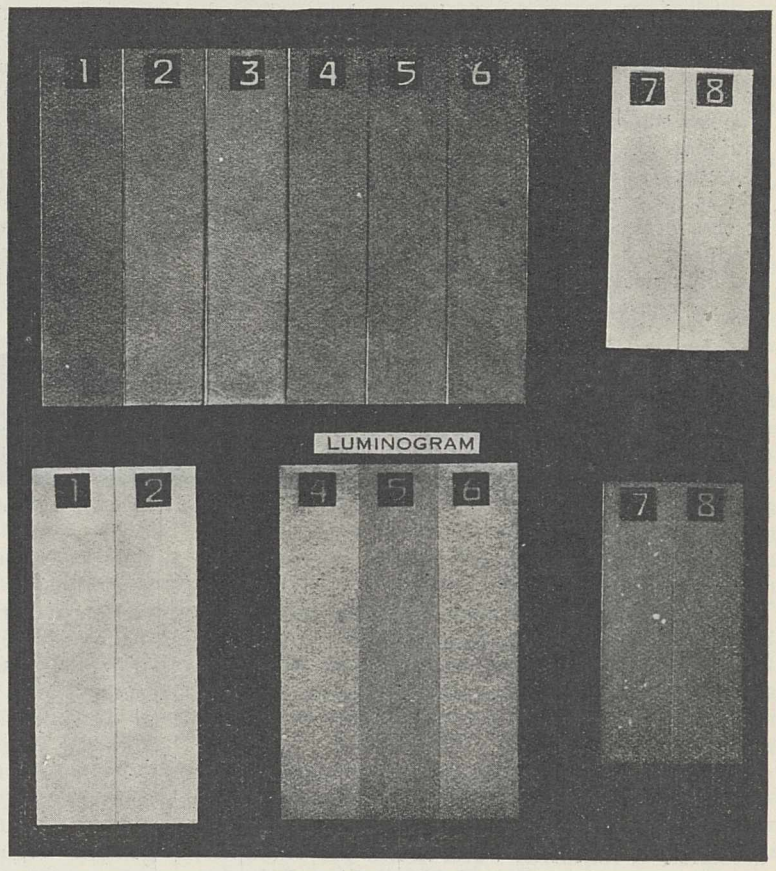


FIG. 2. Comparison of daylight and fluorescence photographs of strips of yellow paper.

The examination of chemical substances for purity is one of the best known. Many alkaloids, most dyestuffs and numerous inorganic and organic compounds give characteristic colours, and as these may depend on the origin, purity and method of manufacture, they form the basis of rapid testing methods, the importance of standardised conditions being always emphasised. Such methods have found application in connexion with paint pigments, drugs and all industries where dyestuffs are used. Thus in Fig. 2 specimens 1–4 are strips of dyed yellow paper which appear identical in daylight (top row) but vary considerably in colour and in intensity in ultra-violet light (bottom row); Nos. 5 and 6 are the same as

No. 4 after exposure to sunlight (1 week) and to ultra-violet light (2 hours), respectively, and comparison of No. 7 with No. 8 shows the effect of addition of wax size. Accelerated fading tests are best carried out with the carbon arc, which gives effects nearest to those of sunlight; in many cases the results from the mercury arc are definitely misleading and this lamp is more suitable for ageing tests, or for tests based on the use of the change in fluorescence on exposure (see Nos. 5 and 6 in Fig. 2) as a measure of stability.

Plant materials offer a wide scope for the method, particularly if fluorescence microscopy is employed. Examples are the differentiation of woods and of various strains of seeds, and the control of the composition of farm products such as fertilisers, poultry and cattle foods, dairy produce, etc. Fig. 3 shows the appearance in ultra-violet light of five rhubarbs (*R. Palmatum*, High-dried Flats, Rough Rounds, *R. Rhaponticum* and Canton, respectively), and is an example of the numerous applications of the method to plant drugs. The fluorescence produced by bacteria, fungi, animal organs, sera and biological fluids also lends itself to the method, and a considerable amount of work has been carried out (notably by C. Dhéré[4]) on blood and the porphyrins.

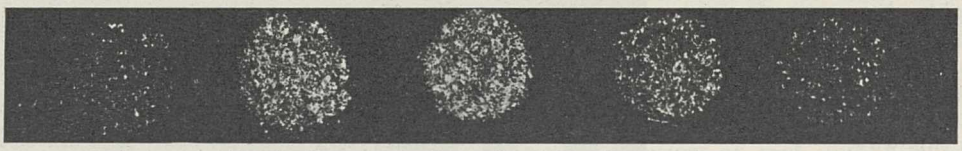

FIG. 3. Fluorescence photographs of five different rhubarbs.

Closely related to this are applications to medico-legal work, particularly from the point of view of identifying stains on garments and drugs in body fluids, and although the method is in its infancy, it has already met with some encouraging successes.

The method is also of considerable use in other branches of criminological work; erasures or alterations of written matter (see Fig. 1) and the detection of imitation water-marks are examples, and in a case recently submitted to me[5], it was possible to differentiate easily between a genuine banknote and a particularly clever forgery from the fact that the dyestuff used to produce a blue design fluoresced with a green colour in one case but appeared black in the other.

Museum work should be mentioned in this connexion, since photographs in ultra-violet light of paintings, palimpsests and other documents frequently provide evidence of superimposition. The dyestuffs used on postage stamps are excellent indications of possible imitations in philately, and a complete technique has been evolved for the examination of geological specimens and fossils. Since ageing influences the appearance of sculpture materials, ivory, woodwork, etc., repairs and imitations may be detected.

The application to work involving the use of organic solvents and mineral or essential oils is particularly wide, as such materials usually glow vividly in ultra-violet light. Reference has already been made to the identification of dyestuffs and the use of fluorescent indicators, but it should also be mentioned that this work has provided useful information concerning the influence on fluorescence of chemical constitution.

In conclusion, the applications to the food industries merit a few words. Fatty foods fluoresce, the yellow colour of butter being modified by the presence of margarine or other foreign fats. A great deal of work has been carried out on milk, partly from the public health point of view and partly with the object of ascertaining the nature of the fluorescent constituent (lactochrome), which has now actually been isolated.

The sensitiveness of micro-tests for organic or inorganic substances may often be magnified if the test involves the production of a compound which fluoresces, and several aids to the detection of preservatives such as boric, benzoic and salicylic acids, as well as sulphites[6], are provided in this way. Other work has been directed to the examination of spices, cheese, jams and bakery and fermentation products, and among the confectionery products special mention should be made of honey[7], since applications of the methods of capillary analysis and absorption spectroscopy have yielded results which, it is claimed, enable a distinction to be made between honeys of different origins.

No mention has been made of applications of the method to the rubber, cellulose, paint, fuel or ceramic industries, or to sewage disposal and general organic and inorganic analysis, but numerous applications suggest themselves, and the general utility of the method (provided always that working conditions are standardised) is now recognised.

I am indebted to the British Hanovia Quartz Lamp Co., Ltd., for the loan of Fig. 1, and to Messrs. Chapman and Hall, Ltd., for Figs. 2 and 3 (from "Fluorescence Analysis in Ultra-Violet Light") which were kindly photographed for me by Col. W. R. Mansfield.

[1] P. W. Danckwortt and E. Pfau, *Analyst*, **52**, 707; 1927.
[2] J. Grant, *ibid.*, **56**, 653; 1931.
[3] J. A. Radley and J. Grant, "Fluorescence Analysis in Ultra-Violet Light" (Chapman and Hall, Ltd., 1933).
[4] C. Dhéré and others, *C. R.*, **179**, 351; 1924; **183**, 321; 1926.
[5] J. Grant, *Analyst*, **58**, 603; 1933.
[6] J. Grant and J. H. W. Booth, *ibid.*, **57**, 514; 1932.
[7] G. Orbán and J. Stitz, *Z. Unters. Lebensm.*, **56**, 467; 1928

## The Ray Society

THE recent appearance of the one hundred and twentieth volume of the publications of the Ray Society is a step onward in a great national undertaking. In the 'thirties of last century, the idea of producing a 'fauna' worthy of British science, in which every species of animal known to occur in Britain should be described and figured, with some account of its habits, habitat and synonymy, by the united labours of several naturalists, each an expert in his own line, was being realised under the sympathetic management of Mr. Van Voorst. Yet in spite of the loving care that he lavished on the production, as is abundantly shown by the charming vignettes which adorn each chapter of his books, it became apparent to the naturalists who in 1843 attended the meeting of the British Association in Cork, that Van Voorst's series had begun with monographs which were 'best sellers', such as Bell's "British Quadrupeds" 1839, Yarrell's "British Fishes" 1836 and "Birds" 1843, and that there would remain a considerable residue of unmonographed classes of animals for which neither the British Association, nor the scientific societies, nor publishers would have the funds necessary for publication. "To rescue such precious materials from oblivion, is one of the objects for which the Ray Society was instituted."

The original proposal to found a "Ray Club", an association for publishing zoological and botanical monographs and translations "which would not be likely otherwise to find a publisher", was taken up by a considerable body of naturalists in response to a circular drawn up by George Johnston of Berwick-on-Tweed, and widely circulated by Sir William Jardine. Their replies are bound up in a volume of letters addressed to Sir William Jardine, recently presented to the Ray Society. Not all were enthusiastic. Botanists were on the whole inclined to the opinion that sufficient provision had already been made for the British flora, but Prof. Charles Babington of Cambridge saw that in cryptogamic botany much remained to be done. Prof. Richard Owen, quoting his experience of the early struggle of the Sydenham Society, at first refused to join the proposed club on the ground of the impossibility of getting enough members for the purpose. However, by dint of much correspondence, a sufficient body of subscribers was eventually secured, and on February 2, 1844, with a slight change of title, the "Ray Society" was instituted, and officers were elected; and on October 2, under the chairmanship of Sir Philip Egerton, the report of the first annual meeting was read by the secretary, Dr. Edwin Lankester. Four hundred members, including Prof. Owen, had been enrolled, £236 had been received in cash, and a programme of projected publications was issued; the first two being "Memorials of John Ray" and "Iconographia Linnæana or Illustrations of the original specimens in Zoology of Linnæus at present existing in the Museum of the Linnean Society", to be edited by Profs. Bell and Forbes.

The second annual meeting was held at Cambridge on June 23, 1845, Prof. John Phillips being in the chair.

Already in December 1843, "A Monograph of British Nudibranch Mollusca" was in preparation by Messrs. Alder and Hancock; and a volume of "Reports on the Progress of Zoology and Botany" in 1841–42 was the first volume to be issued to the subscribers. Also the Council of the Society had plans for the translation of Aristotle on "Animals", Dioscorides on "Plants", Azara on the "Birds of Paraguay"; and for a new edition of Linné's "Systema Naturæ".

None of these was attempted, though Johnston, who shared the secretarial duties with Dr. Edwin Lankester, wrote: "I trust the Ray Society may publish a good translation of Aristotle and Pliny, but beyond these I hope we may have better fish to fry for a very long time to come." This hope has been most fully realised, for in its programme the Ray Society has gone from strength to strength.

The first great folio monograph to be undertaken was on the "British Nudibranch Mollusca". This continued to appear in parts for eleven years, and was completed by a supplementary volume fifty-five years later. Meanwhile, the high reputation of this folio series of monographs was firmly secured by the classic volumes of Allman on "Fresh-water Polyzoa" 1856, Huxley on "Oceanic Hydrozoa" 1859, Blackwell on "British Spiders" 1861–64, Carpenter on "Foraminifera" 1862, Günther on "Reptiles of British India" 1864, Allman on "Gymnoblastic Hydroids" 1869–70, and McIntosh on "Nemerteans" 1873–74. They are not only scientific works of the first order, but also of artistic merit that had not been equalled.

The practice of publishing translations and reports on the progress of the biological sciences was discontinued after 1868. A high standard was also set in the series of octavo volumes. Charles Darwin's great "Monograph of Cirripedia" 1851–54, soon to be followed by Bowerbank's "British Spongiadæ" 1864, etc., put new life into the study of these groups. If we classify the various groups of organisms that have been monographed, we find them distributed as follows:

PROTOZOA: Foraminifera 1857; Rhizopoda 4 vols. 1905–18.

PORIFERA: by Bowerbank and Norman, 4 vols. 1864–79.

COELENTERATA: 1847, 1859, 1869–70; Sea Anemones 1927 and in continuation.

ANNELIDA: by McIntosh, Nemerteans, 1872–73; Polychæta, 1898–1921.

Fresh-water Polyzoa, by Allman 1856.

TRILOBITA: 1846.

CRUSTACEA: Entomostraca, 1849; Cirripedia,

1851–54; Copepoda, 1876–79; 1931–33; parasitic Copepoda, 1912–13.

ARACHNIDA: Oribatidæ, 1883–87; Tyroglyphidæ, 1901–3; Hydracarina, 1924–28.

INSECTA: Collembola and Thysanura, 1871; Aphides, 1875–82; Coccidæ, 1900–2; Orthoptera, 1919; Phytophagous Hymenoptera, 1881–92; Dragon-flies, 1930; Larvæ of Butterflies and Moths, 9 vols. 1885–99.

TUNICATA: 1904–12.

VERTEBRATA: Batrachia, 1896–97; Reptiles, 1863; Cetacea, 1866.

Among the botanical works are memoirs on Desmids, 1904–22; Diatoms, 1929; Charophyta, 1917–23; Lichens, 1851; and on Vegetable Teratology, 1868, 1915–6.

In the face of this successful record, it is now amusing to read a passage in one of Bowerbank's early letters to Jardine. "I have seen Owen this morning and find he is strongly opposed to us. I tried him very hard, but it was without effect. Never mind. His weight is not so great as you in the country may imagine, and I can see that we shall get on very well without him."

It is to be observed that although the majority of the volumes issued by the Society are concerned with the systematic description of the animals and plants of the British Isles, this was only one of the objects which the founders had in view, and from the first some of the publications had a wider scope. Some systematic monographs deal with Europe or India, or include the whole world in their survey, and there are occasional works on such subjects as morphology and teratology and on the historical and biographical aspects of the science.

When, as a boy, I stayed with my father at various country houses, I recall that frequent reference was made to the Ray volumes for the identification of unfamiliar forms of life. The library of a large country house would not have been considered as adequately furnished without these works of reference. Now, alas, owing to increasing specialisation, fewer and fewer people have time to be interested in the productions of their home-land, and it is therefore becoming more and more difficult to obtain support for scientific publications from individual subscribers. It has thus become the bounden duty of the public libraries to stimulate and provide for the public interest.

This account of the monumental achievement of the Ray Society must not be closed without some allusion to the fact that the earliest circulars and volumes issued by the Society in 1844 were printed by Messrs. C. and J. Adlard of Bartholomew Close, and that, although name and address have been modified, no other firm's imprint has appeared on the title pages for ninety years. Nor must we forget the very great services which have in recent years been rendered to the Society and to its authors by Dr. W. T. Calman in his editorial, no less than in his secretarial, capacity.

The agents for the sale of the Ray publications are Messrs. Dulau and Co. R. T. GUNTHER.

## Obituary

### PROF. T. SWALE VINCENT

DR. THOMAS SWALE VINCENT, formerly professor of physiology, University of London, died on December 31, 1933, at his home in Fishpool Street, St. Albans, at sixty-five years of age.

Born on May 24, 1868, the son of Mr. J. Vincent, Swale Vincent was educated at King Edward VI Grammar School, Birmingham, and took his medical course at the University of Birmingham, then Mason University College. After taking his degree, he went to the University of Heidelberg to study physiological chemistry under Prof. Kossel, and returned to Birmingham to take up his first appointment as demonstrator of physiology. The year 1894 had seen the birth of endocrinology as we know it to-day, with the discovery by Oliver and Sharpey-Schafer of the striking rise in blood pressure produced by the intravenous injection of an extract of the suprarenal capsules. Swale Vincent at once followed this new line of investigation, and pursued it through the whole length of his scientific career, with occasional excursions into the related fields of the circulation and of vaso-motor reflexes. In 1896 he published his first paper entitled "The Suprarenal Capsules in the Lower Vertebrates" in the *Proceedings of the Birmingham Natural History and Philosophical Society*. Soon afterwards he was appointed British Medical Association research scholar, and went to Sharpey-Schafer's laboratory at University College, London, where he continued his investigations. After two years he became Sharpey scholar in physiology, an appointment which carried with it the post of chief assistant in the physiology department, and later he was appointed assistant professor of physiology under Prof. Starling.

Swale Vincent left University College in 1900 to take up the post of lecturer in histology in the University of Cardiff. One of his students there was T. Lewis, now Sir Thomas Lewis, with whom he published two papers on the biochemistry of muscle. He left this post in 1902 to hold the Francis Mason research fellowship for investigating the physiology and pathology of the thymus and other ductless glands, and went to the Physiology Department of the University of Edinburgh which, under Sir Edward Sharpey-Schafer, had become an active centre of endocrinological investigations. He collaborated there with two advanced students, W. Cramer and W. A. Jolly, now professor of physiology at Cape Town. In 1904 he was appointed to the chair of physiology in the University

of Manitoba, and remained in Winnipeg until 1920. He had to create an entirely new department there, a task which he performed so successfully that when he left Winnipeg to return to London as professor of physiology at the Middlesex Hospital, the University of Manitoba paid him a well-deserved tribute by conferring upon him an honorary LL.D. In London it again fell to his lot to reorganise the Department of Physiology, and its active scientific state when he retired in 1930 bears witness to the success of his efforts. Swale Vincent was at various times examiner in the University of London and the University of Leeds, and also of the Conjoint Board. He had been secretary of the Ductless Glands Committee of the British Association since 1898. In Canada he served as a member of the Industrial Fatigue Board.

Swale Vincent's numerous publications cover a large part of endocrinology. Beginning with a study of the suprarenal glands, he proceeded to investigations on the pituitary, the thymus, the thyroid and parathyroid glands, and the Islets of Langerhans. He was a prominent representative of the Schafer school of physiology which, regarding the cell as a basic unit of physiological functions, combines histological studies with experimental technique. The present generation of physiologists who can buy most of the various internal secretions in a more or less pure state at a chemist's shop, must find it difficult to realise the laborious investigations required to understand the morphological and functional relationships of the different parts of the endocrine organs, most of which are formed as a result of the joining up of histogenetically and functionally different tissues.

In extending his investigations to the action of normal tissues other than endocrine organs, Swale Vincent discovered the existence of substances present in all tissues producing a marked lowering of blood pressure and different from choline. One of these substances was identified later by Barger and Dale as histamine, the subsequent study of which in the hands of Dale and his collaborators has revealed its profound physiological significance. Swale Vincent was a careful worker, with a highly critical mind, qualities which enabled him to make positive contributions of lasting value, and to clear the new science of endocrinology from many pseudo-scientific weeds. The high international reputation of his work found recognition in the request to write a series of reviews on the ductless glands for Ascher-Spiro's "Ergebnisse der Physiologie". These reviews were later expanded into a book "Internal Secretion and the Ductless Glands" which, first published in 1912 and since passed through three editions, is one of the standard works on the subject. He also published in 1924 an "Introduction to the Study of Secretion" and in 1929 with Prof. Sampson Wright, formerly his pupil and now his successor, "Introduction to Practical Mammalian Physiology".

Swale Vincent was a man of firm principles and high ideals on which he would not compromise. He was essentially a shy man, and this sometimes gave an impression of brusqueness, while to those who had the privilege of knowing him well he was a staunch friend and a charming companion. He had a deep love and a great understanding of music and was himself no mean pianist. It was characteristic that in the last years of his active life he became interested in the study of the physiological reactions of the body to music. In 1914 he married Beatrice, daughter of Mr. W. Overton of London, who survives him, and had two daughters. W. C.

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### Dr. Knud Rasmussen

Knud Rasmussen, who died in Copenhagen in December last, devoted most of his life to the exploration of Greenland, particularly in regard to the ethnography of the Eskimo. He was born in Greenland on June 7, 1879, the son of Chr. Rasmussen, who was a pastor in that country and later a lecturer in the University of Copenhagen. His mother was of Eskimo descent.

After taking his degree at Copenhagen, Rasmussen visited Lapland to study the natives and in 1902 returned to Greenland with M. Erichsen to examine the social conditions of the Eskimo on the west coast. The report of that two years' study led to several reforms in the Danish system of administration, and in 1905 the Danish Government sent him again to Greenland to explore the conditions for reindeer as a source of livelihood for the natives. From 1906 until 1909 he was in Greenland studying Eskimo folk-lore, and his visits to the isolated Polar Eskimo of the Cape Yuk area led to the foundation in 1909 of the mission station of Nordstjernen in North Star Bay. The following year Rasmussen added a trading station and changed the name to Thule. Afterwards the mission station was moved farther north, and Thule became the base for a long series of scientific expeditions under Rasmussen, in most of which he successfully used the Eskimo technique in travelling and hunting.

The first Thule expedition, in 1912, crossed the ice-sheet in the north-west to Danmark Fjord and Independence Fjord, thus linking the discoveries of Peary with those of Erichsen. After spending some time in exploring around Thule and Melville Bay, Rasmussen led the second Thule expedition in 1916–18 to explore the topography and structure of the north-west coast. The return to Thule over the edge of the ice-sheet led to the death of the Swedish botanist, Th. Wulff, who succumbed to the hardships. This expedition convinced Rasmussen that there can have been no migration of Eskimo round the north to the east coast of Greenland. Rasmussen did not take part in the third Thule expedition but devoted the fourth, in 1919, to a study of the folk-lore of the east coast Eskimo. The fifth Thule expedition, in 1921–24, entailed a journey, with K. Birket-Smith, from Greenland to Bering Strait through the whole extent of Eskimo territory with the view of studying the origin and evolution of

Eskimo culture. He found the oldest culture among the Caribou Eskimo, west of Hudson Bay. This spread to the arctic coasts and became dependent on marine animals, and then east and west until the Thule culture was homogeneous from Greenland to Alaska. An Alaskan culture, borrowing Asiatic influences, spread eastward as far as Greenland and is superimposed on the earlier culture. Rasmussen's researches on the Caribou Eskimo were a new chapter in ethnography.

With Denmark's increased attention to East Greenland subsequent to her suzerainty being established over the whole country, Rasmussen turned his attention to the east in the sixth Thule expedition of 1931. The aim was to explore the coast between Cape Farewell and Angmagssalik. Many additions to the charts were made and it was found that this part of the east coast is relatively free from ice in late summer. The seventh Thule expedition of 1932 was the largest that Rasmussen led. It was also the first on which he made aerial surveys. The work was the outcome of the previous year's reconnaissance and resulted in detailed surveys from Cape Farewell to Umivik, as well as two flights across the ice-sheet. Equally important was the archæological work on former Eskimo habitation of the coast. Rasmussen decided that seals were numerous enough to support a scattered Eskimo community. Hunters remained to investigate this problem more fully. It was from a resumption of this work that Rasmussen returned ill to Copenhagen last year.

Several of Rasmussen's works have been translated into English, including "The People of the Polar North" (1908), "Greenland by the Polar Sea" (1921) and "Across Arctic America" (1927). The reports of the various expeditions appeared in English and Danish in *Meddelelser om Grönland* and elsewhere. He also wrote several books in Danish including "Nye Mennesker" (1905), "Under Nordenvindens Svöbe" (1906) and "Myter og Sagn fra Grönland" (1921–25). In all his works he had the happy faculty of combining a charming lucidity of style with a wealth of information. Among the many honours bestowed on Rasmussen were the Founder's Medal of the Royal Geographical Society, the Danish Medal of Merit and the orders of Dannebrog, St. Olav and the North Star. R. N. R. B.

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We regret to announce the following deaths:

Sir William Hardy, F.R.S., director of food investigation in the Department of Scientific and Industrial Research, secretary of the Royal Society in 1915–25, and president this year of the British Association, on January 23, aged sixty-nine years.

Dr. F. L. Kitchin, F.R.S., palæontologist to H.M. Geological Survey of Great Britain, on January 20, aged sixty-three years.

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## News and Views

### The Endless Adventure of Government

Problems of government and citizenship in the modern world were discussed by Mr. Walter Elliot, the Minister of Agriculture, in his rectorial address as Rector of the University of Aberdeen on January 18. Government to-day, he said, is passing through a great transformation both at home and abroad. Governments and States are no longer merely geographical or political units, but economic units which every kind of intercourse has to take into consideration. Production is becoming decentralised; international trade less and less an interchange of specialised lines of production and more and more a competition in similar lines. The powers of modern science tend to make it feasible for specialised lines to be produced anywhere in the world, or to be replaced by others just as good; hence the national unit has become possible, although not necessarily desirable.

### Interdependence of Various Countries

The formula of the continually increasing interdependence of the world requires qualification. Mr. Elliot gave three examples in illustration. In the first he traced the change in the economic aspect of the trade in nitrate for use as a fertiliser. In the nineteenth century a great trade was built up with South America; steel rails went out and nitrate came back. Large fortunes were made, international lending improved, and the economists were happy. But men of science, thinking it unnecessary to transport nitrogen to fields already supporting the pressure of a column composed mainly of that gas, found a means of producing it in Europe, which was good for production but bad for trade. Referring to the neon lamp, Mr. Elliot said it was the old lamp, and not the new, which demanded all the paraphernalia of nineteenth century economics; whilst the new artificial plastics derived from acetylene are replacing walnut and maple and the mahogany which took our forefathers to the West Indies. Mr. Elliot next turned to foreign investment, another section of the world's work where interdependence is no such certain sequence as was once assumed. A great deal of what is described as 'trade' is not exchange, but investment. The uneconomic nature of a great deal of foreign development has been masked by the free gift to competitors of transport systems, railway and steamer lines, which have been constructed at the expense of the producers in Great Britain and presented to their competitors.

### Marketing Boards

The 'endless adventure of government, has become the problem of problems, the real riddle of the Sphinx. The reason is immediate fear—fear both of war and of peace. Organisation is essential; there are two methods—to organise the world at once, or to organise smaller units and gear them up to each other as soon as time and hard thinking will

permit. Both methods are required. The States of the British Commonwealth of Nations have many economic problems in common, and the need of some standing organisation to examine these problems has been repeatedly felt. Mr. Bruce, formerly Prime Minister of Australia, has suggested that some of the best minds available should be applied exclusively to these formidable tasks, particularly in view of the emergence of British agriculture as one of the great and growing agricultures of the Empire. Mr. Elliot greatly hopes that the work will be undertaken. But an organisation which holds within itself the possibility of just such a development—the Empire Marketing Board—has within the last few months been brought to an end. The failure of some of these attempts, the difficulties of others, do not exonerate us from the necessity for making fresh trials. Let us try marketing boards to cover the United Kingdom if we cannot get one to govern the world, if we cannot get one to span the Empire. In agriculture we are working on the lines of self-government in industry. We are trying to reconcile the producers and the customers, the industrial and the political aspects of the nation, which can no more be separated than the front and the back of a man's head.

### Another Large South African Diamond

A DIAMOND of fine quality was found in January by Jacobus Jonker in South Africa in the Elandsfontein alluvial diggings on a tributary of the Pienaars River, near the Premier diamond mine and north-east of Pretoria. The weight is given as 726 carats (145·2 gm.). There is no evidence to support the suggestion that this new 'Jonker' diamond is the missing portion of the 'Cullinan' diamond, which was found in 1905 in the yellow ground in the wall of the Premier mine at a depth of 18 ft. beneath the surface. The 'Cullinan' weighed 621·2 gm. (3106 metric carats), and, as shown by the large cleavage surface, it was evidently only a portion (perhaps rather more than half) of a larger crystal. Diamonds sometimes become fractured during the eruption of the kimberlite magma into the pipes. Other large stones, but of doubtful quality, have been recorded from the Premier mine, namely one of 1640 carats in 1912, another of 1500 carats in 1919, and another of 1195½ carats in 1924. The first of these weighings would be against the English carat of 205·304 mgm., and the last two presumably against the metric carat of 200 mgm. The next largest stone is the 'Excelsior' found in 1893 in the Jagersfontein mine in Orange Free State, which in the rough weighed 199·04 gm. With the older diamonds there still exists an unfortunate confusion in the weights when expressed in carats. The re-cut 'Koh-i-Noor', usually listed as 106$\frac{1}{16}$ carats, weighs 21·786 gm. or 108·93 metric carats. A mass of carbonado (a compact aggregate of small crystals of diamond) found in Bahia in 1895 weighed 630 gm.

### Sir Hans Sloane's Collections

A TEMPORARY exhibit of a selection of minerals and botanical specimens and books from the Sloane collections is now displayed in a lighted case in the Central Hall of the Natural History Museum at South Kensington. It was these collections that formed the nucleus of the British Museum in 1753, and they contain many objects of considerable intrinsic value and of historic interest. A recent study of the voluminous MS. catalogues written by Sloane himself has led to the identification of many mineral specimens belonging to his collection. There is a good series of "pretious stones", including a magnificent Indian-cut sapphire weighing 31·5 carats, and a wonderful series of objects carved in agate, mocha-stone, carnelian, jasper, rock-crystal, nephrite, lapis-lazuli, etc. Most interesting are two drawers with the original labels from an old cabinet of minerals supposed to have medicinal virtues and listed as 'officinalis'. Sir Hans Sloane was a celebrated physician—it was he who certified the death of Queen Anne in 1714; and he succeeded Sir Isaac Newton as president of the Royal Society. One of the quaint entries in his MS. catalogue reads: "Lapis variolosus if hung about the Person makes the small Pox come favourable and hinders their being mark'd from its Signature". The Sloane collections were formerly in the old Manor House of Chelsea (built by Henry VIII), and his memory is preserved in a dozen streets, places, and squares named Hans or Sloane.

### Indian Earthquake of January 15

A BRIEF notice of this great earthquake, based on the earliest reports, was inserted in our last issue (p. 94). Later accounts add considerably to the first estimates of the loss of life and of the extent of the disturbed area. It is clear that the number of deaths will amount to several thousand—in Monghyr alone, 4,000 are reported as killed. The epicentre, given by the seismographic records at Kew and Bombay, lies in lat. 26·8° N., long. 86·3° E., or a short distance to the east of the towns (Patna, Muzaffarpur, Monghyr, etc.) which suffered most from the earthquake. Thus, it would seem that the crust movement started a few miles east of Darbhanga and spread rapidly westwards for fifty miles or more. The distances from the epicentre of some of the places from which reports of the shock come are so great that it is only their close grouping that justifies their acceptance. Bombay is about 970 miles from the epicentre and Madras 980. Still farther to the south, and somewhat isolated, are Madura (1,250 miles) and Aleppey in Travancore (1,330 miles). If we assume the disturbed area to be bounded by a circle passing through Madras, it would contain three million square miles. The area included within the isoseismal of intensity 4 of the Kansu earthquake of December 16, 1920, was about 2½ million square miles, so that the area actually shaken must have been of the same order of magnitude as that disturbed by the recent earthquake.

### Early History of the Reverberatory Furnace

AT a meeting of the Newcomen Society held on January 17, Mr. Rhys Jenkins read a paper on "The Reverberatory Furnace with Coal Fuel, 1612–1712". The term reverberatory, he said, came from the Low Latin "reverbero", to beat back; to-day, by reverberatory furnace, we mean one in which the

material under treatment and the solid fuel are kept apart, and the flame and hot gases from the burning fuel enter the furnace proper at one end and are deflected or beaten down on to the material on the hearth by the roof of the furnace. The earliest account of such a furnace was given by Theophilus the monk, who wrote in the eleventh century. It was used for making glass. Early in the sixteenth century reverberatory furnaces were used in Germany for melting bronze for guns, but Agricola in his "De re metallica" makes no mention of them. The earliest description in the English language of a reverberatory furnace was found in a work published in 1613 by John Rovenson, while the earliest drawing of any value of a coal-burning reverberatory furnace was given by the German metallurgist Schlüter in his "Gründlicher Unterricht von Huttenwerken" of 1738. During the seventeenth century the smelting of lead, copper and iron in reverberatory furnaces was attempted by various individuals at several places; the furnaces being generally without chimneys. An interesting point was when was it recognised that with a closed fireplace the air required for the combustion of the fuel could be drawn through by a chimney. The first record of the use of chimney draught is contained in Glauber's work of 1646 "Furni novi Philosophici", translated into English in 1651.

### Petrie Portrait Fund

THE retirement of Sir Flinders Petrie from the Edwards professorship of Egyptology at University College, London, has seemed to many of his friends an appropriate occasion for an expression of appreciation of his lifelong services to archæology. It is thought that this might most appropriately take the form of his portrait, to be presented to the College with which he has so long been associated. An appeal for funds for this purpose has been issued over the names of Prof. J. H. Breasted, M. J. Capart, Dr. Howard Carter, Prof. F. Ll. Griffith, Sir George Hill, Sir Henry Lyons, Dr. Allan Mawer, Sir Robert Mond and Dr. Margaret Murray. In issuing the appeal, it is pointed out that it is now more than fifty years since Sir Flinders began work as an archæologist at Stonehenge, and soon afterwards carried out the first accurate survey of the Pyramids at Gizeh. Referring to his influence on archæological studies during his long career as an excavator, the committee states no more than the bare truth when it points to his insistence on accurate observation and recording, and the stress he has laid on the significance of smaller finds, equally with the larger, in an excavation, in developing knowledge of the social conditions of the past. The appeal also refers to his early recognition of the importance of correlation in studying the intercourse between the various peoples of the Near East from earliest times. Finally, in attributing to him in large measure the awakening of modern interest in archæology, mention is made of the great number of archæologists who have achieved distinction after receiving their training and inspiration from him as lecturer and excavator. Subscriptions towards the fund will be received by Sir Henry Lyons, F.R.S., 3 York Terrace, Regent's Park, London, N.W.1.

### Infra-Red Photography as an Aid to Navigation

THE United States liner *Manhattan* has recently been fitted with a special look-out camera intended for an investigation of fog penetration with infra-red sensitive materials. Mechanism for the automatic developing and fixing of the photographs is included in the body of the camera itself, and the photographic record may be viewed one minute after the exposure has been made. The weather conditions encountered by the *Manhattan* since the new apparatus was installed have not been suitable for experimental work, so no records obtained under service conditions are yet available. The problem of fog penetration is not at all simple, and it remains to be seen whether the degree of penetration actually obtained by this method will be really helpful to navigators.

### The Gases of the Atmosphere

IN his presidential address before the Royal Meteorological Society at its annual general meeting on January 17, Prof. S. Chapman discussed "The Gases of the Atmosphere". The permanent gases of the atmosphere (mainly nitrogen and oxygen) are known, from direct measurements in the stratosphere, to be in constant proportions up to the greatest heights yet attained by Piccard and his successors in stratospheric flight. Other constituents vary in their concentration, because of processes tending to produce and destroy or transfer them in the atmosphere: among such constituents are water, ozone and the newly discovered positrons, which enter the atmosphere from outside as cosmic rays. Experiments were suggested to determine the rate of large-scale transfer of such gases by turbulence, using some easily detectable gas, artificially introduced, as an 'indicator'. Such experiments might also be made using ozone as the indicator, which would throw light on the distribution of ozone, as recently estimated by Dobson, Götz and Meetham. The possibility of removing the atmospheric ozone above certain ground areas was also considered. The absorption of solar radiation by oxygen and ozone was discussed in the light of new experimental data, and in relation to the composition and temperature of the upper atmosphere.

### London's Underground Railways

BY the formation of the London Passenger Transport Board last year, the unification of the underground train, bus, trolley-bus and tram systems of London has been accomplished. The British Electrical and Allied Manufacturers Association (Beama) has recently published a well-illustrated book giving an account of the part played by British manufacturers in providing machinery and equipment for this great transport service. The account given proves the sound administrative qualities of those who have made London's 'Underground' the foremost institution of its kind in the world. So far back as 1846, the prospectus which led to the foundation of the

Metropolitan Railway was issued, the object being to encircle the metropolis with a tunnel. The scheme, of which Mr. Charles Pearson, a city solicitor, was the author, was at first received with derision, and it was not until 1863 that the first section of the line, from Farringdon Street to Bishop's Road, was opened. The seven stations which formed this line have now increased to 226, and considerably more than a million passengers per day are carried. Every weekday, 2,800 trains pass through Charing Cross station. After forty years of steam, the Metropolitan and the District Railways were equipped for operation by electricity. The great extension of London's underground railways and the equipment for electrical operation of the older steam lines was started in 1902 by the formation of the Undergound Electric Railways Co. of London, Ltd., the site for the generating station being in Lots Road, Chelsea. The great success of the undertaking is due to the recognition by the administration of the fact that the position is continually changing and that progress cannot be checked or thwarted in a living organisation.

THE Lots Road Station is situated on the bank of the Thames at Chelsea and is well known to Londoners. The amount of power generated per square foot of engine room area is six kilowatts, which is the highest figure for Great Britain. The Neasden power station near Wembley Park supplies nearly 100,000 kilowatts, which is a third of that supplied by Lots Road. The original plant was designed to operate with a steam pressure of 180 lb. per sq. in. and a temperature of 550° F.; the present plant operates at a pressure of 265 lb. per sq. in. and 750° F. To supply the condensers with the necessary water, four artesian wells were sunk to depths varying between 400 ft. and 600 ft. and these yield about 18,000 gallons her hour. After passing through the condensers, the water is cooled in wooden towers and utilised over again. The electric transmission of energy is on the three-phase system at 11,000 volts, and many hundreds of miles of three-core cable at this pressure are used. The distribution voltage on the track is 630 direct current, the alternating current being converted to direct current either by rotary converters or mercury arc rectifiers. The first escalator was installed at Earl's Court Station in 1911, and wherever escalators have been installed there has been a notable increase in the traffic. In the event of any interruption to the train service, precautions are taken that there will be no delay in the issue of instructions to all sections concerned. At such points a loud speaker is installed and emergency messages are received from a central microphone in the control room at Leicester Square station.

### International Congress of Anthropology and Ethnology

ARRANGEMENTS are now well advanced for the first session of the International Congress of Anthropological and Ethnological Sciences, which will be held under royal patronage in London on July 30–August 4 next. The proposal to hold a congress of this nature was first made in 1912, when the International Congress of Americanists met in London, but the meeting in 1916, for which arrangements were then made, had to be postponed indefinitely owing to the War. In future the Congress will be held every fourth year, alternating with the International Congress of Archæological and Proto-historic Sciences, which will be held in the second of the intervening years. The Anthropological Congress will coincide with the meeting in Europe of the International Congress of Americanists, which this year is to be held at Seville. The sessions of the Congress will be held at University College, Gower Street, and at the Wellcome Historical Medical Museum. The president is Lord Onslow and the chairman of the executive committee, Capt. T. A. Joyce. Prof. J. L. Myres and Mr. A. H. Brodrick are the joint honorary secretaries and Mr. H. G. Beasley the treasurer. Presidents of sections are Prof. G. Elliot Smith (Anatomy and Physical Anthropology), Mr. F. C. Bartlett (Psychology), Prof. C. B. Fawcett (Demography), Dr. A. C. Haddon (Ethnography), the Rev. E. Smith, president of the Royal Anthropological Institute (Subsection of African Ethnography), Mr. H. Balfour (Technology), Prof. C. G. Seligman (Sociology), Prof. E. O. James (Religions) and Dr. Alan H. Gardiner (Languages and Writing). Among the vice-presidents are the Archbishop of Canterbury, the Lord Mayor of London, the High Commissioners of India and South Africa, Sir James Frazer, and the presidents of the Societies of Antiquaries, the Folk-lore Society and the Royal Asiatic Society. Particulars of the Congress may be obtained from the Royal Anthropological Institute, 52 Upper Bedford Place, W.C.1.

### Archæology and Unemployment in the United States

IN the United States advantage is being taken of the funds available for the relief of unemployment to carry out certain archæological investigations which hitherto, although considered of great importance, have been regarded as too costly for the resources of the Smithsonian Institution, Washington. The funds are to be provided by the Civil Works Administration and about one thousand men of the local unemployed will be engaged for the work of excavation. According to an announcement issued by the Smithsonian Institution, six Indian mound sites, each considered to be key positions in an archæologically unknown area, are to be explored. In each case the work will be carried out under the direction of an official of the Bureau of American Ethnology. Three sites in Florida will be in charge of Mr. Matthew W. Stirling, chief of the Bureau, one of these being an extensive system of pre-Seminole mounds and earthworks near Lake Okechobee which was discovered in 1931; Dr. F. H. H. Roberts, Jr., will excavate a group of mounds in the Shiloh National Military Park at Pittsburg Landing, Tennessee; and Dr. W. F. Strong will be in charge of the exploration of a large mound six miles from Taft, Kern County, California, one of the key sites of Californian prehistory, which is known to have been abandoned soon after the first Spaniards reached the country. At Macon, Georgia, a mound thought to be the site of an ancient Hitchi village

will be explored. While deploring the circumstances which have made these undertakings possible, archæologists welcome the expenditure of funds in this direction, which, it is hoped, will at least make a beginning in putting the archæological exploration of the south-eastern States on the same systematic basis as the exploration of the south-west.

### Coventry Libraries

THE Coventry Libraries and Museum Committee's report on the work of the year 1932–33 gives evidence of vigorous growth of the services under its care. The Committee fosters the closest possible contact between the libraries and all activities of a cultural character, and is providing additional accommodation for such activities adjacent to its central library, where already during the past year meetings of societies devoted to the study of art, history, natural history, the drama, engineering, bee-keeping, etc., numbered 271, including 120 meetings of groups for the discussion of broadcast talks. Among the most popular of the subjects of these discussions was "Biology and Everyday Life". Provision of books for children through the school library system, serving 55 schools and supplementing the activities of the special junior departments of the libraries, accounts for one sixth of the total issues. Through the West Midlands Regional Library Bureau, the resources of many libraries in other parts of the country were drawn upon by way of temporary loans to meet special requisitions. By the circulation of publicity material among branch libraries, the maintenance of a variety of book displays throughout the system was ensured. Some of the most popular displays related to cooking, wireless, gardening, polar exploration, holiday literature, modern drama and home decoration. Among other services successfully maintained are : the *Coventry Bookshelf*, a monthly medium of communication with readers ; an "Illustrations Collection" of 15,000 pieces ; a "lucigraph" for making facsimile copies of maps, prints, drawings, etc. ; a commercial and technical intelligence service, equipped with up-to-date indexes to practically all technical material published throughout the world, patent abridgments, consular and diplomatic reports, etc. ; and frequent exhibitions of material relating to matters of special local or regional importance.

### Reform of Medical Education

IN his Bradshaw lecture recently delivered before the Royal College of Physicians, Dr. C. S. Myers discusses the education of the medical student from the point of view of the industrial psychologist. As regards pre-medical study, which consists of physics, chemistry and biology, he considers that far more time is spent in practical work on such subjects than is necessary for those who are not going to specialise in any of them, especially as they have no educational value for the future doctor. A similar criticism is directed against the enormous amount of detail in anatomy and physiology required of the student, whereas little attempt is made at this stage to gather anatomical information from the corpse in the post-mortem room. The student derives his knowledge of human anatomy mainly from dissection of the cadaver, in which the desiccated organs have lost their form and their relations in the living body. As a remedy for these and other defects in medical education, Dr. Myers makes the following suggestions. In the first place, the student should spend part of his time in the wards as soon as he begins to study anatomy and physiology. Secondly, during the hospital period, he should receive a more complete education in the whole range of medicine and surgery before he attends the specialist departments. Thirdly, some training in the recognition and treatment of psychoneuroses is necessary for the future general practitioner, who is too liable to mistake the true nature of such conditions. Lastly, before entering into general practice, he should serve an apprenticeship between the passing of the qualifying examination and the actual conferment of the diploma or degree.

### Australian Meteorological Data

THE Council for Scientific and Industrial Research of the Commonwealth of Australia has published valuable meteorological statistics under the title "Meteorological Data for Certain Australian Localities" (Pamphlet No. 42, Melbourne, 1933). A foreword explains that, for some time past, various investigators on the Council's staff had made extensive use of unpublished data collected by the Commonwealth Meteorological Bureau, in connexion with researches in soil science, entomology, plant industry, animal health, etc., and it was thought worth while to make such information more accessible to investigators by publishing selected data. The matter was discussed with the Meteorological Bureau, and it was agreed that the Bureau should provide the data and arrange the material in a form suitable for publication, while the Council would bear the costs of publication. This pamphlet is the result of the co-operation of those two bodies. It gives in tabular form, for several hundred stations in Australia and Tasmania, mean monthly and annual values of daily maximum and minimum temperature and relative humidity, and average monthly and annual totals of rainfall. These averages refer to periods of varying length, as a rule not less than 15 years, and in not a few cases between 70 and 80 years. In the rare cases where the period is only five or six years, the figures may—especially in the case of such a variable quantity as rainfall—depart considerably from those that would be found over a suitably long period, but this drawback is nearly always met with in meteorological statistics for sparsely populated countries, and recourse must be had to such short records if large areas are not to be left unrepresented. A large folding map is attached at the end of the publication, which gives the meteorological divisions adopted by the Bureau and shows many of the stations included in the tables.

### Eugenics in Vera Cruz

IN December 1932 a new eugenic law was enacted in the State of Vera Cruz, which has the largest population in Mexico. A Bureau of Eugenics and Mental Hygiene was organised as a part of the

Health Department of the State. This Department has been engaged in eliminating smallpox and yellow fever, and has also greatly reduced the frequency of hook-worm, its sanitary services being in co-operation with the Mexican Government and the Rockefeller Foundation. The new Bureau is thus included in a public service and has large powers. Free birth control clinics were instituted, and sterilisation provided for in serious cases of unfitness and inadaptability. This is the culmination of a series of reforms made by Governor Tejada, which included the suppression of saloons, compulsory sex education in the schools, mandatory medical treatment for venereal disease and a new civil code which entailed eugenical provisions in matters of marriage and divorce. By the new regulations, which are given in full (*Amer. J. Psychiatry*, 13, No. 2) by Dr. S. Mendoza, who drafted the bill, provisions are made through the Bureau of Eugenics and Mental Hygiene not only for the dissemination of information but also for the control of sterilisation of persons suffering from hereditary diseases or from conditions which the Bureau considers to be "a cause of biological degeneration or mental deficiency in their offspring".

### Association of American Geographers

THE thirtieth annual meeting of the Association of American Geographers was held on December 26–28, at North-western University, Evanston, Illinois. In the three day session fifty-seven papers were presented, including thirteen in the field of geomorphology, ten or more in regional geography and six in urban geography. The remainder represented a diversity of subjects. The afternoon of December 26 was devoted to the general subject of "Conventionalizing Geographic Investigation and Presentation". The papers on this subject were presented by Profs. P. E. James of the University of Michigan, Wellington D. Jones of the University of Chicago and V. C. Finch of the University of Wisconsin. A feature of the meeting was an address by Dr. L. Dudley Stamp, an invited guest of the Association, who spoke on "One Hundred Years of Change in Land Utilisation in the British Isles—the Work of the Land Utilisation Survey of Britain". The retiring president, François E. Matthes of the United States Geological Survey, gave the annual address. He spoke on "Our Greatest Mountain Range, the Sierra Nevada of California". The following officers were elected for 1934: *President*, Dr. W. W. Atwood, president of Clark University; *Vice-President*, Prof. V. C. Finch, chairman of the Department of Geography, University of Wisconsin; *Secretary*, Prof. F. E. Williams, University of Pennsylvania; *Treasurer*, Prof. R. S. Platt, University of Chicago.

### Greenkeeping Research

THE autumn volume (No. 9) of the *Journal of the Board of Greenkeeping Research* contains a useful summary of experimental and practical results on the use of sulphate of ammonia and sulphate of iron as fertilisers and weed killers for lawns. It is interesting to note that the treatment has stood the test of several years' practical application, but its effects cannot be ascribed directly to increase in the acidity of the soil. Dr. F. T. Bennett describes a disease of turf known as *Fusarium* patch. The Director of the Board's Research Station at St. Ives, Bingley, Yorks, Mr. R. B. Dawson, contributes the fourth of a series of articles on "Common Weeds of Turf", whilst other members of the staff write on "A Greenkeeper's Guide to the Grasses" (Mr. I. G. Lewis) and "Composts and Fertilisers in Relation to Greenkeeping" (Dr. T. W. Evans). A new form of steriliser for killing weed seeds in compost which is to be applied to weed-free turf is described by Mr. K. M. A. Enthoven, of Hilversum, Holland. The subject matter of the whole volume is of great interest—almost a necessity—to golf green keepers, but the more general horticulturist will find a great deal of definite teaching which will help him to make his lawns the beautiful stretches of green sward which he so earnestly desires.

### Scientific Horticulture

THE "Horticultural Education Association Year Book", vol. 2, 1933 has just appeared under the able editorship of Mr. R. T. Pearl (Wye, Kent. H. E. A., South-Eastern Agricultural College, 3*s*. 6*d*.). "Commercial Horticulture in Lincolnshire" is described by Messrs. J. G. Murray, F. Wakerley and J. C. Wallace, whilst Mr. D. V. Howells writes on the same topic for Scotland. Various aspects of fruit-growing are dealt with by Messrs. N. B. Bagenal, W. G. Kent, F. Kidd and C. West, B. S. Furneaux, R. Hart and A. J. Wooldridge. Dr. R. N. Salaman contributes a paper on potato virus diseases, Mr. C. A. Cameron Brown reviews early progress in electric soil heating, Dr. R. M. Woodman writes on weed killers, Mr. R. K. MacDowall on spraying with sulphuric acid, Mr. W. E. H. Hodson on chrysanthemum eelworm, and Mr. F. A. Secrett on "Early Market Garden Produce". Direct problems of teaching are discussed by Messrs. W. H. Christian and R. T. Pearl, whilst the presidential address by Mr. N. B. Bagenal is a biography of Thomas Andrew Knight. A valuable series of book reviews is added. The whole volume is a pleasing blend of science with practice.

### Fossilised Tree Remains in Yellowstone National Park

SCIENCE SERVICE, Washington, D.C., has recorded an interesting discovery made during the construction of a new road from Tower Falls to Mammoth Hot Springs in Yellowstone National Park. While cutting through a rock, two petrified tree-stumps, both upright as they stood, the report says, millions of years ago, were brought to light. The progress of the new road has left the specimens cut in halves, embedded in the solid rock, which was probably volcanic dust when petrification was taking place during the Miocene period. It is even possible to trace the complicated root systems of the specimens. It has not been decided what species the remains represent. Chestnut, sycamores, sequoias, pines and cypress have all grown in this region during the centuries in which the fossilisation took place.

### The Qattara Depression and Water Power

IN a note in NATURE of December 23, 1933, p. 960, on Dr. J. Ball's paper in the *Geographical Journal* for October on the utilisation of the Qattara depression for water power, a misprint occurs in the estimate of distance that the power would need to be transmitted to the Nile delta. This figure should be 150 miles, a distance over which water power could be readily transmitted, whereas the distance from the Aswan dam to the delta is 560 miles.

### Zoological Society of London

AT the monthly general meeting of the Zoological Society of London held on January 17, it was stated that the total number of visitors to the Society's Gardens at Regent's Park for the year up to the end of December was 1,557,791. The number of visitors to the Aquarium during the same period was 263,438. At Whipsnade Park the number of visitors during the year was 433,429.

### The Night-Sky in February

MERCURY reaches its greatest eastern elongation on February 18, when it will set an hour and ten minutes after the sun. It is not easy to see this planet, but a sharp look-out just after sunset in a situation where there is a good view of the western horizon may be rewarded. There will be no risk of confusion with Venus, which passes through inferior conjunction on February 5, and will not be visible in the evening sky after that date for several months, though it will be a brilliant object in the early morning sky just before sunrise. Mars is getting near the sun. On February 18 it will set twenty-two minutes before Mercury, and will be practically invisible in the glare of the sunset. Jupiter can be well seen in the early morning. In February it will rise at about 10 p.m. Saturn will be too near the sun for observation. It passes through conjunction on February 8.

### Announcements

THE Council of the South Wales Institute of Engineers has awarded the Institute's Gold Medal to Prof. A. E. Trueman, of the Department of Geology, University of Bristol, formerly of University College, Swansea, for his paper, "A Suggested Correlation of the Coal Measures of England and Wales", as being the most valuable paper received and published during 1933.

THE Committee of the Cancer Hospital (Free), Fulham Road, London, has awarded a scholarship of the value of £100 per annum to Mrs. Boyland in recognition of her services in the Research Institute of the Hospital. She has investigated with Dr. E. Boyland the respiration of normal and cancerous tissues in the presence of derivatives of cancer-producing compounds, and will continue the development of this work.

THE Secretary to the Minister of Health has announced that Sir Frederick Gowland Hopkins, Prof. E. P. Cathcart and Prof. Edward Mellanby, as physiologists representing the Minister's Advisory Committee on Nutrition, will confer with Prof. V. H. Mottram, Prof. S. J. Cowell and Mr. G. P. Crowden, as physiologists representing the British Medical Association Committee on Nutrition, in regard to the differences which appear to exist between the two Committees on the question of the amount of calories and first-class protein appropriate as a basis for suitable diets.

AT the annual general meeting of the Royal Meteorological Society held on January 17 the following officers were elected for the ensuing year :—*President*, Col. Ernest Gold ; *Vice-Presidents*, Mr. David Brunt, Prof. Sydney Chapman, Mr. Francis Druce, Dr. A. Crichton Mitchell ; *Treasurer*, Mr. R. A. Watson Watt ; *Secretaries*, Dr. J. Glasspoole, Mr. W. M. Witchell, Mr. M. McCallum Fairgrieve ; *Foreign Secretary*, Capt. C. J. P. Cave ; *New Councillors*, Dr. A. J. Bamford, Mr. M. G. Bennett, Mr. I. D. Margary.

THE following officers of the Royal Microscopical Society have recently been elected : *President*, Prof. W. A. F. Balfour-Browne ; *Vice-Presidents*, Mr. J. E. Barnard, Mr. Conrad Beck, Prof. D. M. Blair, Dr. G. M. Findlay ; *Hon. Treasurer*, Mr. C. F. Hill ; *Hon. Secretaries*, Prof. R. T. Hewlett, J. Smiles ; *New Members of Council*, Dr. A. S. Burgess, Dr. R. S. Clay, Prof. R. Ruggles Gates, Dr. G. S. Sansom ; *Hon Librarian*, Dr. Clarence Tierney ; *Hon. Curator of Instruments*, Mr. W. E. Watson Baker ; *Joint Hon. Curators of Slides*, Mr. N. I. Hendey, Mr. E. J. Sheppard.

MESSRS. LONGMANS, GREEN AND CO., LTD., hope to publish shortly the first of two supplementary volumes of Thorpe's "Dictionary of Applied Chemistry". This volume will contain subjects up to and including those coming under the letter M and the second will cover the remaining letters of the alphabet and include an index. The present editors, Profs. J. Thorpe and M. A. Whiteley, have preserved continuity and the traditional connexion of the "Dictionary" with the Royal College of Science.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned :—A junior scientific officer in the Wood Chemistry Section of the Forest Products Research Laboratory, Princes Risborough, Buckinghamshire—The Secretary, Department of Scientific and Industrial Research, 16 Old Queen Street, Westminster, S.W.1 (Jan. 29). A chief instructor in the Engineering Workshop of the Polytechnic, Regent Street, London, W.1—The Director of Education (Feb. 5). A woman pharmaceutical chemist to the Gloucester County and City Mental Hospitals—The Medical Superintendent, County Mental Hospital, Gloucester (Feb. 7). A junior engineer for the Safety in Mines Research Board—The Under-Secretary for Mines, Establishment Branch, Mines Department, Dean Stanley Street, London, S.W.1 (Feb. 10). A lecturer in physiology in the University of Leeds—The Registrar (Feb. 19). A senior botanist in charge of the Cereal Sub-Section of the Botanical and Plant Breeding Section of the Ministry of Agriculture, Egypt—The Under-Secretary of State, Ministry of Agriculture, Cairo (March 15). A professor of economics at Raffles College, Singapore—The Secretary, Universities Bureau of the British Empire, 88A, Gower Street, London, W.C.1.

## 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.*]

### Activity of Crystalline Preparations of Vitamin $B_1$

In the same laboratory where thirty years ago Eykman made his famous investigations, Jansen and Donath[1] succeeded in 1926 in obtaining for the first time the antineuritic vitamin in crystalline form, in quantities too small, however, for further study. Five years later, the same results were also obtained by other investigators; almost simultaneously there appeared publications on the same subject by van Veen[2], Windaus and Tschesche[3] and Ohdake[4], whose crystalline products were only slightly more active than that of Jansen and Donath, although at first the contrary was stated[5]. Moreover, all these substances had roughly the same empirical formula, though they had been isolated from different sources —rice-bran and yeast.

This uniformity of results was broken by an announcement of Peters[6] and his collaborators, that they had isolated a still more active product. As a matter of fact, we were able to demonstrate in this laboratory that Peters' substance was about $1\frac{1}{3}$ times as active as our purest product (and also Windaus's). The experiments were made with a kind of rice bird[7]. These rice bird tests, which can only be made in Java (this being the one region where these birds occur), have the advantage that one works simultaneously with ten of these birds, which are very sensitive to a $B_1$ vitamin shortage and give very constant results. Whereas about 0·5 mgm. of the original preparation of Jansen and Donath was needed to provide ten birds during about 25 days with the necessary $B_1$ vitamin (not a single case of polyneuritis occurring within 15 days), the necessary quantity of Windaus's and also of our preparation was 0·4 mgm., while of Peters' preparation only 0·3 mgm. was required.

By improvements of our method of isolation[8] applied thus far we have succeeded in isolating a crystalline product, which is about twice as active as our former preparation and then probably also more active than Peters' preparation; namely, 0·2 mgm. sufficient for the rice bird test. Of this preparation a rice bird therefore needs a daily dose of 0·8 γ, a young rat 1·5 γ or a little more. 1 gm. of this preparation is equal in activity to about 500,000 (provisional) international standard units. The crystals are much flatter than those of the less pure preparations; the melting point is about 2° higher. Also its behaviour to different reagents is as described before[5]. The empirical formula is also similar to that of the less pure preparations from this laboratory (C, 40·7 per cent; H, 5·5 per cent; N, 15·7 per cent; it also contains sulphur). Hence it appears probable that the less active preparations contain inactivated vitamin, and the possibility is not excluded that even the most active preparations now obtained still contain inactive substance.

The 'activated clay' from this laboratory (which serves also as the League of Nations standard preparation) is a substance easily prepared in large quantities, and the isolation of the crystalline vitamin is a rapid process. In our opinion it is urgent that the investigation of this important vitamin should be made by numerous laboratories, in order to obtain definite results as soon as possible. We shall shortly publish elsewhere a detailed account of the improved technique for its isolation.

A. G. VAN VEEN.

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Batavia.
Dec. 6.

[1] *Proc. Acad. Sci. Amsterdam*, **29**, 1390; 1926.
[2] *Recueil*, **49**, 1196; 1930.
[3] *Z. physiol. Chem.*, **204**, 123; 1932.
[4] *Proc. Imp. Acad. Tokyo*, **7**, 102; 1931.
[5] A. G. van Veen, *Z. physiol. Chem.*, **208**, 125; 1932.
[6] *Biochem. J.*, **27**, 232; 1933.
[7] *Meded. Dienst Volksgezondheid*, N. I., **21**, 184; 1932.
[8] *Recueil*, **50**, 610; 1931.

### The Unit Character in Genetics

In his British Association address on "The General Nature of the Gene Concept"[1], Prof. R. Ruggles Gates states that "the conception of the unit character was given up many years ago". It is hard to let this fertile conception go without a word to be said for it, even though it may be ineffectual. If the conception of the unit character is not wholly true in its original connotation, it cannot be wholly false since man himself has been spoken of as a "rational animal", denoting an individual unit of the highest degree of complexity. The cuticular bristles of arthropods are structures of their own kind, that is to say, they are homologous, whether transformed into tactile, olfactory, natatory setæ, supporting spines or prehensile hooks. They may be regarded as units of the first order, although they possess such different potentialities, to which may be added the qualities of position, colour and size.

In the district of Mille Isles, situated in a part of the province of Quebec where the Laurentian Hills begin to sink down to the level plain of the St. Lawrence basin, I have recently picked up from the snow a dipterous insect destitute of its two wings. There are several kinds of 'flies' to be found on snow in late autumn and early spring, but only one of them is wingless, namely, *Chionea*. Through the kindness of Mr. Arthur Gibson, Dominion Entomologist, I have been supplied with a list of Canadian records of *Chionea*. These are few and far between, but they go back to the time of P. H. Gosse (1839). When seen moving with its long legs slowly and somewhat helplessly on the snow, it presents at a distance a spider-like appearance, and the species found in Germany was named *Chionea araneoides*. The wings have simply ceased to be, they have dropped out of existence at a plunge, but the balancers or 'halteres', which represent the hind-wings of the two-winged flies, are maintained in full working order. The wings of a fly behave as a unit, but they have many accessory characteristics, chief among them being the venation. Nevertheless the wings not only function as a unit but in *Chionea* they have also vanished as a unit, while the balancers remain in full force.

The finding of *Chionea* in the flesh is a rare experience not easily dismissed from the mind. The lesson of it is the persistence of vestigial organs, when modified to serve a new function, after the normal organs of flight have disappeared without a trace. There are plenty of flightless female moths lying dead upon the snow at this season; before the

snow sets in they are to be found clinging to the trunks of trees; some of them have rudimentary scaly wing-pads. There is a distinction to be drawn between mere loss of the power of flight, as in the female silkworm-moth, reduction of wings, suppression of wings and phyletic loss of wings. But for the absence of its wings, *Chionea* is a normal dipteron with compound eyes and primitive segmentation of the body. As indicated above, the smallest units have a collective value and it is probably in the sense of absolute indivisible units that the conception of the unit character has been abandoned by geneticists.

A. WILLEY.

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Dec. 5.

[1] NATURE, 132, 768, Nov. 18, 1933.

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IN my address on the gene concept, part of which appeared in NATURE of November 18, I was discussing the subject particularly from the cytological point of view. Prof. Willey, in his interesting letter, has in mind another aspect of the unit character conception which I consider is of great importance from a phylogenetical point of view. When I said that "the conception of the unit character was given up many years ago", I meant that the early conception of a strict one-to-one correspondence between a particular character and a particular factor or gene, is no longer tenable. Studies of the interactions of genes and the multiple effects of single genes in development of the organism show (1) that many genes may contribute to the final production of single characters, and (2) that single genes may have multiple effects in the organism. While these are now well-known principles in genetics, nevertheless it remains true that each gene usually has a preponderating effect in the production of a single character.

Cases such as the wingless species, to which Prof. Willey refers, may be the result of single mutations, like some of the *Drosophila* mutations which are in a more or less completely wingless condition. The literature of systematic botany and zoology abounds with cases of a similar kind, where the natural interpretation is that a unit gene mutation has resulted in the sudden loss or marked change of a single character. The investigation of such cases opens up a vast field in which the systematists and geneticists could co-operate, but unfortunately until now comparatively little has been done in this direction.

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## Variation du Rayonnement cosmique suivant la Latitude

LES études de la variation du rayonnement cosmique suivant la latitude (Clay, Compton et collaborateurs, Hoerlin) ont été effectuées jusqu'à présent avec la méthode des chambres d'ionisation; ces mesures ont montré l'existence d'un minimum de l'ionisation par rayons cosmiques dans les régions équatoriales.

Nous avons pensé qu'il serait bon de faire des mesures sous différentes latitudes, non de l'ionisation globale, mais du nombre de corpuscules pénétrants formant la partie directement décelable du rayonnement cosmique. Cette étude peut se faire avec des compteurs de Geiger-Müller montés en coïncidence.

Trois appareils, comportant chacun un dispositif de trois compteurs cylindriques superposés avec un sélecteur de coïncidences, un amplificateur et des relais, ont été emmenés dans un voyage Le Havre–Buenos-Aires et retour. Ils ont enregistré le passage des corpuscules ionisants pendant toute la durée du parcours, soit deux mois. Le nombre total de corpuscules enregistrés dépasse 100,000. Les résultats montrent une baisse régulière en fonction du temps que la comparaison des mesures à l'aller et au retour a montré être sensiblement linéaire; cette baisse due à une lente altération des appareils peut-être éliminée en faisant chaque fois la moyenne des mesures faites à l'aller et au retour aux mêmes points. On obtient ainsi les points figurés (Fig. 1) ou les ordonnées représentent, à un facteur près, les nombres de particules traversant les compteurs en 1 heure, et les abscysses les latitudes des lieux d'observation. Les points marqués + sont relatifs à un appareil portant

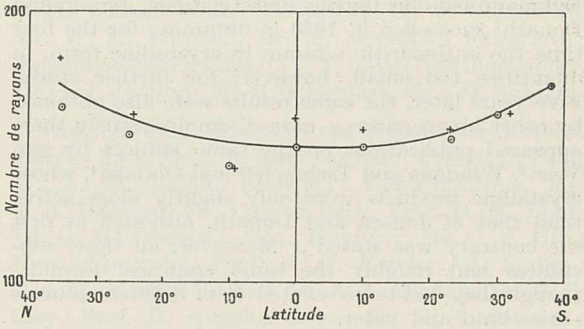


FIG. 1.

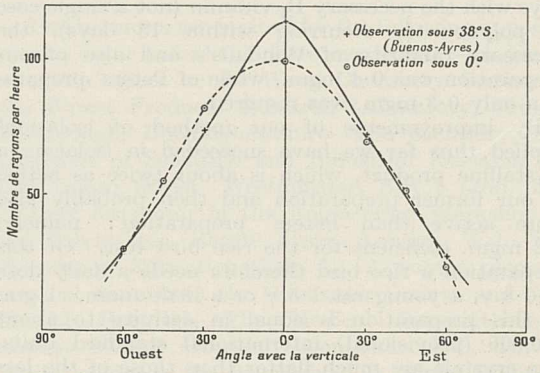


FIG. 2.

un filtre de 20 cm. de plomb. Les points marqués ⊙ sont relatifs à un appareil sans filtre, à compteurs proches. La courbe tracée présente un minimum dans la région de l'équateur. Le nombre de corpuscules pénétrants arrivant sur la terre à l'équateur est d'environ 15 pour cent inférieur à celui des corpuscules arrivant sous la latitude 40° (nord ou sud). Ceci est en concordance avec la diminution de l'ionisation globale observée, et montre que cette ionisation, qui peut-être due en partie à des rayonnements secondaires mous, suit bien le nombre de particules pénétrantes. Des mesures avec inter-

position entre les compteurs d'écrans absorbants (20 cm. de plomb) nous ont donné des nombres régulièrement inférieurs de 30 pour cent à ceux obtenus sans écran, la proportion relative de rayons très pénétrants restant donc sensiblement la même (au point de vue des rayons verticaux) sous toutes les latitudes explorées.

Nous avons également étudié la répartition angulaire des corpuscules cosmiques sous différentes latitudes, et trouvé que la symétrie entre les directions est et ouest que l'on observe sous les latitudes supérieures à 30° est détruite au voisinage de l'équateur en faveur des rayons venant de l'ouest, résultat qui est à rapprocher de ceux de Johnson.

La forme de la courbe est également assez différente, comme le montre le diagramme (Fig. 2), dans lequel sont portés les nombres de rayons arrivant sous différents angles à l'est et à l'ouest de la verticale.

La mission était subventionnée par la Caisse des Recherches Scientifiques. Nous désirons remercier la Compagnie des Chargeurs Réunis et l'équipage du vapeur *Kerguelen* qui ont beaucoup facilité notre tâche.

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## Chemical Separation of Diplogen from Hydrogen

WE may reasonably anticipate that in those reactions which proceed at low temperatures, that is, reactions for which the energies of activation are small enough to render them sensitive to the difference in the zero point energies, diplogen and hydrogen will undergo reaction at different rates.

We have found such a difference in the velocity of the liberation of hydrogen effected by the solution of metals in water or acids, for the liberated hydrogen does not possess an [H]/[D] ratio ([D] signifies the concentration of diplogen or the heavy hydrogen isotope) identical with that of the original water or acid. For example, on solution of zinc in 0·1 *N* sulphuric acid which contains 25 per cent D ([H]/[D] = 3), the hydrogen liberated contains only 8 per cent of D ([H]/[D] = 11·5), that is, the rates of production of H and D are in the ratio of about 4 : 1[1]. On solution of other metals similar differences are obtained, the approximate ratios for aluminium, calcium and sodium being 2, 1·5 and 1·2 respectively. Analogous reactions in which compounds containing hydrogen, such as ammonia, acetylene, etc., are liberated instead of hydrogen, are now being investigated.

It appears possible that a reaction of this type, in which an enrichment of the heavy hydrogen isotope takes place as in the process of electrolysis, may serve as an alternative method for the production of heavy hydrogen and its compounds.

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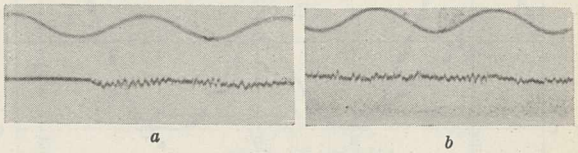
Jan. 13.

For the method of analysis see NATURE, **132**, 894, Dec. 9, 1933.

## Measurement of the Frequency of Longitudinal Vibration of Non-Magnetic Rods

IT has been known for many years[1] that the resistance of a copper wire is increased by loading and that this increase of resistance is in excess of that which can be accounted for by the accompanying change of cross section. It seemed to be probable, therefore, that this phenomenon could be applied to the measurement of the frequency of longitudinal vibration of non-magnetic rods, since the method which has been described previously[2] cannot be used for such rods.

In order to test this possibility, a rod of the material was suspended in a long solenoid and clamped at the upper end. A load was fixed at the lower end and the rod was connected in series with the solenoid winding, which was excited from a 30 volt battery of accumulators. Surrounding the rod near the central part of the solenoid was a search coil of about 20,000 turns, and this coil was connected through a valve amplifier to an oscillograph. The rod was then set in a state of longitudinal vibration by means of a slight tap on the lower clamp. In consequence of the corresponding variations of stress in the rod the resistance changed and the current in the solenoid varied accordingly. These variations of the exciting current induced corresponding E.M.F's. in the search coil and the vibrations of the rod are thus recorded on the oscillogram. The effect is small but definite and the results for two different rods are shown in Fig. 1 *a* and *b*.



*a* *b*

FIG. 1.

Fig. 1*a* refers to a brass wire $\frac{1}{8}$ in. diameter, the density being 8·4 and the free length 178 cm. The fundamental frequency of the vibrations as found from the oscillogram is 1030 cycles per second. For a rod clamped at both ends, the frequency $f$ is related to the length $l$ cm., the density $\rho$, and Young's modulus $E$ by the expression

$$f=\frac{1}{2l}\sqrt{E/\rho} \text{ or, } E=f^2(2l)^2\rho \text{ dynes per sq. cm.,}$$

from which it is found that the value of $E$ for a brass wire is $11\cdot2\times10^{11}$ dynes per sq. cm., or $16\cdot3\times10^6$ lb. per sq. inch.

Fig. 1*b* refers to a rod of duralumin $\frac{1}{4}$ in. diameter, the free length being 209 cm. and the density 2·8. The fundamental frequency of longitudinal vibrations as found from the oscillogram is 1180 cycles per second, from which it follows that the value of $E$ for a rod of duralumin is $6\cdot8\times10^{11}$ dynes per sq. cm., or $9\cdot9\times10^6$ lb. per sq. inch.

This investigation is being continued with the view of obtaining a larger amplitude for the wave due to the longitudinal vibrations. A higher frequency for the time calibration wave is also being used.

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Dec. 9.

[1] Ency. Brit., 9th Ed., Vol. 8: Art. "Electricity", p. 52.
[2] NATURE, **132**, 351, Sept. 2, 1933.

## Polarised Photoluminescence of Adsorbed Molecules of Dyes

I HAVE investigated the degree of polarisation of fluorescence and phosphorescence from 'Cellophane' films coloured by Kautsky's method[1] ('Cellophane' phosphors). The molecules of the dye, adsorbed on the surface of the microcrystals of the film, cannot rotate; therefore the luminescence cannot be depolarised by rotation.

The films used, 0·09 mm. in thickness, are optically anisotropic. It is known that the orientations of the axis of the microcrystals are regular to a certain extent. The observations were made with a Savart analyser and a set of compensating glass plates approximately in the direction of the exciting light, perpendicular to the surface of the 'Cellophane' phosphor. The latter could be rotated around this direction and the azimuth ($\alpha$) could be read. The analyser gave the value of $P = (I_1 - I_2)/(I_1 + I_2)$, where $I_1$ and $I_2$ are the intensity of the components the vibrations of which are parallel and perpendicular respectively to the direction of the vibrations of the exciting light transmitted through the polariser. When natural light was used for excitation, the same position of analyser was used.

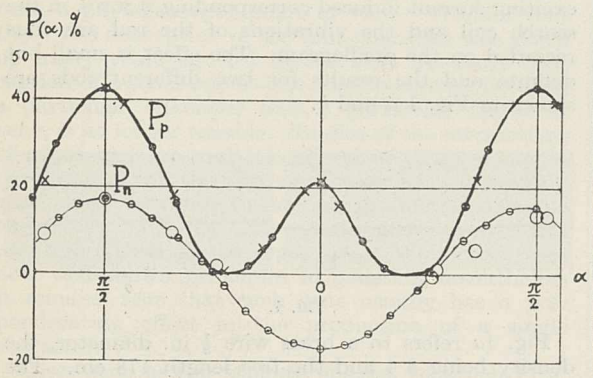


FIG. 1. $P$ as a function of azimuth ($\alpha$) for euchrysine-'Cellophane'-phosphor.
$Pp$, excitation with polarised light.
$Pn$, excitation with natural light.
x and o observed values, ⊗ and ⊖ calculated values from the formulæ

$$P_p = \frac{(\varepsilon_1^2 \cos^2\alpha - \varepsilon_2^2 \sin^2\alpha)\cos 2\alpha - \cos^2 2\alpha}{\varepsilon_1^2 \cos^2\alpha + \varepsilon_2^2 \sin^2\alpha + 1} \quad \text{and}$$

$$P_n = \frac{(\varepsilon_1^2 - \varepsilon_2^2)\cos 2\alpha}{\varepsilon_1^2 + \varepsilon_2^2 + 2}$$

Fig. 1 shows the $P(\alpha)$ curves for the fluorescence of a euchrysine-'Cellophane'-phosphor, for natural and polarised exciting light. In the latter case, it is clear that the degree of polarisation for $\alpha = \pi/2$ is higher than for $\alpha = 0$. For these two azimuths, the exciting light vibrates to one or to the other principal direction of vibration in the 'Cellophane' film. Also when excited with natural light, the fluorescence shows partial polarisation in a certain direction (Fig. 1, $P_n$).

Similar curves were obtained for phosphorescence but the values of $P(\alpha)$ were somewhat smaller.

Anisotropy was also examined by absorption; the absorption coefficients show an anisotropy, however. The position of the absorption band does not depend upon the direction of light vibration.

Although different dyes have $P(\alpha)$ curves of the same character, the values of $P(\alpha)$ differ very much. This indicates that the phenomena are not only due to the anisotropy of the field intensity of the exciting light (caused by the birefringence of the medium) but also to the polarisability tensor of the dye molecules and anisotropy of the distribution of the directions of their axes.

Details of this investigation will be shortly published elsewhere.

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University of Warsaw.
Nov. 27.

[1] H. Kautsky and A. Hirsch, *Chem. Ber.*, **65**, 401; 1932.

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## Predissociation in the Upper Level of the Ångström Bands of Carbon Monoxide

IN taking a photometer curve of the $0 \rightarrow 1$ band $^1\Sigma \rightarrow {}^1\Pi$ ($\lambda = 4835$), we observed that in all three branches, $P$, $Q$ and $R$, beginning with the same value $J = 38$ of the upper level, the lines abruptly decrease in intensity to less than half the original value. It seems to us reasonable to assume that this remarkable feature is caused by a predissociation of $^1\Sigma$ into the triplet dissociation term $^3P$ (oxygen) $+ {}^1D$ (carbon).

Triplet-singlet intercombinations in the emission spectrum of CO have already been observed by Cameron. In this case the selection rule forbidding singlet-triplet transitions does not hold, but at any rate the Cameron bands are much more difficult to get than most of the other CO-bands, even though no other transition to a lower state of the molecule does exist. In the same way a predissociation of a singlet by a triplet term may occur. As the transition to the dissociated molecule must be rather improbable, it seems that the life time of predissociation here becomes of the same order of magnitude as that which belongs to a transition with radiation. In this case the emission lines do not disappear, but only decrease in intensity as has been observed. A triplet-singlet intercombination with predissociation has also been observed by Herzberg[1] in the case of $P_2$. But for this much heavier element the probability of the triplet-singlet intercombination is already so large, that for $P_2$ the band lines totally disappear.

From the energy of the predissociation we were able to calculate the dissociation energy of the normal state. We found $D = 9{\cdot}82$ volts, in good agreement with the value generally assumed (10 volts). For the other molecular terms we found as dissociation energies: $A\,{}^1\Pi$, 1·82 volts; $B\,{}^1\Sigma$, 2·28 volts; $a\,{}^3\Pi$, 3·84 volts; $a'\,{}^3\Sigma$, 3·94 volts; $d\,{}^3\Pi$, 3·10 volts.

The upper zero vibration level of the Herzberg bands lies about 3100 cm.$^{-1}$ *higher* than the dissociation term $^3P + {}^1D$. Thus these bands from their beginning already suffer from predissociation and it is easy to understand why they are much more difficult to get than the Ångström bands.

Further particulars will be given shortly in the new Dutch periodical *Physica*.

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Groningen.
Dec. 16.

[1] G. Herzberg, *Phys. Rev.*, **40**, 313; 1932.

## Effect of Pressure on High Terms of Alkaline Spectra

In the alkaline spectra, very long absorption series have been observed. Wood and Fortrat have detected 56 terms of the Na, $3S-nP$ series. One might expect that the high terms of the series would be destroyed by adding a foreign gas, as the excited states of high quantum number have such a large volume that the number of molecules of the foreign gas contained in it can be, under experimental conditions, of the order of 10,000.

This argument proves to be untrue, as we have been able to observe the absorption series up to very high terms in sodium-nitrogen and sodium-hydrogen mixtures with a pressure of the perturbing gas of the order of magnitude of an atmosphere.

With nitrogen as foreign gas, only a little broadening of the high terms, but no shift, was observed. Instead, in the case of hydrogen, all the high terms of the series are shifted by an approximately constant amount towards the violet. With a concentration of about $4{\cdot}8\times10^{19}$ molecules per c.c. of hydrogen, we observed a displacement of 7·5 cm.$^{-1}$ as is shown in Fig. 1. This shift is approximately proportional to the concentration of the perturbing gas.

One might attempt to explain this shift with the

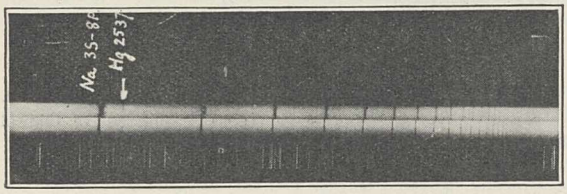


FIG. 1. Absorption spectra of sodium-hydrogen mixtures at higher pressures (above) and at lower pressures (below) of hydrogen. Note the unshifted mercury line 2537, which lies in the background.

aid of the ordinary perturbation theory, considering some average potential for the electron over the very many potential holes, representing the foreign molecules contained inside the electronic eigenfunction. This would give a lowering of the high terms, and therefore a shift of the lines towards the red. However, Prof. Fermi has pointed out that this simple theory cannot be applied, as the first approximation of the perturbation theory is not sufficient for describing the phenomenon. His theory shows that the effect, though having the same order of magnitude as elementary theory, can be also of opposite sign, and explain a shift towards the violet as observed for hydrogen. The magnitude of the effect is connected with the limiting cross section of the perturbing molecules in the Ramsauer effect for zero velocity; the theory can also explain the fact that the high terms are not completely destroyed by the perturbation.

An account of experiments with different gases and absorbing vapours will be published elsewhere.

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Dec. 2.

## Graphical Determination of Contemporaries

LET points representing the years of birth and death of each of a group of individuals—for example, eminent men of science—be plotted with the year of birth as abscissa and the year of death as ordinate on the same scale. Each of these 'life-points' lies above the line $y=x$ since $y>x$, and, if 100 be taken for the limit of age, below the parallel $y=x+100$.

The dotted lines in Fig. 1 show two positions of a 45° set-square of transparent celluloid the hypotenuse of which slides along a straight-edge (not shown) parallel to $y=x$ and at such a distance from it that the apex is always on this line.

At the date given by the position of the apex on the line $y=x$, which may be called the time-line, any individual is not yet born if his life-point is to the right of the vertical edge, and dead if it is below the horizontal edge, while contemporaries are those whose life-points can be seen through the transparent set-square. The ages of these at the date are given by the distances of the points from the vertical edge, and also the ages at death of any of the group are given by the vertical distances of their life-points

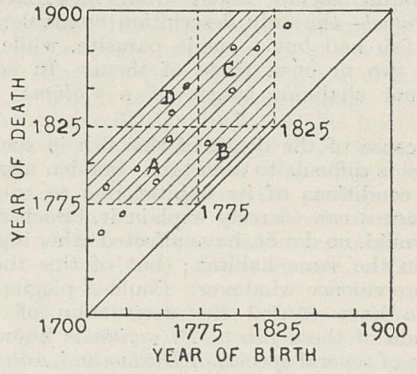


FIG. 1.

above the time-line, so that the life-points of all attaining the same age lie on a line parallel to it.

Suppose, as an example, that the group consists of thirteen individuals, all of whom are born and die between 1700 and 1900, and that their life-points are plotted as in Fig. 1. Then, placing the set-square with its apex at say 1775 on the time-line (the dotted lines show its position), it is seen at a glance that at this date two are dead, six contemporary, and five unborn. Similarly, at date 1825 seven are dead, five contemporary, and one unborn.

All whose life-points are within the shaded area have lived at some time during the period 1775–1825. This area is composed of the parts $A$, $B$, $C$, $D$. Those with life-points in $A$ were born before and died during the period, in $B$ were born and died in the period, in $C$ were born in and died after the period, and in $D$ were born before and died after the period. When the period is sufficiently long the area $D$ vanishes, and in such case none can be born before and die after the period.

When the number in the group is large the plotting of the life-points is laborious; but, this being done, complete information for any dates and any period can be obtained at once by mere inspection.

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## Parasitic Infection of Porcupine Fish

BETWEEN the first week in October and the middle of November last, thousands of dead porcupine fish, *Diodon maculatus*, were cast up on the south and west coasts of Ceylon. These dead fish were observed near Galle early in October; by the second week in November they were to be found in large numbers along a stretch of about two hundred miles of sea-coast from Hambantota to Chilaw. The fact that they were first found on the shores of the south-west corner of the island and later along the western coast seems to point to their having been brought in from the deeper waters to the south of the Gulf of Manaar, as their distribution corresponds with the prevailing direction of currents in October and in November.

I examined a few of these fish collected at random. All of them were adults of about the same size and all were infested with a parasitic copepod which may be *Pennella sagitta*, the common parasite of *Diodon*. I cannot be definite with regard to this identification on account of lack of literature here and as this copepod differs in some respects from the description of *Pennella sagitta* taken from an *Antennarius marmoratus*[1]—the only description available. Some of the fish had but a single parasite, while others carried two or even three of them. In addition, some had chalimus stages of a *Caligus* sp. on them.

The cause of the death of this fish in such large numbers is difficult to ascertain. Sudden alterations in the conditions of its habitat due to submarine disturbances can scarcely explain it. Such disturbances would, no doubt, have affected other organisms living in the same habitat; but of this there has been no evidence whatever. Could a plague of this *Pennella* have caused the destruction of such a multitude of these fish? *P. sagitta* is known as a parasite of several species of *Diodon* and *Antennarius* and the presence of one or two individuals does not, in ordinary circumstances, bring about the immediate death of the host. Many of them on the same fish would endanger its life, but in this instance they were not present in such numbers as to justify the conclusion that they were solely responsible for this slaughter.

P. KIRTISINGHE.

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Colombo.
Dec. 5.

[1] Leigh-Sharpe, W. H., "The Genus *Pennella* as represented by the Collection in the British Museum", *Parasitology*, **20**; 1928.

## Blood Composition in Relation to Milk Secretion

MANY attempts have been made to determine the changes in composition of the blood that occur in its passage through the mammary gland, with the view of elucidating the mode of secretion of milk. Earlier workers in the field (Meigs[1] 1922) thought that by examining blood taken from the jugular vein they were studying a fluid of similar composition to arterial blood, and undoubtedly the former can be obtained far more easily than the latter in the case of the bovine. More recently, Blackwood and Stirling[2] (1932) have suggested that jugular venous blood is more concentrated than arterial, and they attribute this concentration to removal of water by the salivary glands.

Considering the small magnitude of the differences in blood composition which are under investigation in these studies, we feel that attention should be directed to the numerous grave sources of error which may be involved in obtaining blood samples, as in no instance reported in the literature have all of these been taken into account. These errors are fully discussed by Peters and Van Slyke[3] (1931) and the following examples need only to be mentioned, namely, changes in plasma concentration arising from venous stasis, such as may result from compression of the vein, use of oxalate as anticoagulant, undue exercise on the part of the animal or loss of carbon dioxide from the blood sample. In regard to the first point, we have observed such evidence of stasis as œdema in taking jugular samples, and it is a common practice to use means of compression in this procedure. We are attempting to eliminate these sources of error from the work we have in progress, and hope to publish more detailed findings in the near future.

S. J. FOLLEY.
G. L. PESKETT.

National Institute for
Research in Dairying,
Shinfield.
Jan. 6.

[1] Meigs, E. B., *Physiol. Rev.*, **2**, 204; 1922.

[2] Blackwood, J. H., and Stirling, J. D., *Biochem. J.*, **26**, 357; 1932.

[3] Peters, J. P., and Van Slyke, D. D., "Quantitative Clinical Chemistry", Vol. 1. (Baillière, Tindall and Cox, 1931.)

## Catalytic Hydrogen Replacement and the Nature of Over-voltage

DR. J. A. V. BUTLER has criticised our remark that the influence of the composition of the liquid phase on the catalysed reaction of hydrogen and water seems to prove that the rate-determining factor is the ionisation of the adsorbed hydrogen and not the preliminary dissociation of hydrogen into adsorbed atoms.[1] Butler suggests that changes of the catalyst such as coagulation, may explain our observations. Our communication as it stands is certainly open to this objection. We should have added, that in our experiment the greatest care has been taken to meet it, by ascertaining that all changes caused by the composition of the liquid phase are completely reversible. Twenty measurements were made on an identical sample of platinum black, all consistent with one another. Our platinum black was a quickly settling powder; it was shaken 15–20 times per second with an amplitude of 4–5 cm.

In these circumstances a structural change of the platinum black appeared to be an improbable explanation for which we could find no foundation in colloid chemistry. Our recent observations on the activation energy of the reaction, which will be soon reported, have confirmed our assumption.

J. HORIUTI.
M. POLANYI.

University of Manchester.
Jan. 13.

[1] NATURE, 133, Jan. 6, 1934.

## Research Items

**Acaxee of Ancient Mexico.** The culture of a forgotten people of ancient Mexico, the Acaxee, is reconstructed from early records by Mr. Ralph L. Beals in *Ibero-Americana*, 6. The Acaxee, although now almost unknown to American ethnologists, once occupied a considerable area in the Mexican Sierra Madre, and remnants are said still to exist. Their culture presents many features unusual in North America. The term Acaxee is applied to a group of languages of the Uto-Aztecan linguistic stock, belonging to the Sonoran and not to the Mexicano-Nahua group. The Acaxee proper had their centre about the valleys of the San Andres and Topia. They differed from the lowland peoples in having a shorter stature and a yellowish-brown complexion. The Spaniards found them an admirable people, except for their persistent head-hunting and their extensive cannibalism. They were agriculturists and the chief features in their culture were warfare, head-hunting and the accompanying cannibalism, games, principally the footrace and the ball-game, and a strong agricultural-religious complex. It is possible that they lived in localised clan groups. It may be that their culture represents an intermediate link between, say, southern Mexico and the southern United States; but more probably it is the culture of a more or less stagnant area, a backwash surviving as a distorted reproduction of an earlier period in the history of Mexican culture.

**Sunlight and Death of Snakes.** Several notices have appeared in *Copeia* quoting well-authenticated reports that rattlesnakes (*Crotalus confluentus*) are killed by short periods (about 10 minutes) of exposure to direct sunlight, and popular belief attributes similar susceptibility to the sidewinder (*Crotalus cerastes*). As a consequence, several observers have tested the reaction of snakes to sunlight with a variety of species, and the general result has been that, in full sunlight on sandy ground, the desert snakes have rapidly become uncomfortable, lost the power of co-ordinating movements and have died in 6–20 minutes. To discover the lethal factor, H. F. Blum and C. R. Spealman tested the light rays and came to the conclusion that no definite part of the spectrum was injurious to the rattlesnake, but that death was due to rise in body temperature owing to the combined effect of the absorption of solar radiation and conduction of heat from the ground surface (*Copeia*, 1933, p. 150). That this supposition came near the truth was shown by testing the reactions of snakes in a hot-air bath. Death resulted when the bath had reached a temperature of 49° C. It is significant that Walter Mosauer and E. L. Lazier found that in all the specimens they tested the body temperature at death was almost identical and was 46·5–47° C. (*Copeia*, 1933, p. 149).

**Indian Polychætes.** Prof. P. Fauvel has recently given a systematic account of the Polychæta of the Indian Museum, Calcutta (*Mem. Ind. Mus.*, 12; 1932); 306 species, belonging to 30 families, are recorded. The coastal region is, as might be expected, much richer in species than the deep sea, and among the examples from brackish water, modified and often peculiar forms are plentiful; one of them cannot apparently be referred to any known family. As is usual in tropical seas, the families best represented are the Aphroditidæ, Nereidæ and Eunicidæ. Twenty-eight new species are described. This polychæte fauna does not differ materially from that of the Red Sea, the Persian Gulf, the Philippines and the Malay region; many species from the Pacific and the Australian region are also found in the Indian area. Of the 306 species, 67 are also European and the author points out that it is becoming more fully recognised that many polychætes are really cosmopolitan. *Mercierella enigmatica*, first recorded from brackish waters near Caen and from the London docks, was believed to be an exotic polychæte brought home on the hulls of ships. In the collection now described, specimens of *Mercierella* were found adhering to oyster shells from the Ennur backwater, Madras, thus confirming the suspicion of its Indian origin. It was probably brought to London on ships' hulls and transported thence by coasting vessels to the French ports and estuaries from which it has been recorded.

**The Frog's Tongue.** As the result of a study of the tongue of *Rana hexadactyla*, C. P. Gnanamuthu (*Rec. Ind. Mus.*, 35; 1933) concludes that the movements of the frog's tongue are brought about entirely by muscles; Hartog's view, that extension of the tongue is due to lymph pressure, is untenable. He states that the submaxillaris muscle and the lymph spaces below the hyoid are not adapted to participate in the projection of the tongue. The tongue has two muscles—the hyoglossus and the genioglossus. The hyoglossus remains in a contracted or tonic state when the tongue is at rest and is relaxed when the tongue is pushed out of the mouth. The genioglossus, by which the front part of the tongue is attached to the symphysis of the lower jaw, is peculiarly modified; its dorsal part serves to reduce the length and breadth of the tongue while the ventral or basal part serves to give the anterior part of the tongue a forward pivotal movement.

**Aerial and Soil Roots in *Acanthus* and Propagation from its Leaf.** A. McMartin has recently published two papers (*Trans. and Proc. Bot. Soc. Edin.*, 31, Part 2, 1933), which deal mainly with the anatomy of the root system. He shows that the differences between air and soil roots must be traced in the main to factors at work in the growth of the apex. In the soil, growth in length is greater than in the air, but in the latter case there is more radial growth and, as a consequence, considerable development of a pith. The aerial roots in this genus have usually been described as 'prop' roots, but their mechanical structure is shown to have little relation to such a function and their presence is correlated with the inadequate radial growth proceeding in the stem, basipetal growth activity taking instead this form of aerial root development, which provides a further source of water supply to the leafy shoot. A second paper describes the origin of the root in leaf cuttings of *Acanthus* and the modification in structure of this root which follows as its proximal end tuberises and then develops buds. An analogy is drawn between the change in structure in this region and in the hypocotyl of the normal seedling.

**Mosaic Disease of Raspberries.** Mr. R. V. Harris has recently published the results of his investigations on the mosaic disease of raspberries ("Mosaic Disease

of the Raspberry in Great Britain. I: Symptoms and Varietal Susceptibility". *J. Pomol and Hort. Sci.*, 11, No. 3, 237–255, Sept. 1933). The range of leaf symptoms is classified according to severity, as 'type a', 'type b' and 'type c', and the disease seems to be quite distinct from leaf-curl and from a peculiar chlorosis upon the variety Devon. A tentative classification of varieties according to their relative susceptibility is given, and evidence is collected to show that this virus disease becomes worse in certain districts.

**Lower Gwanda Gold Belt.** The geology of the Lower Gwanda Gold Belt, one of the lesser known inliers of the Basement Schists of Rhodesia, is described by Mr. A. E. Phaup in Bulletin 24 of the Geological Survey of Southern Rhodesia (Salisbury, 1933, pp. 74, with coloured geological map). The region is situated about 85 miles south of Bulawayo. As in some of the other gold belts, the Basement Schists are predominantly a series of metamorphosed basic lavas, some of which were limburgites, which must have reached an immense thickness, whatever allowance be made for folding. Sedimentary rocks, including banded ironstone, form only a small part of the lower division of the Series. Proof is given of two periods of granite intrusion and the mineralisation of the gold reefs is referred to the earlier granite. Up to the present, eight small gold mines have been productive, the chief being the Legion Mine, which has produced more than 22,000 oz. of gold. After pre-Cambrian times, denudation removed several miles of rock, before the injection of an easterly swarm of basaltic dykes, probably during late Karroo times. Since then only a few hundred feet of rock have been worn away to produce the present topography.

**Climatology in Rhodesia and East Africa.** One of the five sections into which the last of the five volumes of Köppen and Geiger's "Handbuch der Klimatologie" is subdivided is devoted to the climate of Rhodesia, Nyasaland and Portuguese East Africa. This section, which has recently been completed, can be obtained, like the other sections, as a separate publication (Berlin: Gebrüder Borntraeger. 6 marks) in English. The authors are C. L. Robertson, chief engineer, Irrigation Division, and N. P. Sellick, meteorologist, of Salisbury, Southern Rhodesia. Before proceeding to the general and detailed descriptions of the climates of these countries a short history of their meteorological services is given. From this can be gathered an idea of the difficulties encountered in dealing climatologically with these areas, arising from the fact that until recent times there has been little co-ordination of the observations made by private individuals, on which a detailed knowledge of climate, and especially of rainfall, ultimately depends. There is nothing in this work calling for special notice, the handling of the available statistics being on orthodox lines. Attention is directed at an early stage to the great influence on the weather exerted by the high altitude—3,000 feet or more—of a large proportion of South Africa. The lofty plateau profoundly modifies the movements of the high and low pressure systems appropriate to these low latitudes, and this has, of course, large meteorological consequences; moreover, the influence on temperature of the mere elevation underlies all the seasonal and casual variations of the weather, and mitigates the unpleasantness of some of the climatic features.

**Cold Emission from Liquid Mercury.** It has been established that electrons may be pulled out of metal surfaces by a sufficiently large electric field. The quantitative study of this effect is hampered by the uncertainty in the field due to minute roughness of the metal surface. Beams (*Phys. Rev.*, Nov. 15) has attempted to study the emission from a liquid mercury surface, which must be free from such roughness. An added interest is in the probable part played by auto-electronic emission in the cathode spot of the mercury arc. In the experiments the mercury pool was cooled by a freezing mixture to keep down the vapour pressure, and an impulsive potential was applied to a spherical steel anode placed just above the mercury surface. Since the potential was applied only for a few microseconds, the mercury surface was not distorted by the electrostatic forces. A rotating mirror photograph shows that the luminous discharge starts at the anode, presumably as a result of bombardment by the electrons drawn from the cathode. The experiments showed that with a clean mercury surface the discharge was initiated by a well-defined field of about $1{\cdot}8 \times 10^6$ volts per cm. This value is much lower than predicted by the theory of Fowler and Nordheim. Taking the work function of liquid mercury derived from photoelectric experiments (4·53 volts) the theory predicts a field current of less than one electron per second, which could not possibly start a discharge. This discrepancy may be due to the submicroscopic structure of the surface—the author is going to undertake measurements of the photoelectric threshold and autoelectric breakdown at the same mercury surfaces. The magnitude of the autoelectronic threshold indicates that this electron emission may be important in the mercury arc.

**Effects of Sun on Radio Transmission.** By sending radio impulses to the outer regions of the earth's atmosphere, far above the stratosphere and unreachable by balloons or aeroplanes, physicists have obtained evidence that regular variations in radio echoes are due to the effect of ultra-violet light from the sun. Irregularities in the radio echoes show, however, that they are affected by other causes. In a paper read on December 22 to the American Physical Society, Drs. H. R. Mimno and P. H. Wang, of Harvard University, discussed the results obtained by using automatic apparatus for 6,000 hours last year. According to Science Service, they pointed out that changes in the electric conductivity of the ionosphere, which extends far above the stratosphere, affect our daily life. Most auroral displays occur at great heights and are accompanied by violent magnetic storms which interfere with telegraph and cable communication. Less violent disturbances may have the effect either of improving or of interrupting radio reception. Long distance trans-oceanic radio communication would not be possible if these atmospheric electric charges were not dense enough to deviate the radio wave and turn it back towards the ground. Even at short distances 'reflected waves' produce 'fading' in broadcast reception, 'ghost images' in television and are responsible for the slow alterations in signal strength noticed after nightfall. Radio transmission is affected by the 11-year sunspot cycle. Substantial progress has been made by physicists in finding out the nature and cause of these continual changes by using radio apparatus merely as a tool in their measurements.

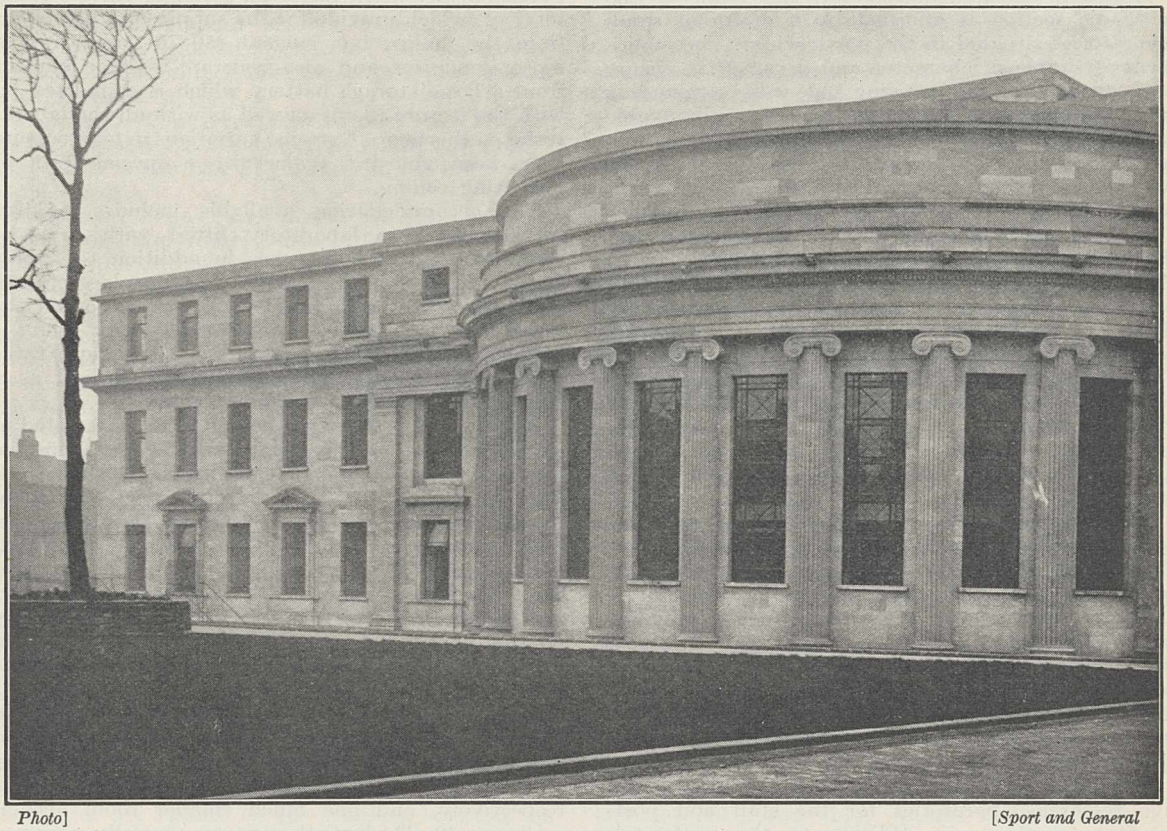
## New Chemistry Building of the University of Leeds

SIR FREDERICK GOWLAND HOPKINS formally opened the new building for the Department of Chemistry at the University of Leeds on January 12 (see NATURE, Jan. 20, p. 95).

The major portion of the new building consists of two wings extending at right angles to the frontage in Woodhouse Lane. The shorter or north wing, with its large semi-circular window and pillars of Portland stone, forms a conspicuous external feature ; it contains the lecture rooms, large-scale laboratory, workshop, private rooms for the staff, common room, library, and a number of small research laboratories. The south wing, which is built of red brick and is not visible from the main road, contains the large teaching laboratories with their service rooms and store rooms. The front section, which faces east on to Woodhouse Lane and connects the north and south wings, contains a number of laboratories for advanced and post-graduate work as well as rooms devoted to the study of special branches of chemistry. The building consists of three floors above ground and a basement extending under the south and east block. The ground floor is devoted mainly to inorganic chemistry, organic chemistry occupying the first floor and physical chemistry the second floor. All three sections share the lecture rooms, large-scale laboratory, library and the basement, where work requiring freedom from rapid temperature changes and vibration can be carried out. The total floor space in the whole building is about 72,000 sq. ft. The architects are Messrs. Lanchester and Lodge, of London.

At the present time the total number of students working in the Department is about 380 undergraduates, including an honours school of approximately fifty, and a research group of from ten to fifteen.

The general arrangement of rooms is best considered in relation to the teaching laboratories in the south wing. On the ground floor are two inorganic laboratories, each of a floor area of 3,400 sq. ft. and containing together 144 working places ; and a smaller one in the entrance block for more advanced work with 24 places. These serve to accommodate the large number of elementary students taking a one year's course, as well as those studying inorganic chemistry as part of a final or special honours subject. The large laboratories each contain twelve bench units of six working places, affording a 5 ft. length of space for every student. Each bench unit contains twelve lockers.



*Photo*] [*Sport and General*

FIG. 1 North wing of the new Chemistry Building of the University of Leeds.

The gas, water and electrical services run between the girders across the laboratories and are laid under the benches in concrete channels, which also serve to carry the stoneware water pipes from the sinks. Accessibility to the channels has been ensured by having the locker cupboards in movable units which can easily be withdrawn. In addition to the usual services, each working place is provided with its own draught flue which fulfils the double function of

removing noxious fumes and of ventilating the rooms. The flues, which are constructed of cement asbestos, join up with trunking below the bench level but above the waste channels, and run into ducts of the same material carried in vertical chases in the side walls, to the exhaust fans on the roof of the building. These vertical chases also carry the waste pipes and services and are easy of access for repairs. This principle applies also to all the laboratories in this wing. Situated between the two large laboratories and conveniently arranged are the apparatus store, acid store and steward's office, as well as rooms for furnaces, sulphuretted hydrogen, distilled water, and other necessary adjuncts. In the entrance block, besides the honours laboratory there are a gas analysis room and a balance room, and immediately below the latter in the basement is a small spectroscopic room for teaching purposes.

Research accommodation for the staff of the inorganic section is afforded by a group of small laboratories situated in the north wing. The equipment is simple in character and designed to ensure easy adaptation for carrying out work demanding special apparatus. Ledges with services and movable tables form a special feature of the fittings, and by means of a large duct for services running above the main corridors, it is easy to introduce special types of installation or to modify the existing services (gas, electricity, water or compressed air) as occasion may demand. Amongst this group of rooms is situated the departmental library, containing a valuable collection of chemical journals and treatises from the library of the late A. Chaston Chapman, generously presented to the Department by Mrs. Chaston Chapman in memory of her husband. The basement rooms are also of the same type and designed for post-graduate research. Those under the main entrance are without windows and completely below ground, and have proved to be singularly free from earth tremors and vibration.

The building is heated throughout by radiators supplied with hot water from the University boiler house. Compressed air for laboratories and lecture rooms is supplied from a small compressor in the basement.

On the organic floor the arrangement of teaching laboratories, main stores and accessory rooms is similar but modified to meet the requirements of this branch. Unlike the ground floor, the two large laboratories are provided with island benches, twelve in number, and will accommodate a total of ninety-six students.

Along the east and north wings are distributed five research laboratories for the staff and post-graduate workers, in addition to the professor's private accommodation.

Every laboratory is fully equipped as to services, which include compressed air and direct as well as alternating current. Hooded stone benches for combustions are provided in both teaching and research laboratories, and the space below the fume chambers is utilised for iron-shuttered bomb cupboards. Every island bench has power plugs for stirring motors; and a noteworthy feature is the supply of steam to enamelled iron baths on every working bench in the teaching laboratories as well as to suitable points in the research rooms.

Special attention has been given to the provision of adequate and effective fume chambers. These, both in the research and teaching laboratories, are of large size and lined with Sindanyo material which is specially resistant to the action of organic solvents as well as to acid steam. Gas, water and steam taps can be controlled from outside each chamber. The draught is taken from openings at the top and bottom of the chamber which lead into vertical ducts in the walls to exhaust fans on the roof. The air flow is approximately 500 cubic feet per minute for each chamber. It can thus be claimed that the traditional unpleasantness of organic operations has been largely eliminated. The general lay-out and detailed planning of this floor was mainly the work of Prof. C. K. Ingold, now professor of organic chemistry at University College, London.

The laboratories on the second floor are planned and equipped with a view to the special requirements of teaching and research in physical chemistry. The laboratory benches are to a large extent of the island type without super-structures, and are thus adapted for experimental work with physical apparatus. Particular attention has been given to the electrical services, which provide for the supply of A.C. current from the mains, D.C. current (50–75 volts) from a motor-generator and also constant voltage current from a large storage battery which is connected up with the lecture rooms as well as with all the laboratories on this floor. Extreme variations in temperature have been guarded against by a special form of insulating ceiling.

The accommodation available includes a large general teaching laboratory fitted with fireproof thermostat and side-benches in addition to twelve island benches which provide working places for 48 students. In close proximity to this are, as on the lower floor, a number of smaller accessory rooms—balance room, fume-cupboard room, special apparatus room, store rooms and cloak rooms as well as a drawing office and staff common room.

A special laboratory on the north side is devoted to electrochemistry and experimental work involving the use of heavy currents of electricity. Optical work may be carried out in dark rooms situated partly on the second floor and partly in the basement. Other rooms on the north and east sides of the building are designed for use as special research rooms or for experimental work which cannot be carried out in the main laboratory. The second large laboratory on this floor is set apart to provide for the special needs of medical, dental and pharmaceutical students in physical and organic chemistry.

The lecture theatre accommodation is situated in the north wing, and students have direct access to it without passing through the rest of the building. It consists of two large theatres, seating 250 and 144 respectively, and one much smaller room accommodating 40. The large theatres are specially equipped for experimental lectures; the lecture benches carry all services, and are fitted with draught flues. The natural lighting is from above and can be cut off by a sliding panel operated electrically by the lecturer, who can vary the artificial lighting by a dimmer switch. Special ventilating fans draw in air from behind the heating radiators and exhaust it through the roof, and a wall lining of acoustic board has proved very successful in securing good acoustic properties. The largest theatre occupies the upper part of the semi-circular frontage facing up Woodhouse Lane, and it is noteworthy that no traffic noises are audible inside. The lecture preparation room is conveniently situated between the two large theatres, with a gallery for the manipulation of the diagram screens and a chemical museum on the floor below.

## Prize Awards of the Paris Academy of Sciences

AT the annual public meeting of the Academy of Sciences, held on December 11, the prizes and grants awarded in 1933 were announced as follows:

*Mathematics.*—The Francœur prize to Paul Mentré for his work on geometry.

*Mechanics.*—A Montyon prize to René Thiry, for his work on the mechanics of fluids; the Poncelet prize to Eugène Bertrand de Fontviolant, for his works on mechanics; the Boileau prize to Adrien Foch, for his works on hydraulics; the Pierson-Perrin prize to Paul Langevin, for his work on the mechanical applications of piezo-electric quartz.

*Astronomy.*—The Lalande prize to Georges Prévost for his tables of spherical functions and their integrals; the Benjamin Valz prize to Henri Labrouste for his methods of research on periods in solar phenomena; the G. de Pontécoulant prize to David Belorizky, for his work in celestial mechanics; the Antoinette Janssen foundation to Daniel Chalonge for his studies in astronomical physics.

*Geography.*—The Gay prize to Alphonse Berget, for his treatise on oceanography; the Alexandre Givry prize to the late Pierre Gerson, for his hydrographic work.

*Navigation.*—The Prix de la Marine between Gaston Dollé and Henri Dutilleul (4,000 francs) for their work on autogenous electric welding and Jean Fieux (2,000 francs) for his applications of the gyroscope to navigation; the Plumey prize between André Grebel (1,500 francs) for his study of combustion in internal combustion motors, the late Paul Leroux (1,500 francs) for his experiments in hydraulics, and Gérard Delanghe (1,000 francs) for his work on Diesel motors.

*Physics.*—The Gaston Planté prize to Lucien Jumau, for the whole of his work on accumulators; the Hébert prize to Pierre Fleury, for his work on photometric standards; the Henri de Parville prize to Louis Leprince-Ringuet, for his work on atomic physics; the Hughes prize to Salomon Rosenblum, for his work on the α-rays; the Paul Marguerite de la Charlonie prize to Amédée Guillet, for the whole of his scientific work.

*Chemistry.*—The Montyon prize (Unhealthy Trades) to Georges Darzens, for his work in connexion with the control of petrol storage; Paul Émile Thomas receives an honourable mention for his researches on carbon monoxide and nitrous vapours; the Jecker prize between Mme. Pauline Ramart-Lucas (5,000 francs), for her studies on the relations between the properties of molecules and their absorption spectra, Émile André (2,500 francs), for his studies on fats, and Raymond Delaby (2,500 francs), for the whole of his work in organic chemistry; the Cahours prize to Georges Allard, for his work on the electronic structure of the ethylene carbon atom and on metallic borides; the Berthelot prize to Henri Moureu, for the whole of his synthetic work in organic chemistry; the Houzeau prize to Paul Laffitte, for his studies on explosives.

*Mineralogy and Geology.*—The Cuvier prize to Jules Lambert, for the whole of his work on the Echinidæ; the Delesse prize to Christopher Gaudefroy, for his work in physical crystallography; the Victor Raulin prize to Jean Cuvillier, for his work on the Egyptian Nummulitic; the Joseph Labbé prize to Pierre Despujols, for his studies on the mineral resources of Morocco.

*Botany.*—The Desmazières prize to René Vandendries, for his work on the sexuality of the Basidiomycetes; the Montagne prize to Roger Heim, for his work in mycology; the de Coincy prize to Louis Emberger, for the whole of his work.

*Rural Economy.*—The Bigot de Morogues prize to Serge Winogradsky, for the whole of his work on the microbiology of the soil.

*Anatomy and Zoology.*—The Da Gama Machado prize to Jean Verne, for his memoirs on pigments in living beings: the Savigny prize to Georges Sénevet, for his work on the blood sucking arthropods of Algeria and the Mediterranean basin.

*Medicine and Surgery.*—Montyon prizes to Charles Cot (2,500 francs), for his work on asphyxia, Paul Durand (2,500 francs), for his researches on pustular fever, Jean Lereboullet (2,500 francs), for his memoir on the tumours of the fourth ventricle; honourable mentions (1,500 francs) to J. A. Lièvre, for his book on parathyroidal osteosis, Adolphe Zimmern and J. A. Chavany, for their book on electro-radiological diagnosis and therapeutics of diseases of the nervous system, Henri Velu, for his book on "Dermes"; a citation to Nguyên-Van-Khai, for his memoir on the study of the prophylaxy of cholera by anti-cholera vaccination; the Barbier prize to Augustin Boutaric, for his researches on the properties of colloids and their relations with various biological phenomena; the Bréant prize to Georges Le Dentu, Adolphe Sicé and Marcel Vaucel, for their work on the therapeutics of human trypanosomiasis; the Godard prize to Henry Blanc, for his book on the phenolsulphonephthalein test in urinary surgery; the Mège prize to Edgard Zunz for his book on the elements of general pharmacodynamy; the Bellion prize to Mme. Lucie Randoin, for her work on vitamins; the Baron Larrey prize to Félix Pasteur, for his work on the utilisation of sunlight in the Sahara for the heating and purification of water.

*Physiology.*—The Montyon prize to Jean Gautrelet, for his book on the elements of physiological technique; the Pourat prize to Jean Chaze, for his biological work on the tobacco alkaloids; the Philipeaux prize to Pierre Dussumier de Fonbrune, for his memoir on a new micromanipulator and arrangement for the manufacture of micro-instruments; the Fanny Emden prize between Herbert H. Jasper (2,000 francs), for his psychological and physiological study of right and left handedness and ambidexterity, and Mme. Andrée Courtois-Drilhon, for her book on biochemical studies on the metamorphosis of the Lepidoptera.

*Statistics.*—The Montyon prize to Charles Marie, for his work in connexion with the annual tables of constants and numerical data of chemistry, physics, biology and technology.

*History and Philosophy of Science.*—The Binoux prize to Louis Pasteur-Vallery-Radot, for his work in connexion with the publication of the "Œuvres de Pasteur".

*Works of Science.*—The Henri de Parville prize to Gustave Juvet for his book on the structure of the new physical theories.

*Medals.*—Berthelot medals were awarded to Georges Darzens, Mme. Pauline Ramart-Lucas, Raymond Delaby, Henri Moureu and Paul Laffitte.

*General Prizes.*—The Grand prize of the physical sciences to Clodomir Houard, for the whole of his

work; the Bordin prize to Szolem Mandelbrojt, for his memoir on the unicity of Fourier's series; the Lallemand prize to Alexandre Monnier, for his work on the physico-chemical mechanism of nerve action; the Petit d'Ormoy prize (Mathematical Sciences) to Arnaud Denjoy, for the whole of his mathematical work and in natural science to Louis Léger, for the whole of his work on theoretical and applied zoology; the Estrade-Delcros prize to Ernest Vessiot, for the whole of his scientific work; the Le Conte prize to Eugène Bataillon, for his work on experimental parthenogenesis; the Parkin prize to René Hazard, for his work on the pharmacology of the alkaloids; the Saintour prize to Georges Giraud, for his work on partial differential equations and integral equations; the Lonchampt prize to Edmond Voisenet, for his work on the production of bitterness in wine and on the Adamkiewicz reaction; the Wilde prize to Mme. Irène Joliot-Curie and Frédéric Joliot, for their experimental work establishing the existence of neutrons; the Gustave Roux prize to Maurice Collignon, for his palæontological work on the Madagascan fauna; the Charles Dupin prize to Bertrand Gambier, for his work on geometry; the Marquet prize to Alexandre Bigot, for his work on the geology of Normandy.

*Special Foundations.*—The Lannelongue foundation to Mmes. Gabriel Cusco and Raphaël Rück.

*Prizes of the Grandes Ecoles.*—The Laplace prize to Maurice Allais; the L. E. Rivot prize to Maurice Allais, Raymond Fischesser, Robert Paoli and Max Dumas.

*Funds for Scientific Researches.*—The Gegner foundation to Valerian Agafonoff, for his researches on French soils; the Hirn foundation to Paul Ditisheim, for his work on chronometry; the Henri Becquerel foundation to Ludovic Driencourt, for his work on navigation and geographical maps.

### Loutreuil Foundation

1. *Researches on Fixed Questions.*—Jean Basset (4,000 francs), for researches on the pathogeny and immunisation in anthrax; Charles Lombard (3,000 francs), for experimental researches on the pathogeny of cirrhosis; Pierre Pons (3,500 francs), for researches on wool products from central and southern France; James Basset (5,000 francs), for his studies on the influence of high pressures on physical and chemical phenomena; Jean Dufay and Daniel Chalonge (5,000 francs), for chemical and spectrographic researches on the atmosphere carried out at the Observatories at the Jungfraujoch and at Interlaken; André Charriou, for his researches on the latent photographic image; Paul Henri Fleuret, for his studies of the mechanism of the formation of ketonic and oxalic acids; Laboratoire central d'electricité (12,000 francs), for making the standard of inductance with a view to the measurement in absolute value of the unit of electrical resistance; Charles Marie (3,000 francs), for systematic researches in electrochemistry; Henry Pollet (2,000 francs), for his studies of atmospheric electricity during dust winds in north China.

2. *Researches to be carried out in the French Colonies.*—Henri Humbert (15,000 francs), as a contribution to the cost of an expedition to Madagascar and southern Africa with a view to the study of various types of vegetation and their variations under the influence of the nature of the soil, altitude and climate; Louis Dubertret (7,000 francs), as a contribution to an exploration of the volcanic desert region to the south-east of Damascus; Jean Piveteau (4,500 francs), to contribute to the cost of excavations in a deposit of vertebrates at Oranais.

3. *Purchase of Laboratory Material.*—Ecole nationale vétérinaire de Lyon (6,000 francs), for the purchase of a Phillips' portable apparatus for radiography and radioscopy; Léon Huillet (3,000 francs), for the purchase of a Chevenard temperature regulator; Jules Lemoine (2,000 francs), for the purchase of a microphone designed for the study of internal friction in metals; Henri Chaumat (2,000 francs), for the purchase of material for the construction of an electrostatic machine; Maurice Javillier (3,000 francs), for the purchase of an incubator; Raymond Ricard (3,000 francs), for the purchase of a Fabry and Pérot interference standard.

4. *Libraries.*—The following grants are given to libraries for the purchase of books: Ecole polytechnique (7,000 francs), Ecole national vétérinaire d'Alfort (10,000 francs), Ecole national vétérinaire de Toulouse (2,000 francs), Ecole supériore de Chimie de Mulhouse (2,000 francs), Société française des Electriciens (1,500 francs), for the purchase of "Faraday's Diary".

*Publications.*—Archives de zoologie expérimentale (10,000 francs), for assisting the publication of a jubilee volume; Bibliothèque national et universitaire de Strasbourg (5,000 francs), as a contribution to the publication of the catalogue of scientific periodicals; Emile Mathias (4,000 francs), for the publication of two memoirs dealing with the action of lightning on man and animals.

### Mme. Victor Noury Foundation

Norbert Casteret (2,000 francs), for his hydrological and speleological explorations in the Pyrenees; Mlle. Madeleine Friant (2,000 francs), for her book on the dentition of mammals; Josué Hoffet (2,000 francs), for his study of the centre of Indo-China and his ethnological work in Annam; Nicolas Menchikoff (2,000 francs), for his numerous expeditions in the Sahara and the Libyan desert with resulting contributions to geology; Edouard Fischer (1,500 francs), for his researches on the marine fauna of the Channel.

### Other Foundations

Pierre Lafitte Foundation to René Mesny (3,000 francs), for the whole of his work on radio-electricity. The Roy-Vaucouloux Foundation to Philippe Lasseur, for his work in the laboratory of microbiology at Nancy. The Charles Frémont Foundation to Léon Pomey (2,500 francs), for his work on geology and analysis.

## University and Educational Intelligence

Cambridge.—A lecture on the Liversidge Foundation will be delivered by Prof. R. H. Fowler in the Lecture Theatre of the Engineering Laboratory on Friday, February 2, at 5 p.m. The subject of Prof. Fowler's lecture will be "Heavy Hydrogen".

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A liberal education as a prophylactic against the manifold ills that threaten the very existence of western civilisation is the theme of an address

delivered at Lehigh University on October 4 by Prof. Hans Zinsser and entitled "None of my Business : or Thoughts of a Biologist on Education". The address is printed in *School and Society* of November 25. The old problem of the relative cultural values of science and the traditional humanities is merged at the present day in another: how to determine the limits of the non-specialist and non-vocational parts of both, for a cultivated man of to-day should possess as clear a comprehension of the fundamental laws of science as he does of classical culture and of the language and literature of his own country. The great freedom of choice at present allowed in the earlier college years in the United States needs to be curtailed and there should be a far more rigid insistence than at present on a substantial minimum of mathematics distributed between those years and the high school, and general courses in the history of science, in physics, chemistry and biology should be combined with so much of the humanities as is indispensable for intelligent appraisement of the civilisation of our time.

THE annual report of the University of Bristol records a small increase in the number of students and several interesting developments in the course of the year 1932–33. A link with New Zealand was established by the foundation of a Hiatt Baker memorial research scholarship of £200 a year tenable for two or three years by a graduate from New Zealand. At a celebration of the centenary of the foundation of the medical school, the history of which by Dr. G. Parker was published without charge to the University by Messrs. John Wright and Sons, Lord Dawson of Penn paid a tribute to the work of Prof. Fawcett in the faculty of medicine over a period of nearly forty years. In co-operation with the City Council, the University established a department of preventive medicine which undertakes all the bacteriological, pathological and chemical examinations and research required from time to time by the corporation or its medical officer of health, who is ex-officio professor of preventive medicine. A faculty of law was established with the help of contributions from local solicitors and others. The university halls of residence were all full throughout the year.

THE dispersal of German scholars frowned on in their own land for reasons connected with their political affiliation or racial origin has led to the establishment by the Institute of International Education in New York of a graduate faculty in political and social science comprising Profs. Lederer, Brandt, Speier, Wunderlich and von Hornhostel of Berlin, Heimann of Hamburg, Feiler of Königsberg, Colm and Kantorowicz of Kiel and Wertheimer of Frankfort. It is hoped that in the near future this faculty will be matched with others so as to form a general "university in exile", a rallying point for distinguished scholars displaced by political intolerance in Europe, and a medium for cross-fertilisation of American and European scholarship. For the American student it would perform, by reason of its reproducing the spirit and method of German educational organisation, much the same service as he secured from one or two years of study in a German university. The scheme is described in the Institute's News Bulletin and a summary of it appears in *School and Society* of December 16.

## Science News a Century Ago

### Insects in the Heads of Mummies

The Rev. F. W. Hope read a paper on January 27, 1834, before the Entomological Society (*J. Proc.*) in which he described several species of insects found in the heads of Egyptian mummies, some of which had been extracted from the head of a female mummy with plaited hair. This was exhibited at the meeting by Mr. Wilkinson, the celebrated Egyptian traveller, by whom it was brought from Thebes. In the head of one mummy was found, it was said, a considerable quantity of the pupæ of dipterous insects . . . and from their appearance Mr. Hope was led to remark that the process of embalming could not possibly have been a rapid one. Mr. Pettigrew observed that in some mummies, however, no insects were discovered, as in the one recently opened at the College of Surgeons (see NATURE, Jan. 13, p. 74).

### Currency Problems in the United States

Throughout the year, the United States continued to be agitated by the contest which had begun in the preceding year as to the legality of the conduct of the President in withdrawing the public deposits from the national banks. Meanwhile, the importation of gold into the United States went on to an unprecedented extent. The increase of specie between the beginning of January 1833 up to June 11, 1834, exceeded 20,000,000 dollars, and the excess of specie imported during the next nineteen days, above what was exported during the same period, came to about 2,000,000 dollars. The result of this crisis was that a metallic currency was established for paper money ("Annual Register", 1834).

### Drought in England

On the last day of January 1834 a drought began in England and Wales, and from that date until July 4 the rainfall was very limited. At Chiswick the total fall for the whole period amounted to only 4·7 inches, and over England and Wales as a whole the rainfall in the months of February to May inclusive was only 58 per cent of the normal. In the early months high temperatures following a wet January caused the vegetation to be very forward, but a series of north-easterly winds and severe frosts in April brought disaster to the fruit crops. July was rainy and thundery, but the drought returned in September and was severe in October, November and December. October 1834 appears to have been the driest month of that name in England and Wales between 1810 and 1933 inclusive.

### Lyell's "Principles of Geology"

In January 1834 the *Gentleman's Magazine* printed the following notice of vol. 3 of Lyell's "Principles of Geology" :—

"Those who have read the former volumes of Mr. Lyell will have recognised the great alteration and improvement which has taken place in the theory of Geology. The older geologists were more fitted for the island of Laputa than for a Philosophical Society, and even some of the latter were not far behind in pushing forward their crude fragments of discovery. With them it was assumed that enormous changes and sudden and violent catastrophes, confounding and dislocating all the

globe, were necessary to account for its present aspect. Now Mr. Lyell's reasoning goes to the destruction of this ingenious but visionary fabric. He considers that the operations *now* going on in the great workshop of nature are sufficient to show how the others that have preceded them have also moved. The changes in animated nature he refers to the circumstances in which the animals are placed. Some animals are extinct that were existing a few years ago ; others are changed in their nature, habits and climate ; thus, though unmarked except by the thoughtful eye of science, are changes now taking place very similar to those which have so long attracted the wonder and employed the attention of the sons of wisdom. The superentaceous groups form the subject of examination in the third volume. Mr. Lyell's account of fossil shells is more extensive and important than ever was given before."

### The Post Office

"In my opinion," wrote Lord Brougham, "the teachers of the age of George III covered it with still greater glory than it drew from the statesmen and warriors that ruled its affairs." Brougham himself was one of the first public men to concern himself with national education, and he was the founder of the Society for the Diffusion of Useful Knowledge. To this Society was due the publication a century ago of the *Penny Magazine* and the "Penny Encyclopædia", to which many eminent men of science contributed. The *Penny Magazine* was issued weekly with a monthly supplement and the supplement for January 1834 was devoted to "The History and Present State of the Post Office". "In the advanced state of civilisation to which we have now attained in this country," the article says, "we possess many advantages of the highest importance which are indeed essential to our daily comfort, but which, presenting themselves with unfailing regularity, pass without observance and almost without our being conscious of enjoying them." Among the principal of them, it was said, may be reckoned an efficient and well-regulated system for the transmission of letters not only in Great Britain but also all over the world. For inland letters the charges were 4*d*. for 15 miles, 8*d*. for 50 miles, 10*d*. for 120 miles and, not exceeding 300 miles, 1*s*. 1*d*. When a letter weighed an ounce it was charged at four times the rate of a single letter. It cost 3*d*. to send a letter from Holyhead to Dublin and 6*d*. from England to the Isle of Man. Charges for overseas letters ranged from 1*s*. 2*d*. to France, to 2*s*. 2*d*. to America, 2*s*. 10*d*. to Gibraltar, 3*s*. 2*d*. to the Mediterranean and up to 3*s*. 6*d*. to Brazil. Peers and members of parliament could frank ten letters daily. The revenue of the Post Office, it was stated, amounted to £97,365 in 1754 ; £952,893 in 1804 and £1,457,132 in 1832. The number of persons employed in the post offices of the country in 1829 was 4,905.

### Richard Lemon Lander

Richard Lemon Lander, the African explorer, died in Fernando Po on February 2 or 7, 1834. There is some doubt as to the actual date, as the accounts vary slightly in detail. He was born in 1804 and even as a youth travelled widely, being in the West Indies when only thirteen and he crossed Cape Colony as the servant of Major Colebrook, a commissioner of inquiry, in 1823. With Clapperton, Lander went to West Africa and he brought home the news of Clapperton's death. He published the records of the expedition on his return to England. In 1830 Lander left England in charge of another expedition to the Niger. On his return in 1831, he was awarded the first Gold Medal of the then recently formed Royal Geographical Society of London. In 1832 a group of Liverpool merchants sent Lander on a new expedition to open up trade in the Niger basin. While on this expedition Lander was wounded in an encounter with the natives of the Brass River region and returned to Fernando Po, where he died.

## Societies and Academies

### London

Royal Society, January 18. B. F. J. Schonland and H. Collens : Progressive lightning. Eleven lightning flashes, comprising fifty separate strokes from two separate thunderstorms, have been photographed with a rotating lens camera based upon the design of C. V. Boys. The speed was fast enough to permit the study of the propagation of the discharge. The majority of the strokes were double and consisted of a dart-like downward-moving leader stroke, followed immediately upon arrival at the ground by a more intense flame-like upward-moving main stroke. The mean velocity of the leader strokes was $1{\cdot}1\times10^9$ cm./sec. along the tortuous track in two dimensions and $7{\cdot}0\times10^8$ cm./sec. in the vertical direction. The dart was less than 54 metres long. Corresponding mean velocities for the main strokes were $6{\cdot}0\times10^9$ cm./sec. and $3{\cdot}8\times10^9$ cm./sec. The leader strokes are identifiable with electron avalanches and the main strokes with thermally ionised channels. The cloud base was negative and the earth positive. A. O. Rankine : A simple method of demonstrating the paramagnetism and diamagnetism of substances in magnetic fields of low intensity. The instrument described is the result of an attempt to construct a magnetic gradiometer capable of measuring small distortions of the earth's magnetic field in the same way that the Eötvös torsion balance measures non-uniformities of gravity. Although this purpose has not yet been achieved, the first model of the instrument has revealed itself as a means of demonstrating the paramagnetism or diamagnetism of substances of small susceptibility. Moreover, the magnetising fields employed are much smaller than has hitherto been customary, being of the order of 50 gauss or less. The system used also provides a basis for the construction of a new form of very sensitive galvanometer. C. W. Gilbert : The production of showers by cosmic radiation. Experiments made with triple coincidence counters showed that the frequency of showers produced in lead by the passage of cosmic radiation is proportional to the general cosmic radiation. The transition curves for air to lead were obtained at 3,500 m., and it was found that there the energy of the shower particles was greater than at sea-level. To explain the curves obtained, three types of radiation are needed, a primary radiation, a shower-producing radiation and the shower particles.

### Paris

Academy of Sciences, December 18 (*C.R.*, **197**, 1545–1704). The president announced the death of Georges Friedel, *Correspondant* for the Section of Mineralogy. G. Perrier : The fifth general meeting of the Inter-

national Geodesic and Geophysical Union at Lisbon, September 1933. A short account of the matters under consideration at the meeting. L. BLARINGHEM: 'Fever' in *Arum*. The work of Garreau on the rise of temperature for some hours during the flowering of *Arum* is confirmed. The seat of oxidation is in the male flowers and their support. These consume 5–10 times as much oxygen as the female tissues. ANDRÉ BLONDEL: Observations on terminology in new discoveries. Examples are quoted to which objection may be made on linguistic grounds. It is suggested that the various international commissions in existence should determine as soon as possible international words appropriate to the definition of new phenomena, but only after consultation with linguists. W. VENADSKY, B. BRUNOVSKY and C. KUNAŠEVA: γ-Mesothorium in *Lemna*. *Lemna* concentrates the isotopes of radium (Ra, MsThI, ThX) but does not contain the isotopes of thorium. Hence the living material does not contain thorium. HENRI LAGATU and LOUIS MAUME: The alimentary variations of cultivated plants, apart from the intervention of manure, under the conditions of practical agriculture. SERGE ROSSINSKI: A case of deformation of isotropic congruences with persistent conjugated system. P. VINCENSINI: Associated systems and their transformations. AL. PANTAZI: Couples of stratifiable congruences. MANDELBROJT: Some theorems on Fourier's series. ROBERT GIBRAT: A fairly general type of singular integral equations. FLORENT BUREAU: Systems of two uniform functions of two complex variables. ARNAUD DENJOY: Integration along closed rectifiable ensembles. N. ARONSZAJN: The invariants of transformations in the domain of $n$ complex variables. A. MÉTRAL: Precession in gyroscopic phenomena. SILVIO MINETTI: Integration with a single quadrature of the movement of regular precession. SIMON DE BACKER: Atmospheric turbulence. D. RIABOUCHINSKY: Lines of emission. MAX SERRUYS: The rôle of peroxides in the knocking of petrol motors. From the experiments described, the authors conclude that peroxides are not the sole cause of detonation, but only one element favourable to its appearance. BERNARD LYOT: A monochromator with a large field utilising interference in polarised light. L. GOLDSTEIN: The complex process of materialisation. L. BOUCHET: Dry batteries with a solid radioactive electrolyte and ionised air. MLLE. M. CHENOT: The discharge produced by the superposition of a constant field and a high frequency field. E. CABANEL and J. CAYREL: The point effect and crystal detection. Although the use of a metallic electrode in the form of a point is favourable when used with sensitive galenas, the point effect cannot be considered as the cause of the detection, but acts only as a secondary factor.

(*To be continued.*)

## SYDNEY

**Royal Society of New South Wales, Oct. 4.** ADOLPH BOLLIGER: Volumetric determination of methylene blue and picric acid. Small amounts of methylene blue and picric acid can be titrated against each other with a high degree of accuracy. The sparingly soluble compound formed, namely, methylene blue picrate, can be readily removed with chloroform, in which it is very soluble. The end point is reached when the watery layer becomes colourless. L. W. O. MARTIN: Quantum numbers and valency. On the basis of London's generalisation of the non-ionic bond and Pauli's exclusion principle, the principal quantum numbers ($n$, $l$) of the electron pair bond between two elements are determined. It is shown, in the cases examined, that the element of higher atomic number determines the value for $n$, and therefore that the electron belonging to the atom of lower atomic number must be promoted. A connexion between the degree of promotion and the strength of the bond is shown to exist. The chemical reactivity is also connected with this promotion.

## WASHINGTON, D.C.

**National Academy of Sciences** (*Proc.*, **19**, 879–938, Oct. 15). DONALD H. MENZEL and ROY K. MARSHALL: Neon absorption lines in stellar spectra. A list of identifications is given, indicating that neon is comparatively abundant in the universe. EDWIN B. WILSON: Transformations preserving the tetrad equations. DIETRICH C. SMITH: Colour changes in the isolated scale iridocytes of squirrel fish, *Holocentrus ascensionis*, Osbeck. Observations similar to those made by Foster on iridocyte aggregations beneath the scales of *Fundulus* (see NATURE, **132**, 456, Sept. 16, 1933) have also been made on the iridocytes in the scales of the squirrel fish. EARL H. MYERS: Multiple tests in the Foraminifera. Observations on living Foraminifera show that in many families the occurrence of two or more shells cemented together with the apertures approximately opposed (multiple tests) is the result of the union of two or more individuals for reproductive purposes (plastogamy) with the production of 'zoospores'. J. L. WALSH: An extremal problem in analytic functions. EINAR HILLE and J. D. TAMARKIN: (1) On moment functions. (2) On the theory of Laplace integrals. JOSEPH MILLER THOMAS: A lower limit for the species of a Pfaffian system. MORGAN WARD: A property of recurring series. M. H. JOHNSON, JR.: Intensities in atomic spectra. A theoretical discussion leading to the determination of the electric moment with a definite scheme of coupling of the orbital and spin angular momenta, from which the electric moment matrix in intermediate coupling is derived. The components of the latter determine the intensities of the spectral lines. THOMAS WAYLAND VAUGHAN: The biogeographic relations of the orbitoid Foraminifera. Related living Foraminifera are characteristic of shoal water of the tropics and sub-tropics, suggesting a similar environment for the orbitoids. Since the orbitoids were bottom dwellers, wide geographical distribution requires planktonic larval stages, indirect evidence of which is provided by the observation by Myers of the production of floating 'zoospores' from certain living Foraminifera (see above). Such distribution would probably require a number of sub-oceanic peaks and ridges where there is now deep ocean. Hydrographic and other data suggest that the routes of migration were (*a*) Upper Cretaceous, between Europe and India by way of Tethys and between Europe and America across the Atlantic, (*b*) Eocene, along Tethys, across the Atlantic and from east to west of America, (*c*) Oligocene and most of Miocene, across Central America between the Atlantic and Pacific, thence to the Pacific islands probably to the East Indian region, as well as across the Atlantic and possibly round the southern end of India, but not round the south of Africa.

## Forthcoming Events

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

### Monday, January 29

ROYAL GEOGRAPHICAL SOCIETY, at 5.30.—T. A. Glover: "From Senegal to Italian Somaliland" (Geographical Film).

UNIVERSITY COLLEGE, LONDON, at 5.30.—Dr. R. E. M. Wheeler: "Race and History in Ancient Europe".*

EAST LONDON COLLEGE, at 5.30.—L. H. Bedford: "Low Voltage Oscillographs" (succeeding lectures on February 5, 12 and 19).*

### Wednesday, January 31

ROYAL SOCIETY OF ARTS, at 8.—Alan E. L. Chorlton, M.P.: "The Pooling of Water Supplies."

### Thursday, February 1

KING'S COLLEGE, LONDON, at 3.—C. J. Gadd: "Some Babylonian Myths and their Influence in Israel".*

ROYAL SOCIETY, at 4.30.—A. K. Denisoff and Prof. O. W. Richardson: "The Emission of Electrons under the Influence of Chemical Action".

Sir Robert Robertson, J. J. Fox and A. E. Martin: "Two Types of Diamond".

### Friday, February 2

UNIVERSITY of CAMBRIDGE, at 5—(in the Engineering Laboratory). Prof. R. H. Fowler: "Heavy Hydrogen" (Liversidge Foundation Lecture).

BEDSON CLUB, at 6.30—(at Armstrong College, Newcastle-upon-Tyne).—Dr. G. C. Simpson: "The Physical and Chemical Constitution of the High Atmosphere" (Bedson Lecture).

## Official Publications Received

#### GREAT BRITAIN AND IRELAND

The Cretan Labyrinth: a Retrospect of Ægean Research. (The Huxley Memorial Lecture for 1933.) By J. L. Myres. (Reprinted from the *Journal of the Royal Anthropological Institute*, Vol. 63.) Pp. 269–312. (London: Royal Anthropological Institute.) 2*s.* 6*d.* net.

The Pharmaceutical Society of Great Britain: Codex Revision Committee. Report of Pharmacy Sub-Committee: Summary of the Principal New or Revised Formulæ recommended by the Pharmacy Sub-Committee for inclusion in the British Pharmaceutical Codex, 1934. Pp. 49. (London: Pharmaceutical Press.) 2*s.* 6*d.*

Torquay Natural History Society. Transactions and Proceedings for the Year 1932–3. Vol. 6, Part 3. Pp. 175–267. (Torquay.)

Air Ministry: Meteorological Office, London. Southport Auxiliary Observatory (The Fernley Observatory of the Corporation of Southport). Annual Report, and Results of Meteorological Observations, for the Year 1932; with an Appendix. By Joseph Baxendell. Pp. 31. (Southport: Fernley Observatory; London: Meteorological Office.)

Abstracts of Dissertations approved for the Ph.D., M.Sc. and M.Litt. Degrees in the University of Cambridge during the Academical Year 1932–1933. (Published by Authority.) Pp. 119. (Cambridge: Printed at the University Press.)

The University of Manchester: The Manchester Museum. Museum Publication 104: Report for the Year 1932–33. Pp. 23+1 plate. 6*d.* net. Museum Publication 105: A Short Guide to the Manchester Museum. By Dr. George H. Carpenter. Pp. 16+7 plates. 3*d.* net. (Manchester: University Press.)

The Scientific Proceedings of the Royal Dublin Society. Vol. 21 (N.S.), No. 1: Some Measurements of the Brightness of Various Parts of the Sky by means of a Rectifier Photo-Electric Cell. By Dr. H. H. Poole and Dr. W. R. G. Atkins. Pp. 8. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.) 6*d.*

#### OTHER COUNTRIES

Southern Rhodesia: Geological Survey. Bulletin No. 24: The Geology of the Lower Gwanda Gold Belt. By A. E. Phaup. Pp. 74+3 plates. (Salisbury: Government Printer.) 2*s.* 6*d.*

India: Meteorological Department. Scientific Notes, Vol. 5, No. 55: On the Nature of the Frequency Distribution of Precipitation in India during the Monsoon Months, June to September. By D. Sankaranarayanan. Pp. 97–107+2 plates. (Delhi: Manager of Publications.) 10 annas; 1*s.*

Memoirs of the India Meteorological Department. Vol. 26, Part 2: The Indian Southwest Monsoon and the Structure of Depressions associated with It. By Dr. K. R. Ramanathan and K. P. Ramakrishnan. Pp. 13–36+11 plates. 2 10 rupees; 4*s.* 9*d.* Vol. 26, Part 3: On the Physical Characteristics of Fronts during the Indian Southwest Monsoon. By N. K. Sur. Pp. 37–50+12 plates. 1.9 rupees; 2*s.* 9*d.* (Delhi: Manager of Publications.)

Conseil Permanent International pour l'Exploration de la Mer. Bulletin hydrographique pour l'année 1932. Pp. x+112. 7.00 kr. Journal du Conseil. Rédigé par E. S. Russell. Pp. 309–433. 4.50 kr. (Copenhague: Andr. Fred. Høst et fils.)

Department of Agriculture: Straits Settlements and Federated Malay States. General Series, No. 15: Reports of the Field Branch for the Year 1932. Pp. iii+209+5 plates. (Kuala Lumpur.) 50 cents.

Egyptian Government: Ministry of Public Works. Annual Report for the Year 1927–1928, Part 2. Pp. xiv+283+13 plates. (Cairo: Government Press.) 20 P.T.

Smithsonian Institution: United States National Museum. Contributions from the United States National Herbarium, Vol. 26, Part 7: The Mexican and Central American Species of Viburnum. By C. V. Morton. Pp. vii+339–366. (Washington, D.C.: Government Printing Office.) 5 cents.

U.S. Department of Agriculture. Circular No. 287: Burning for the Control of Aphids on Alfalfa in the Antelope Valley of California. By R. A. Blanchard, H. B. Walker and L. K. Hedden. Pp. 24. 5 cents. Circular No. 289: Observations on the European Corn Borer and its Major Parasites in the Orient. By W. B. Cartwright. Pp. 14. 5 cents. Technical Bulletin No. 395: Subfreezing Temperatures Lethal to the European Corn Borer infesting Green Ears of Sweet Corn. By C. H. Batchelder and D. D. Questel. Pp. 14. 5 cents. (Washington, D.C.: Government Printing Office.)

Geological Series of Field Museum of Natural History, Vol. 6. Preliminary Description of a New Marsupial Sabertooth from the Pliocene of Argentina. By Elmer S. Riggs. Pp. 61–66. 10 cents. A New Devonian Trilobite from Southern Illinois. By Sharat Kumar Roy. Pp. 67–82. 20 cents. (Chicago.)

Zoological Series of Field Museum of Natural History, Vol. 20. The South American Mice referred to Microryzomys and Thallomyscus. By Wilfred H. Osgood. Pp. 8. 10 cents. A New Snake from Arabia. By Karl P. Schmidt. Pp. 9–10. 10 cents. Two New Rodents from Argentina. By Wilfred H. Osgood. Pp. 11–14. 10 cents. New Reptiles and Amphibians from Honduras. By Karl P. Schmidt. Pp. 15–22. 10 cents. Bats of the Genera Anoura and Longchoglossa. By Colin Campbell Sanborn. Pp. 23–28. 10 cents. Preliminary Account of the Coral Snakes of Central America and Mexico. By Karl P. Schmidt. Pp. 29–40. 10 cents. Notes on Fishes of the Family Hemirhamphidæ. By Alfred C. Weed. Pp. 41–66. 15 cents. (Chicago.)

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