NATURE

SATURDAY, APRIL 23, 1932

CONTENTS

Editorial and Publishing Offices:
MACMILLAN & CO., LTD.
ST. MARTIN'S STREET, LONDON, W.C.2

Editorial communications should be addressed to the Editor
Advertisements and business letters to the Publishers

Telephone Number: WHITEHALL 8831
Telegraphic Address: PHUSIS, LESQUARE, LONDON

No. 3260, Vol. 129]

Scientific Research and Patent Law

ONE of the most striking features in the advance of present-day science is the importance which borderland sciences have come to assume. In part this has resulted from the growing tendency towards intensive specialisation, and as more and more fields are demarcated the debatable lands tend to be neglected. With the advance of science there has been a parallel growth in its diversity. Chemists and other classes of scientific worker are tending more and more to subdivide themselves into special sections which often have little in common, and the 'general practitioner', whether in medicine or elsewhere, has tended to lose caste.

Specialisation has its own grave dangers of sterility of thought and a one-sided way of regarding the problems of science or of life, and it is accordingly significant that some of the most important recent advances in science have come in the borderline fields which demand the co-operation of specialists in several branches of science. Notably this is true of advances in chemotherapy and discoveries in the vitamin field, while industrial research could provide numerous examples. The contact thus engendered between different branches of science provides the necessary safeguard against sterility of thought, and this was probably what prompted Major F. A. Freeth's recent suggestion that the time has come when research should be organised by divisions of science and not by divisions of practice, and that, for example, an institution devoted to the study of high temperature equilibria, in which all the necessary classes of scientific workers were engaged, would produce more valuable scientific and industrial results than the study of special problems from the scientific or industrial side.

Contact between different branches of science can, however, only be full and fertile if there are no artificial barriers of thought or practice, and from this point of view it seems at least open to question whether the proposal to differentiate between medical and other classes of patents is wise. The Medical Research Council in its recent report reverts to the question of British patent law in relation to medical research, and publishes as an appendix to the report a memorandum setting forth the views which were submitted in 1929 to the Departmental Committee appointed by the President of the Board of Trade. The proposal for special treatment of medical patents was further elaborated into a draft scheme for 'dedicated patents' in a memorandum

on British Patent Law Reform prepared by a committee representing the Association of British Chemical Manufacturers and various chemical institutions.

This attempt at a compromise between the interests of the manufacturer and the views of many members of the medical profession has, however, met with severe criticism. Prof. F. L. Pyman and other representatives of the fine chemical industry have pointed out that the scheme fails to provide the protection which the manufacturer in Great Britain requires if he is to incur the heavy expenditure required for research and development in this field, thus definitely discouraging the patenting of improved processes for the manufacture of known compounds and hindering the publication of the underlying scientific work. Moreover, the differentiation between chemical products according as they are intended or not for medical purposes involves logical absurdities and creates difficulties for the manufacturer which may be intolerable, and, by stultifying the purpose of the scheme, react against the public interest.

Differentiation between medical inventions and other classes of scientific inventions can only be logically defended to-day on a very narrow interpretation of science. On any broad view, medical science is only one of the ways in which science serves humanity. The contribution of the chemist, the physicist, the engineer, the biologist, the agriculturist, and others are no less important, and upon their efforts also the success of mankind's struggle to maintain its existence often depends.

To question the desirability of affording medical patents, medical inventions, or discoveries treatment distinct from that accorded to discoveries in other branches of science is not to assert that the present patent system is ideal or satisfies the requirements of industry, science, and society. On the contrary, Mr. C. C. Paterson suggested in a memorandum printed in the British Science Guild's Report on the Reform of the British Patent System that we have seriously to consider whether the principles of the existing patent law are suitable to the modern conditions of industry, and particularly chemical industry, when progress depends less on discontinuous invention than on the continuous application of scientific research. If this question can be answered in the affirmative, there can be no convincing or logical reason for refusing to bring medical, biological, and agricultural products within the system. If, on the other hand, as is by no means impossible, our investigation leads to the conclusion that the principles upon which the patent law is based are obsolete, we are faced with the responsibility of developing a new and alternative system in which medical and agricultural discoveries or inventions should receive a normal and logical treatment along with other classes of scientific discovery.

In its memorandum, the Medical Research Council discriminates between scientific discovery and invention, and recognises that, in the main, medical advances now come less from inventive ingenuity than from systematic scientific research. The arguments advanced against the patenting of medical discoveries are not altogether logical, and are so similar to those advanced in other quarters against the protection of scientific discoveries, that a strong suggestion is prompted that a solution to the problem of protecting scientific property might at least include a solution of the lesser problem of protecting medical discoveries. The growing evil of 'paper' patents drawn up in terms which cover whole fields of prospective discoveries has, as we have said before in these columns, led to serious doubts as to the suitability of our present patent law system to modern industrial conditions. No drastic modification of patent law could, however, be contemplated except through international convention. International discussions on the idea of protecting the right of scientific workers to participation in the profits arising out of their discoveries may at least assist in elucidating the whole situation, and provide an opportunity for opening up international discussions on the fundamental position of patent law, if required.

Unsatisfactory as the present position in Great Britain may be, premature action is unlikely to be beneficial. The advocates of 'dedicated patents' themselves recognise the impracticability of total abolition of patents in the medical field except by international agreement. As already urged, any discrimination between one branch of science and another in patenting is logically indefensible; on ethical grounds it may be invidious. Since it can only be effective by international agreement, it might be well to determine first the suitability of the practice of patenting for industrial needs under modern conditions; the possibility of extending some form of protection to all scientific discoveries which receive industrial application; and finally, the broad lines which any new system to supersede a patent system should take. From such discussions there should emerge a considered and scientific policy which, without discriminating between different sciences, would reconcile the requirements of industry and the encouragement of scientific discovery in ways affording the maximum public advantage.

The Study of Wireless Principles

(1) *Wireless: a Treatise on the Theory and Practice of High-Frequency Electric Signalling.* By L. B. Turner. Pp. xviii + 528 + 31 plates. (Cambridge: At the University Press, 1931.) 25*s.* net.

(2) *Experimental Radio Engineering.* By Prof. John H. Morecroft. Pp. v + 345. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1931.) 17*s.* 6*d.* net.

(3) *Foundations of Radio.* By Rudolph L. Duncan. Pp. ix + 246. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1931.) 12*s.* 6*d.* net.

UNDER pressure of the abnormal conditions which prevailed in the world during the years 1914–18, the thermionic valve, born a few years before, successfully passed through its early life as a practical appliance in wireless communication. Its possibilities at both the transmitting and receiving ends of the link were appreciated, and it became evident that a revolution was taking place in the practice of the art. Such a change demanded new literature and textbooks, and Mr. L. B. Turner was one of the first in the field with his "Outline of Wireless" published in 1921. This book presented in a clear and concise manner the fundamental principles of wireless communication as then practised, with an adequate description of the part played by the thermionic valve.

The volume now under review (1) represents the continuation of the author's aim to present an account of wireless theory and practice which should be readable by a competent electrical engineer who had not studied high-frequency phenomena. In extending the work to cover the progress of engineering achievement and scientific research during the intervening ten years, the book has grown from 195 to 528 pages; although it is significant of the economic conditions of our times that the price has only increased from 20*s.* to 25*s.* In considering the size of the book, it may be questioned whether, for the sake of possible completeness, it is desirable to continue to include obsolescent matter dealing with plant and apparatus, the development and applications of which have given way to the valve. Chaps. v. and vi. of the book, occupying sixty pages, deal with spark transmitters, arcs, alternators, and crystal detectors. Even the latter item of apparatus, once so popular among broadcast listeners, has receded into the background at recent radio exhibitions. In the compilation of an up-to-date textbook on a rapidly advancing subject such as wireless communication, the time must come when it is necessary to relegate the historical development of the subject to a mere background in, say, an introductory chapter.

In the present case the introductory chapter outlines the basic properties of waves and their use for signalling purposes, and in Chap. ii. the author plunges straight into an analysis of the propagation of an electromagnetic disturbance. The study of this chapter by the average electrical engineer is not made easier by the use of two systems of units throughout, since most of the formulæ involved are given in parallel columns under the headings "Electrostatics", "Magnetostatics"—surely somewhat curious names for a consideration of high-frequency phenomena. Chap. iii., dealing with "Propagation of Wireless Waves Round the Earth", was found to be very refreshing as a concise, if somewhat brief, summary of the state of this portion of the subject, freed from a consideration of the enormous mass of experimental data on field intensity measurements under various conditions. The fourth chapter gives the usual analysis of the behaviour of an oscillatory circuit under the influence of an impressed e.m.f. of either the damped or the undamped type. The analysis includes a consideration of the principles of the measurement of frequency and decrement, and also the behaviour of an aerial as an oscillatory circuit.

In Chap. vii. the reader is introduced to the thermionic valve, and this and the succeeding four chapters, occupying 180 pages, comprise a detailed consideration of the valve and its applications as a rectifier, amplifier, and oscillator. The student is carried forward from an elementary discussion on thermionic emission and space charge effects to consideration of the action of the part played by the third and following electrodes, as exemplified in the modern triode, screen-grid valve and pentode. Attention is continually directed to the dimensions of the various quantities involved by giving typical values for modern valves and apparatus, but the main object here has been to present a detailed analysis of the features governing operation and performance. In places, such as Chap. x., it might be questioned whether the discussion has not been made unduly complicated, but the difficulties of dealing with this portion of the subject are well known and the reviewer is loth to criticise any attempt to give a generalised treatment free from the approximations which are usually made and often make the results inapplicable to any practical case.

The section on telephony devotes to the subject the fair amount of space which it deserves in view of its importance in our everyday life. A chapter on 'antennas' deals briefly with arrays and other directive systems, and refers to the use of such arrangements for direction-finding purposes; although it is doubtful if pp. 459-460 would be easily understood by one not well versed in direction-finding. Discussion of the distribution of high-frequency currents in conductors is delayed until Chap. xv., while a general analysis on filters follows. The last chapter discusses the atmospheric pulse as a continuous spectrum and refers to the periodogram analysis aspect of the subject. Lack of space has, apparently, prevented the author making any allusion to the large amount of experimental work conducted for several years past in the investigation of the origin and nature of atmospherics.

The photographic illustrations are concentrated in the centre of the book in the form of thirty-one plates. While the majority of these are excellent as illustrating views of apparatus and plant not normally available for inspection by the average student, it was, perhaps, scarcely worth while including Nos. 3 and 16, illustrating a variable condenser and a receiving valve such as nowadays can be seen in any shop window.

Considering the size of the book, the mistakes noted are relatively few in number. It may be pointed out that at the time the book was written, the London broadcasting station was not in Oxford Street (p. 6), and that the Poulsen arcs at Leafield (p. 131) were replaced by a valve transmitter several years ago. The reviewer must also complain that he dislikes very much the author's habit of attaching extensive footnotes to many of the pages of text. Footnotes are permissible as references to literature or, occasionally, as afterthoughts occurring while the book is in the proof stage, but in general, they should either be embodied in the text or suppressed altogether.

These shortcomings, however, form a very small portion of the whole book, and if the author's purpose was to nurture his "Outline" into a comprehensive survey of the fundamental principles of wireless communication, he may be congratulated upon having achieved his object. The book may be recommended to all those serious students and engineers whose interest or occupation demands that they should delve somewhat more deeply into the subject than would be the case if they desired merely to increase their general knowledge of the applications of physical science. The general production of the book, including the diagrams and mathematical symbols, is of the high quality only to be expected from such publishers as the Cambridge University Press.

In the preface to his book Mr. Turner writes: "Particularly in high frequency work does a lack of prolonged practical experience make itself apparent. Proficiency with mathematical equations and circuit diagrams is indispensable, but is not sufficient to make the student effective as an engineer. He must manipulate the things whose idealised qualities are portrayed in the circuit diagrams; and often a rather long apprenticeship proves necessary." To aid the student in passing through this apprenticeship stage, Prof. J. H. Morecroft's book (2) should prove invaluable; and so far as is known, this is the first available textbook directed specifically to the teaching of radio principles in the laboratory. An introduction of thirty pages surveys very briefly the field of radio measurements and gives many practical hints on the acquisition and calibration of suitable apparatus. The remainder of the book is then devoted to fifty-one experiments, each having a clearly stated object and designed to illustrate some particular phase of radio frequency phenomena and to make the experimenter familiar with the use of all types of apparatus. The statement of the object of each experiment is followed by an analysis of the quantities involved in such a manner as to give to the student a realistic view of the theoretical principles with which it is assumed he is already familiar. Instructions are given as to the best method of dealing with the results of the experiments so as to deduce as many quantities as possible. There is no doubt that this book meets a real demand in supplying a kind of laboratory manual for the radio engineering student, and the author is to be congratulated on the production of this companion volume to his already well-known "Principles of Radio Communication", the second edition of which was reviewed about three years ago.* The student who works conscientiously through either Turner or Morecroft to learn his fundamental principles, and also performs all the experiments described in the book now under review, will indeed be well equipped to begin his career as a qualified radio engineer.

The last book (3) under review deals not with radio communication as such, but with the elements of electricity and magnetism, a knowledge of which is usually assumed by the author of any book on wireless principles. In the course of seven

* NATURE, vol. 122, p. 567; 1928.

chapters the author deals with the elements of electrostatics, magnetism, electromagnetic induction, resistance and Ohm's law, and the construction and use of primary cells. The eighth chapter gives some information on sound vibrations and waves, while Chap. ix., headed "Preparatory Mathematics", provides a short summary of arithmetical procedure. The explanation of principles throughout the book is, in general, quite clear, and the reader is helped by some easily understood graphical illustrations. The treatment is not, however, carried to the stage of dealing with alternating currents, a knowledge of which will be essential before the reader can proceed to the consideration of the production of electrical oscillations and wireless waves. On the subject of elementary electricity and magnetism, the reviewer was not aware of the need of a further book on this subject, and at the published price of 12*s*. 6*d*. this volume would seem to be somewhat dear.

R. L. SMITH-ROSE.

Early Europe

The Early Age of Greece. By Sir William Ridgeway. Vol. 2. Edited by A. S. F. Gow and D. S. Robertson. Pp. xxviii + 747. (Cambridge: At the University Press, 1931.) 30*s*. net.

IT is not usual for two volumes of the same work to be published thirty years apart. In Sir William Ridgeway's case the reason is that he began to write about the prehistory of Greece and found himself drawn into writing a prehistory of Europe; for the wide range of his theories led him to consider one district after another, Illyria, Italy, Central Europe, Ireland. The material to be studied was vast and constantly increasing; the angles from which he studied it were many, archæological, sociological, religious, and literary. It is not to be wondered at if it grew unmanageable, especially for one of advancing years and failing eyesight. A lesser man would have given up the task altogether; but Ridgeway struggled on, wrote two or three lesser works dealing with fragments of his material or with subsidiary problems, and finally left behind at his death in 1926 an immensity of half-written work, in all stages from notes to proof-sheets, from which at last a selection has been published by the editors of this volume. Nearly seven hundred and fifty pages, illustrated with 158 figures, are by no means a contemptible fragment; we may judge how enormous the complete work would have been if it had ever seen light in the form the author meant it to have.

As Mr. A. J. B. Wace points out in a short but excellent introduction, much of what now appears was written thirty years ago, and must be judged accordingly. There are echoes in it of controversies now dead and buried, and also, it must be admitted, passages which are instructive chiefly as showing what strange things passed for sociological evidence at the beginning of this century. This is particularly the case with the first chapter, "Kinship and Marriage". Ridgeway's general theory was that Greece was inhabited in very early times by a matrilineal population, of the race he terms Pelasgian, who were the authors of the Mycenæan culture on the mainland and were invaded by the Achaians, a fair, tall people from the north, whose social structure was of the patrilineal type and whose nearest kin were the Kelts. It is difficult to say whether Ridgeway shows more acuteness here in refuting the opinion of M'Lennan that mother-right existed in historical Greece or lack of critical judgment in the arguments he advances for its presence among the 'Pelasgians'.

With regard to the other chapters, "Murder and Homicide", "Fetish, 'Totem', and Ancestor", and "Ireland in the Heroic Age", much the same criticism may be made, with this difference, that the material is more largely archæological, and when archæology was his subject, Ridgeway had an almost unique power of making the dullest details interesting. To say that his interpretation is often doubtful is not to deny that he gives his critics something definite and clear with which to agree or disagree. About half his ideas were magnificently right; and for these we may honour his memory and pass quietly over the other half, which were enormously wrong.

H. J. ROSE.

Dr. Huxley and Mr. Arnold

Brave New World: a Novel. By Aldous Huxley. Pp. v + 306. (London: Chatto and Windus, 1932.) 7*s*. 6*d*. net.

IT is difficult to resist the conclusion that the writing of 'Utopias' is far more entertaining than reading them. This is probably due to the fact that the planning of a novel of the future gives an author an enhanced sense of power unobtainable from a novel of the present. The present is too full of the past not to limit that pleasant sensation; which is probably why so powerful a creator as Mr. Wells turned more than once to the future for his material.

It was inevitable that Mr. Aldous Huxley should sooner or later write a novel of the future. "Brave

New World" is his second-best book, for he will never surpass "Antic Hay". It proposes to describe a scientifically organised world, in which, however, one cannot imagine any scientist of to-day being able to live and work successfully. It is throughout a parody of the scientific point of view—shifting it ever so slightly but sufficiently towards the ridiculous—coupled with an exposition of Mr. Huxley's objections to what he conceives the scientific point of view to be. The reasons for these are two, of which the second will be described later.

In the first place, biology is itself too surprising to be really amusing material for fiction. If one wrote to-day a plain description of the work of Dr. Butenandt on the male sex hormone, it would probably seem funnier than Mr. Huxley's detailed opening chapter on the "Central London Hatchery and Conditioning Centre", where humanity is 'raised' on model factory lines. But never mind. What happens to these Alphas, Betas, Gammas, Deltas, and Epsilons, who are, of course, people, produced and conditioned and reared all nicely class-conscious and contented?

Mr. Huxley's genius here reveals itself: he knows their jokes, and they *are* funny; he also knows their sorrows and a cunning method for dealing with them, the ingestion of a pleasant dream-producing narcotic called 'soma'. He knows their pleasures, of which the foremost is promiscuous intercourse without fertilisation. Here he makes a slight mistake, for no young lady six hundred years hence would wear so primitive a garment as a Malthusian belt stuffed with contraceptives when a periodic injection of suitable hormones would afford her ample protection. But on mass entertainment, such as the 'Feelies'—heirs to 'Talkies'—he is quite sound.

In his search for dramatic relief Mr. Huxley follows Voltaire. Borrowing from him the idea of "L'Ingénu", a nice, simple savage, he provides one, a poor boy born mistakenly of a European father and mother, the latter a Beta-minus and all named Linda, who had got lost on an exploratory excursion to the New Mexican reservation where Indians were allowed to remain on sufferance. While Linda here relapses into a horrible state of pre-scientific squalor, her son John discovers the works of W. Shakespeare. Henceforth his speech is that of the bard.

Now, however, a terrible thing happens which brings us back to the second reason for saying that Mr. Huxley is unable to do justice to the scientific point of view.

The savage is brought back to his kind in Europe and goes berserk in their brave new world. That is nothing. The terrible thing is this: Mr. Arnold appears once more and goes berserk on Dr. Huxley. (Everyone knows that Mr. Huxley is the grandson of T. H. Huxley. He is also the great-nephew, I believe, of Matthew Arnold, and therefore the great-grandson of 'Arnold of Rugby'.)

Dr. Jekyll and Mr. Hyde are nothing to Dr. Huxley and Mr. Arnold. Mr. Arnold is always doing it. He did it in "Point Counter Point"; he does it in "Brave New World". Dr. Huxley, who knows and cares about biology and music, science and art, is once again ousted by this double of his, morbid, masochistic, medieval-Christian. Mr. Arnold takes charge of the last chapter of "Brave New World". . . . The result is distressing. Nevertheless, this is a very great book.

CHARLOTTE HALDANE.

Lavoisier

Lavoisier. By J. A. Cochrane. Pp. xiii + 264 + 8 plates. (London: Constable and Co., Ltd., 1931.) 7*s.* 6*d.* net.

THE great majority of biographies may be divided into two classes: those that tell us what a man did, and those that show us what a man was. Mr. Cochrane's life of Lavoisier is a very competent example of the former, in which the story flows smoothly and evenly, while a due sense of proportion is maintained throughout. If we are left at the end with the feeling that we still do not know what manner of man Lavoisier was, we must nevertheless gratefully acknowledge that the main facts of his life and work have never before been so adequately described in the English language. It has, indeed, been a reproach to us and to our American cousins that, while the adjudication between the relative claims of Lavoisier, Priestley, Cavendish, Watt, and others has always excited considerable interest among us, no complete or even moderately complete biography of the great Frenchman had been written in our tongue. This omission is all the more remarkable in that many historians of chemistry must have been in a position to repair it with very little additional labour to themselves. Happily, the reproach is now expunged, and though Mr. Cochrane would probably be the first to admit that the definitive biography is still to be written, he deserves our warmest thanks for his clear and unbiased account of Lavoisier's career.

Though this is Mr. Cochrane's first appearance

as a historian, he is already widely known as the author of several admirable little books on elementary science, in which his interest in the history of chemistry shows itself very plainly. The present book proves that his ability to write simply and attractively is allied to sound historical sense and critical judgment; and though he modestly says that he had hoped another pen than his own would have undertaken the task he set himself, most readers will feel that, within the same limits, no one could have achieved a more satisfactory result. He is at his best in plain narrative, as, for example, in his account of Lavoisier's early life and in his description of the circumstances of the arrest, trial, and execution, while his summary of Lavoisier's manifold scientific activities contains much that will be new, even to chemists.

On the question of Lavoisier's integrity in his claims to priority in the discovery of oxygen and of the composition of water, Mr. Cochrane sees no reason to dissent from the usual conclusion that he cannot be exonerated from the charge of attempting to pick the brains of Priestley and Cavendish; indeed, the facts are no longer in dispute, and one can only regret this 'moral twist' in a character that is in so many ways both noble and charming. We may frankly admit that Lavoisier was indebted to Priestley, to Beccaria, to Bayen, and to many others, and that he refused to acknowledge his indebtedness with any degree of completeness, but his unruffled calmness in the period of the Revolution and the bravery with which he faced the guillotine on May 8, 1794, go far to cancel the lapse. General nobility of character is not infrequently accompanied by curiously inexplicable shortcomings, and in the final reckoning Lavoisier's unselfish labours in the public welfare, not to mention his strict honesty in the *Ferme*, must surely be taken into account.

It is interesting to learn from Mr. Cochrane's pages that Lavoisier's marriage, which provided him with an ideal companion for his life and work, was agreed upon as a casual matter, undertaken to oblige his friend Paulz. The Controller-General, a man of fifty, had conceived an infatuation for Paulz's daughter Marie Anne Pierrette, a pretty child of thirteen with blue eyes, brown hair, and rosy complexion. Her father strongly objected to the match, and to put an end to a difficult situation (for the Controller-General was an extremely influential man), he suggested to Lavoisier that the girl would form a suitable bride for himself. Lavoisier obligingly consented, and the marriage took place in December 1771. Mme. Lavoisier brought her husband a *dot* of 80,000 livres, while his father gave him 250,000 livres as a wedding present. Since his mother had already left him 170,000 livres, the young couple entered upon their new life in very comfortable circumstances, and Lavoisier was able to carry on his scientific researches free from the shadow of financial cares.

Mr. Cochrane's story of the last few years of Lavoisier's life is an excellent, if sombre, piece of work. He states the facts without emphasis, but in so telling a manner that here, for a short time, we begin to feel that we see the man himself. Doom was in the air, and Lavoisier knew it; but he proceeded imperturbably with his experiments and refused to be frightened into giving up possessions that were legally his. He had sympathy with the Revolution in its early days, and never attempted to avoid payment of the heavy levies that the government made upon the wealthier classes, though he was careful to see that he paid no more than the law could properly demand. When at length he was arrested, with other members of the *Ferme*, he could no longer carry out original research, but he proceeded steadily with the composition of his "Memoirs of Chemistry". By the end of April 1794, the first two volumes were ready for the printer, and one of the last tasks of his life was to correct the proofs. The sands were now quickly running out, and in a few days Lavoisier's head fell on the scaffold, the victim immediately preceding him being his father-in-law Paulz, then an old man of seventy-five.

It is difficult to gauge the loss that science suffered through the untimely death of one of her most brilliant exponents, but Mr. Cochrane is not over-estimating the probabilities when he says that, if his wonted success had continued to attend him in the other problems he intended to explore, he would have anticipated many of the discoveries of the nineteenth century. Like Mr. Cochrane, we think it a strange fact that although Lavoisier was at the time of his death and for at least fifteen years before it one of the most eminent men in France, the general historian usually does not think it worth while to make any mention of him. Perhaps this little book may secure for Lavoisier his rightful position in the history of France; his position in the history of science is already established. The statue in the Rue Tronchet, miraculously undamaged by the German shell that shattered the end of the Madeleine, is a symbol of one who can never be dislodged from the halls of intellectual achievement.

E. J. Holmyard.

Short Reviews

Théorie des fonctions algébriques et de leurs intégrales. Par Paul Appell et Prof. Édouard Goursat. Deuxième édition, revue et augmentée par Pierre Fatou. Tome 1 : *Étude des fonctions analytiques sur une surface de Riemann.* Pp. xxxv + 526. Tome 2 : *Théorie des fonctions algébriques d'une variable et des transcendantes qui s'y rattachent ; fonctions automorphes.* Pp. xiv + 521. (Paris : Gauthier-Villars et Cie, 1930.) 200 francs.

VOL. 1 of the present treatise is a revised edition of Appell and Goursat's well-known " Théorie des fonctions algébriques et de leurs intégrales ". The second volume, contributed by the late M. Pierre Fatou, is an introductory but fairly comprehensive treatise on automorphic functions. One of the most valuable features in the early part of this volume is a new and remarkably simple proof of the theorem, that a group of real linear transformations which has no infinitesimal transformation is properly discontinuous. A determination of the fundamental domains of Fuchsian and Kleinian groups follows, and then the chief known properties of Fuchsian and Kleinian functions, and an account of the theta functions. The only example of a group considered in detail, however, is, as in many previous treatises on automorphic functions, the modular one. No insuperable difficulty exists in the way of extending this list considerably. The whole treatise is written in clear and masterly style ; it forms an admirable introduction to the classical work of Klein and Poincaré.

The Soil and the Microbe : an Introduction to the Study of the Microscopic Population of the Soil and its Rôle in Soil Processes and Plant Growth. By Prof. S. A. Waksman and Prof. R. L. Starkey. (The Wiley Agricultural Series.) Pp. xi + 260. (New York : John Wiley and Sons, Inc. ; London : Chapman and Hall, Ltd., 1931.) 17*s.* 6*d.* net.

" THE Soil and the Microbe " is a difficult book to review, for, knowing how much soil microbiology owes to the researches of the two authors, one is led to expect a high standard of excellence in a book from their pens ; and this, unfortunately, is not the case. Though apparently written for the elementary student or inquiring farmer, yet there is a doubt as to whether such readers would find the way smooth for a real understanding of the principles of soil biology. To illustrate the unevenness of planning, the carbon dioxide cycle is first discussed in the foreword, then the nitrogen needs of the plants are mentioned on p. 14, where it is stated that these needs are furnished by the addition of inorganic substance or organic forms of nitrogen such as urea or guano ; but it is not until much later in the book that there is any mention of the reason for supplying nitrogen in the form of urea or guano, or precisely what rôle microbes play in the transformation of such substances.

The volume, however, should not be condemned out of hand, for undoubtedly it has its points, in that it summarises a great deal of our knowledge concerning the chemical changes going on in the soil and is well illustrated ; though Fig. 5 should undoubtedly be suppressed in any future edition, for it is either unintelligible or, if intelligible, incorrect.

Einführung in die Zytologie. Von Prof. Lester W. Sharp. Mit Genehmigung des Verfassers aus dem Englischen übersetzt und vollständig neu bearbeitet von Prof. Robert Jaretzky. Pp. 733. (Berlin : Gebrüder Borntraeger, 1931.) 52·50 gold marks.

SHARP'S " Introduction to Cytology " was first published in 1921. The present work is a translation and amplification of the second edition, which appeared in 1926. The considerable additions made by the translator, Prof. Robert Jaretzky, refer chiefly to the more recent literature, and are indicated by a ' J ' on the margin of the page. Discussions are added on protoplasmic inheritance, genic changes, mitogenetic rays, and various other topics, leading in some cases to a revision of the original author's point of view on such matters as the nature of the spindle fibres. Some three hundred additional cytological papers are considered.

The present work is a very good account of modern plant cytology, with reference not only to flowering plants but also to all the other plant groups. By way of comparison, numerous references are made to the conditions in animal cells in connexion with such topics as Golgi apparatus, gametogenesis, syngamy, parthenogenesis, and chromosome structure. This useful work for students and investigators ends with an extensive bibliography and a carefully compiled index.

La téléphonie. Par Robert Dreyfus. (Collection Armand Colin : section de physique, No. 125.) Pp. 199. (Paris : Armand Colin, 1931.) 10·50 francs.

ALTHOUGH the use of the telephone in everyday life is continually extending, yet the theory of its working is known to very few of its users. Some of them know that it is connected with the name of Graham Bell, but beyond this their knowledge does not extend. The object of this little book is to fill up the gaps in the knowledge of an otherwise well-educated man. The subject is much wider than is commonly understood by the public. In a book of this size, therefore, it is only possible to give a very brief account of the physical and mathematical difficulties that had to be overcome before the telephone attained its present perfection.

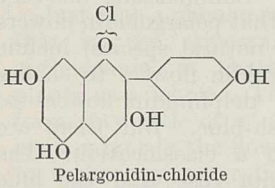
To anyone with a knowledge of differential equations, the few mathematical formulæ given will be readily understood. Other readers can omit the mathematics and yet gain quite an accurate knowledge of the telephone and of the transmission of electric signals through wires. The description of automatic telephony is good, and so also is the account of the great advances made in long-distance transmission. The purchaser of this book gets excellent value at a very small outlay.

Genetical and Biochemical Aspects of Anthocyan Pigments

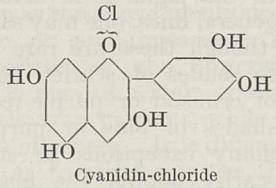
By Muriel Wheldale Onslow

SINCE the publications of Willstätter and his co-workers upon anthocyan pigments during the years 1913–16, other investigators have turned their attention to this field of research. Though the later work has scarcely introduced any fresh facts of fundamental importance about this group of pigments beyond those already presented by Willstätter himself, yet it has given us much additional knowledge as to the distribution of the individual pigments among the flowering plants, especially in connexion with colour varieties of various species. The object of this article is to indicate how the chemical identification of the pigments may be correlated with certain broad aspects of the genetics of flower colour and the metabolic reactions connected with formation of anthocyan pigments in the plant itself.

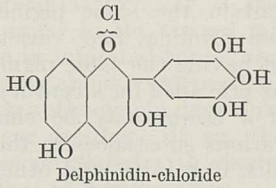
From Willstätter's investigations the fact emerges that there are three commonly distributed anthocyan pigments—pelargonidin, cyanidin, and delphinidin :



Pelargonidin-chloride



Cyanidin-chloride



Delphinidin-chloride

Cyanidin and, especially, delphinidin appear also, according to Willstätter, in various plants as methyl ethers, certain hydroxyl groups being replaced by methoxyl groups. The positions, however, of the methoxyl groups were not defined precisely. Moreover, though the sugars of the glycosidal pigments were identified, the points of attachment of the sugar groups were not definitely ascertained.

The more recent investigations [1] include those of Karrer in Zurich and Robinson in Great Britain. Karrer and his co-workers have determined the positions of the methoxyl groups in such pigments as are methylated ; also to some extent those of the sugars. Robinson and his co-workers have synthesised a number of benzopyrylium compounds, some of which have been identical with the natural pigments, and thus they have confirmed certain of Willstätter's conclusions. They have defined in many cases the position of the sugars and have synthesised some naturally occurring glucosides. Moreover, by elaboration of tests, they have made it possible to identify with relative ease various known anthocyan pigments in any given material.

For the purposes of this article, the presence of methoxyl groups and the kind and the position of the sugars are of subsidiary importance. The points at issue are concerned chiefly with the occurrence of the three main pigments.

Let us turn first to genetical problems. In the majority of horticultural plants which have been long under cultivation it is difficult to determine which species have been concerned in their origin. In a few cases, such as the sweet pea, Chinese primula, and snapdragon, it is relatively simple.

In the snapdragon (*Antirrhinum majus*) the pigment of the magenta flowers is cyanidin, and there is no doubt that this is the pigment of the original, wild, magenta-flowered type. About thirty years ago the most important of recent ' breaks ' in *Antirrhinum* appeared—rose doré—a variety now catalogued under many names, such as coral, salmon pink, etc. Genetically, rose doré is hypostatic (recessive) to magenta, and there is a factorial difference. Though not yet isolated, there is no doubt that the flowers of rose doré contain pelargonidin. The stems, petioles, and leaves often develop pigment too ; in the original magenta type it is cyanidin, in the variety, pelargonidin. Here, then, we have the creation from a plant producing cyanidin of another which produces pelargonidin instead. Moreover, it should be realised that the power to produce one or the other pigment may be limited to the epidermal layer of the plant. In some horticultural types and varieties two or more pigments may be present together, though one usually predominates. Such complications are eliminated from the present discussion, especially as the segregation of pigments is usually complete.

Now a similar case to that of *Antirrhinum* has long been obvious from Willstätter's original results. He found the blue cornflower (*Centaurea Cyanus*) to contain cyanidin ; its pink variety, pelargonidin. Though the genetics of the cornflower may not have been demonstrated in a practical way, it is clear to a geneticist that there is a factorial difference between blue and pink, and that pink is hypostatic.

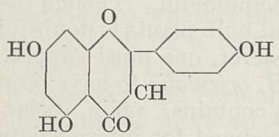
Another case is the blue flower of *Hyacinthus orientalis*, which contains delphinidin. Though the origin of many horticultural bulb plants is doubtful and has often been kept secret, one must suppose the colour of the original *H. orientalis* to have been blue. The pink variety contains, again, pelargonidin, and cyanidin is claimed for intermediate varieties. In Nature, too, a pink variety of the wild hyacinth (*Scilla nutans*) may be found occasionally. In the latter we have undoubtedly a phenomenon of variation alone. In blue *Campanula* delphinidin is reported, and we cannot doubt that the original type was blue. Again, a hypostatic pink variety exists and contains pelargonidin. Thus from a delphinidin type also have arisen varieties containing pelargonidin and, sometimes, cyanidin. This true red (pelargonidin)

group of the geneticist, hypostatic to cyanidin and delphinidin groups, is obviously present in a number of cultivated plants, such as the sweet-william, Chinese primula, stock, phlox, carnation, sweet pea, and *Clarkia*. To determine when it is a true sport (*Antirrhinum*, Chinese primula, and sweet pea) and when it may result from species crossing is, however, difficult.

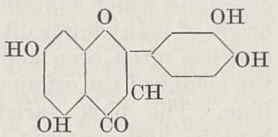
Now the interesting question arises whether, conversely, starting with pelargonidin, the power to form cyanidin may arise by variation; or, starting with cyanidin, the power to form delphinidin (all pigments again may be limited to the epidermis). Evidence in support of this supposition is difficult to acquire. The varieties of types under long-standing cultivation may show, among them, all three pigments, but since there is often uncertainty as to the outward appearance of the original type, so there is also uncertainty as to its pigmentation. Thus in the sweet pea, of which the original type resembled 'Purple Invincible', and in the Chinese primula, where the original type is known, we have not yet been informed as to their pigmentation. Such types may have contained either delphinidin or cyanidin, or both. In the aster, chrysanthemum, gladiolus, gloxinia, phlox, tulip, and others the problem is even more difficult. There is, however, a case where it would appear that a pelargonidin type has given rise to a cyanidin variety. Such is the garden nasturtium (*Tropæolum majus*). The orange-red type contains pelargonidin; purple-red varieties, which are hypostatic to the type, contain cyanidin.

Thus, summing up, we may say that loss of one series of factors leads to loss of power of oxidation in the phenyl ring, so that instead of delphinidin, cyanidin is formed, and instead of cyanidin, pelargonidin. There is little doubt, too, that the reverse effect takes place. This we may express as the loss of a series of factors which inhibit oxidation; in other words, loss of another series of factors leads to increased oxidation. So that, instead of pelargonidin, cyanidin may be formed, and instead of cyanidin, delphinidin.

The occurrence of a more oxidised pigment in a hypostatic variety is also to be found in the inheritance of flavone pigments in *Antirrhinum*. Two varieties, ivory and yellow, exist, and of these ivory contains apigenin, yellow, luteolin:



Apigenin



Luteolin

There is a factorial difference between the varieties, and ivory, moreover, is epistatic (dominant) to yellow.

Now the question arises as to what may be the significance of the facts so far quoted. I have already pointed out [2] that evidence in general indicates the origin of anthocyan pigments from condensation of residues of amino-acids after deamination.

There are three classes of aromatic compounds which may be synthesised from such residues, the flavone pigments,* the anthocyan pigments, and the tannins. Flavone pigments are universally distributed in the tissues under all conditions. Hence it is likely that they are products of de-amination and condensation under the usual conditions of growth and development. Anthocyan pigments are only formed under special conditions. Finally, the tannins only arise in a certain type of plant.

Upon the precise reactions of condensation leading to the formation of anthocyan pigments it is idle to speculate. The phenyl ring, we would assume, has its origin from tyrosine or phenylalanine. The phloroglucinol ring, possibly, from short-chained residues of aliphatic amino-acids; or again, possibly, from hexose. By oxidation, either by enzymes or chemical agents, hydroxyl groups are readily introduced into the phenyl ring in a position *ortho* to that of an existing group. Clearly, the occurrence and segregation of pelargonidin, cyanidin, and delphinidin is a matter of loss or gain of power of oxidation or reduction.

It is obvious from the foregoing that the wide range of coloration in flowers is to some extent due to the pigment involved. Summarising on very general lines, one may say that pelargonidin flowers (though these are rare in natural species) incline to shades of scarlet; cyanidin flowers to shades of crimson or purple-red; delphinidin flowers to shades of blue or purplish-blue. But there are many exceptions to such a classification. The scarlet poppy, the magenta rose, and the blue cornflower contain the same pigment, cyanidin. In the Chinese primula, two varieties, blue and magenta, exist having the same pigment.

The idea has prevailed for a century or more that the colour of a flower may be changed by the presence of various substances in the petals, such as acids, alkalis, iron salts, and other compounds. Willstätter showed that the blue colour of the cornflower is due to a potassium salt of cyanin. He also constantly emphasised his view that the colour of the flower or fruit may be modified by accompanying substances in the tissues. Recently, Robinson [3] has brought forward the idea of the existence of co-pigments in many cases, that is, a variety of substances occurring in the plant which, entering into loose combination with the anthocyan pigments, modify their colour. Such a substance may represent a factorial difference between varieties.

So much for variation in colour. A suggestion can also be made here in connexion with the cause of albinism. In *Antirrhinum* there are two forms of albino in regard to anthocyan pigments, namely, ivory (including the hypostatic yellow) and white. The ivory contains flavone pigment; the white has none. Ivory and white (of correct constitution) crossed together will produce the magenta type. That is, ability to form flavone pigment is one essential for anthocyanin production; the other is a factor borne by white. Such white-flowered plants are always stunted and poorly developed.

* The expression flavone pigment is collective and includes both flavone and flavonol.

They contain no flavone pigment, and hence can never form anthocyan pigment; though not necessarily derived from the yellow pigment, anthocyanin production depends on its presence.

It is reasonable to suggest that some aromatic component of the protein is entirely absent from the white-flowered plants. Hence neither anthocyan nor flavone pigment can be formed. A different cause for albinism must be postulated for the ivory variety, though there is no indication at present as to what this may be. Two kinds of albino, containing between them the elements essential for the production of anthocyan pigment, occur in the sweet pea and many other plants, but in these cases they are usually indistinguishable to the eye.

There is yet another form of variation among cultivated plants of rather a different nature from those we have already considered. In this the type has flowers, either free from anthocyan pigment or only slightly tinged, whereas the variety is fully coloured. That is, loss of a factor gives rise to a fully pigmented, hypostatic variety. The origin of the red variety of the sunflower (*Helianthus annuus*) from the yellow type affords an example; so also does the purple-leaved (copper) beech.

Just such a phenomenon as the above mentioned, that is, the appearance or non-appearance of anthocyanin, is characteristic of the flowering plants as a whole. The flowers of certain species form very little or no anthocyan pigment, while it is abundant in the flowers of others. It is difficult to make any suggestion as to what may be the chemical interpretation. It is conceivable that presence of sugar in the tissues may prevent the de-amination in inhibited types; or that excess of sugar may bring about condensation, as is probably the case when anthocyanin develops as the result of artificial sugar feeding. If so, then the factors concerned are correlated with some metabolic cycle other than that of pigmentation.

Before we leave the above variation among species one more point may be made, namely, the resemblance of the phenomenon to the distribution of autumnal anthocyan pigment in leaves, for the latter also is present in some species and absent from others. In fact, the autumnal coloration of leaves may be regarded as quite analogous to the pigmentation of petals. In each case the organ is senescent; it has ceased to assimilate and is gradually becoming detached from the parent plant. Desiccation is enhanced in the petal by the unprotected condition of the tissues against loss of water; in the autumnal leaf by the decreased water absorption from the soil owing to low temperature. An autumnal leaf developing anthocyan pigment can be regarded as a petal of very coarse texture. When anthocyan pigments are not developed it is yellow, as is also a petal which owes its colour to plastid pigment and has not the power to form anthocyan pigment.

Finally, some additional points of interest are connected with a consideration of the relationship of the particular anthocyan pigment formed in a plant to the accompanying flavone pigments and other aromatic compounds in the same plant. If we ascertain the relative frequency of occurrence of cyanidin and delphinidin among the plants investigated, we find the values to be approximately as follows:

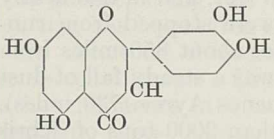
	Plants containing cyanidin.	Plants containing delphinidin.
Where isolation of pigment has been achieved	12	12
Where pigment is identified by reactions only .	61	60

Thus plants appear to form an anthocyan pigment having the three hydroxyl groups characteristic of gallic acid as frequently as one with the dihydroxy grouping characteristic of catechol.

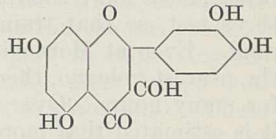
Now an outstanding fact of importance in connexion with aromatic compounds in the flowering plants is the distribution, in about 63 per cent of the natural orders, of the catechol oxidase system involving the presence of substances containing the dihydroxy grouping of catechol. From the remaining plants catechol derivatives are absent, pyrogallol compounds being frequently formed instead.

For all cases available I have made a record of the type of anthocyanin formed and the presence or absence of the catechol oxidase in the same plant. It is clear from the outset that the presence of the latter cannot always be associated with formation of cyanidin and its absence with formation of delphinidin, since the frequency of occurrence of cyanidin to that of delphinidin is 1:1, while that of oxidase to non-oxidase plants is almost 2:1. Such a conclusion is also apparent on analysis of the cases of species producing delphinidin; instead of being universally without oxidase, some contain oxidase, while others are non-oxidase plants. Hence on broad lines there is apparently no indication that plants producing catechol compounds always produce cyanidin.

Nor can any consistent relationship be detected between the anthocyan and flavone pigments of individual plants. Thus, for example, both flavone and flavonol pigments occur in plants:



Flavone (Luteolin)



Flavonol (Quercetin)

But all natural anthocyan pigments, on the simple reduction relationship, are related to flavonols, none to flavones.

In *Rosa gallica* and the wallflower there is a certain symmetry in the relationship of flavone to anthocyan pigment, the former being quercetin, the latter cyanidin; yet in other cases, such as *Delphinium* (kæmpferol, delphinidin), *Viola* (quercetin, delphinidin), and *Antirrhinum*, there is no such connexion.

In varieties of *Antirrhinum* the four pigments, cyanidin, pelargonidin, apigenin, and luteolin, are formed. But there is no correlation between their presence in the epidermis. Cyanidin or pelargonidin can be found either with apigenin or luteolin.

General considerations would suggest that possibly in the flower flavone pigments result from de-amination connected with growth and development; anthocyan pigments with de-amination connected with senescence.

[1] The investigations of Karrer and his co-workers are published in *Helv. Chim. Acta*; those of Robinson and his co-workers in *J. Chem. Soc.* and *Biochem. J.* Details of the data on genetics can be found in the *J. Genetics* and Onslow's "Anthocyanin Pigments of Plants".
[2] NATURE, **128**, 373, Aug. 29, 1931.
[3] *Biochem. J.*, p. 1687, 1931.

The Eruptions in the Andes

By Dr. CHARLES DAVISON

EARLY in the morning of April 10, eruptions began in several volcanoes of the southern Andes, most of which were supposed to be dormant or but rarely in action. The volcanoes affected, from north to south, are Tupungato, Overo, Tinguiririca, Peteroa, Descabezado, Las Yeguas, and Quizapu. Their heights diminish southwards, from 21,810 ft. for Tupungato to 11,342 ft. for Las Yeguas. All of them were in action simultaneously, though the distance that separates the extreme mountains is about 200 miles.

The principal feature of the eruptions is the great amount of the solid materials ejected. Loud explosions were heard at Santiago on the west side, and throughout the department of San Rafael on the east side, one hundred miles or more from the nearest volcano. But they were evidently not to be compared with those during the eruption of Krakatau in 1883, the sounds of which were heard at several places more than 2000 miles from the island, and at one place 2968 miles distant. Some observers in an aeroplane crossed the great crater of Las Yeguas (apparently on April 12). Every half-minute, loud explosions occurred within it, and blocks weighing many tons were thrown upwards more than 200 ft. These, it was said, gave the impression of being pulverised in mid-air.

During the three days of activity—the eruptions had almost ceased on April 13—all the towns near the volcanic zone were in a state of semi-darkness owing to the steady fall of fine dust and ashes. On the west side, the country from Santiago to Talca was covered with a layer of whitish dust, in places more than two inches deep. On the east side, the fall was much heavier. In the department of San Rafael, the layer of dust was a foot in depth, in other places more than two feet, and in one nearly three feet, so that trains were stopped from running. Even at Montevideo, about 850 miles from the nearest volcano, there was a steady fall of dust for many hours. Over Buenos Ayres (730 miles), it is estimated that more than 3000 tons of debris have fallen. The whole country there is coated with grey dust, so that cattle have to be fed with hay and artificial foods. Even if the average thickness of the dust over the whole area of deposition were no more than one-tenth of an inch, the total volume of the fallen dust would be about five cubic miles.

Several villages in the province of Mendoza were shaken by earthquakes, the stronger, no doubt, among many hundreds felt in the neighbourhood of the volcanoes. The shocks that accompany a volcanic eruption, though sometimes destructive within a small area, are seldom felt more than a few miles from their origins. Occasionally, as in Hawaii in 1868 and Sakura-jima in 1914, a tectonic earthquake strong enough to be registered all over the world may occur in the immediate neighbourhood of the volcano, but such disturbances are rare.

About one hundred years ago, on Feb. 20, 1835, an earthquake of somewhat similar type overthrew Concepcion, and with it a long stretch of the Chilean coast was uplifted, in one place by 10 ft. One month before this, as Darwin describes in his great memoir, "On the Connexion of Certain Volcanic Phenomena in South America . . .",* eruptions occurred in three volcanoes, Osorno, Aconcagua, and Coseguina, all beginning within six hours. The first two mountains are separated by 550 miles. The third is so distant from either that, as Darwin says, we cannot be too cautious in assuming that the phenomena were connected. At the moment of the Concepcion earthquake, the volcanoes of Osorno and Minchinmadom, 150 miles apart, burst into action. Some months later, on Nov. 11 of the same year, a severe earthquake occurred at Talcahuano, the port of Concepcion, and on the same day, Osorno and Corcovado, separated by 205 miles, burst into violent action.

To us at a distance, a question of great interest is whether the eruptions will be followed in due time by such wonderful sunsets as were observed all over the world for months after the Krakatau eruption of 1883. With regard to the amount of dust projected into the atmosphere, there can be little doubt. The question is whether enough could rise to heights of from eight to ten miles. As Capt. Cave remarks in a letter to the *Times* (April 14), the explosions seem to have been less violent than those of Krakatau. On the other hand, the height of Krakatau was 2623 feet, while the Andean volcanoes rise from two to three miles higher. On April 13, Capt. Ralph Wooten, the U.S. Air Attaché at Santiago de Chile, flew across Quizapu at an altitude of 14,000 ft. He estimated that the smoke column was then reaching 5000 ft. above the crater, but he considers that, on April 10, at the moment of greatest activity, it must have risen to a height of 30,000 ft. If this estimate is correct, or nearly so, it seems possible that, within a few months, sunset glows may be visible in Great Britain. The eruption of Krakatau, it will be remembered, occurred on Aug. 26–27. The sunset glows were not observed in England until the end of November.

* *Trans. Geol. Soc.*, vol. 5, pp. 601-631; 1840.

Obituary

MR. RICHARD SOUTH

MR. RICHARD SOUTH was born in July 1846 at Cochran Terrace, Marylebone, the site of which has long since been occupied by the old Great Central Railway. Little is known of his early life beyond the fact that he was educated at a private school at Reading. He died at his home in London on Easter Monday, March 28, after a short illness which terminated a long period of failing health.

The earliest contributions made by Mr. South to the entomological journals, in 1874–78, concerned his captures in the Mill Hill district, Hendon, which appears at that time to have been a very rich locality. Up to 1890 he contributed sixty notes and articles to the *Entomologist* and the *Entomologists' Monthly Magazine*, dealing with a great variety of subjects. The most important were his "Contributions to the History of the British Pterophori", published at intervals from 1881 until 1889, which added considerably to existing knowledge of the British plume-moths. He early developed a particular liking for the Microlepidoptera, and many of his notes concern this large group, especially the Tortricidæ; others are faunistic, for example, "The Lepidoptera of the Outer Hebrides, Shetland and Orkneys" (*Entom.* pp. 25, 28, 98, etc.; 1888); some deal with migration, others with collecting results, variation, etc. His "Notes on the Genus *Lycœna*" (*Entom.*, pp. 1, 49, 73, 121; 1887), in which the variation of a number of species was described in detail, led him into an acrimonious discussion of the species-concept, upon which his views were somewhat unorthodox. This was not the only matter which brought him into conflict with other lepidopterists of this period, for a year or two earlier, in 1884, in co-operation with those responsible for the *Entomologist*, he produced a "Synonymic List of the British Lepidoptera". This was designed to act as a label and exchange list and to replace Stainton's, which was long out of date but still the only one available. In the nomenclature used he did his best to apply the law of priority, which necessitated changing a very large number indeed of the names commonly employed—to the very great annoyance of every working lepidopterist of the day. Nevertheless, the list is in constant use even now.

About this time Mr. South's interest in the Microlepidoptera appears to have brought him into touch with John Henry Leech, to whose "British Pyralidæ" (1886) he contributed a number of notes. The association developed, only to be broken by the death of Leech in 1900. During this period he acted as a kind of curator and adviser to Leech, whose interest in the Far East eventually led to the publication of the "Butterflies of China, Japan and Korea" (1882–1894), in the production of which all the spade work was done by South. This was supplemented by the publication elsewhere of the descriptions of a very large number of eastern Heterocera new to science. In order to acquire an outlet for this work, Leech purchased the *Entomologist* in 1890 and appointed South to the editorship, which he retained until 1924. For many years after Leech's death, South continued to work at the Far Eastern fauna, chiefly in collaboration with Wileman, jointly with whom he published a number of papers.

In 1906 there appeared South's "British Butterflies", the first of the three handy little volumes of the Wayside and Woodland Series, which are now standard works on our British Lepidoptera, and have made his name familiar to amateur and professional alike. The volumes on the moths appeared in the following years (1907 and 1908). Although the appeal of these volumes was directed to the beginner, both text and illustrations were so excellent that they at once achieved an immense and deserved popularity, which is not likely to desert them for many years to come. Undoubtedly it is by these volumes and by his long and successful editorship of the *Entomologist* that Mr. South's name will be remembered amongst British lepidopterists long after those of us who had the pleasure of knowing him as a charming and courtly gentleman, an enthusiastic and painstaking entomologist, an excellent companion, and an honoured personal friend, have passed over where he has so lately gone.

MR. ST. GEORGE LANE FOX PITT

BY the recent death of Mr. St. George Lane Fox Pitt at his residence in South Eaton Place, at the age of seventy-five years, we lose one of the few remaining pioneers of electric lighting. He was the second son of Lieut.-General A. H. Lane Fox Pitt-Rivers, a distinguished anthropologist and archæologist, who presented his collections to the University of Oxford. In his early days, Lane Fox Pitt (his father took the surnames of Pitt-Rivers for himself and that of Pitt for his family) devoted himself to scientific research and mechanical invention. In 1878 he took out a patent for the method of running incandescent lamps in parallel. This patent, being one of the earliest in electric lighting, has been often quoted in the law courts.

He also took a leading part in improving incandescent lamps. The early glow lamps had carbon filaments in a vacuous glass bulb. These filaments were connected with the mains by 'leading-in' wires passing through the glass. These leading-in wires were made of platinum, which has the same thermal coefficient of expansion as glass. Great difficulty was experienced in connecting the filaments and the platinum wires. The connexion was at first a simple mechanical one, the filaments being merely clamped to the wires. This joint, however, was not satisfactory, as it often worked loose. One of the earliest methods Lane Fox Pitt employed to get over this difficulty was to use a hollow carbon tube into which the platinum wire was inserted.

In 1883, Lane Fox Pitt took out an important patent for altering the pressure of electric supply by means of a motor dynamo. This was one of the earliest types of transformer. He was also one of the first to advocate a public supply of electricity from central stations.

Lane Fox Pitt was one of the early active workers in the Society for Psychical Research, and wrote several books on science, philosophy, education, and social problems. He contested three elections in the Liberal interest, but without success. He married, in 1899, Lady Edith Douglas, daughter of the eighth Marquess of Queensberry.

WE regret to announce the following deaths:

Prof. W. R. Dron, Dixon professor of mining in the University of Glasgow since 1923, on April 16, aged sixty-three years.

Sir Patrick Geddes, formerly professor of sociology and civics in the University of Bombay and of botany at University College, Dundee, who was well known for his work for education and the study of sociology, aged seventy-eight years.

Dr. Alfred Hay, sometime professor of electrotechnology, Royal Indian Engineering College, Coopers Hill, and afterwards at the Indian Institute of Science, Bangalore, on April 13, aged sixty-six years.

Prof. G. M. Robertson, professor of psychiatry in the University of Edinburgh, and physician superintendent of the Royal Edinburgh Hospital for Mental and Nervous Disorders, on March 28, aged sixty-eight years.

Mr. Eustace Short, of the firm of Short Brothers, of Rochester, who was a pioneer in the design and construction of aeroplanes, on April 8, aged sixty-two years.

Prof. A. L. Urquhart, O.B.E., professor of pathology at the University of Cairo, on March 28.

News and Views

In Honour of Darwin

ON April 19, 1882, science sustained an irreparable loss by the death of Charles Darwin in his seventy-fourth year. On April 26 of that year his mortal remains were borne on the shoulders of his comrades to his last resting-place at Westminster Abbey, where they were laid close beside the graves of Sir John Herschel and Sir Isaac Newton. At the end of last year we commemorated the centenary of the start of Darwin's famous voyage in the *Beagle*; three years after his return he married, and in 1842 settled at Downe, Kent. It is no exaggeration to say that the work which emanated from that quiet English home during the succeeding forty years proved more effectual than any other in making the nineteenth century illustrious. The general facts upon which the principle of evolution by natural selection is based —the struggle for existence, survival of the fittest, and heredity—were all well known before Darwin's work. His claim to everlasting memory rests upon the many years of devoted labour whereby he tested the idea in all conceivable ways, amassing facts from every department of science, balancing evidence with the soundest judgment, and at last astonishing the world as with a revelation by publishing the completed theory of evolution by natural selection. Of very few men in the history of our race can it be said that they not only enlarged science but also changed it, not only added facts to the growing structure of new knowledge but also profoundly modified the basal conceptions upon which the whole structure rested: and of no one can this be said more truly than of Charles Darwin. It is a striking tribute to his memory that April 19 was declared a public holiday in the U.S.S.R. in honour of the author of the "Origin of Species".

Research Scholarships at the Royal College of Surgeons

AT a meeting of the Council of the Royal College of Surgeons of England on April 14, the president of the College, Lord Moynihan, announced an important benefaction from the trustees of the late Viscount Leverhulme. In presenting £1000 to provide "Leverhulme Scholarships" in surgical research, the trustees expressed the hope of being in a position to make a similar donation from year to year. The gift thus announced permits the Council of the College to go forward with an ambitious scheme of experimental research made possible by the munificence of Sir Buckston Browne, who a year ago gave £100,000 to build, equip, and endow a Research Farm at Downe, Kent. The Buckston Browne Research Farm, which is approaching completion, has been built on land which adjoins the home and grounds of Charles Darwin, which Sir Buckston acquired in 1928 and conveyed to the British Association, to be maintained as a memorial of Darwin and to be used for the advancement of science. The Leverhulme Scholarships are to be given to aid young men and women who are selected by the Council of the College to investigate surgical problems at the Buckston Browne Research Farm. Besides the laboratories at Downe, the Council has also equipped laboratories in the College, Lincoln's Inn Fields. These are now fully occupied. Lord Moynihan succeeded in obtaining temporary scholarships for men working in the College laboratories from Sir Bernhard Baron, Lord Beaverbrook, and the late Lord Melchett. The Council also sets aside annually from its own funds £500 to provide a College fellowship in surgical research.

Australian Observatories

FOR reasons of economy, the Australian Premiers' Conference has decided that there shall in future be only two national observatories instead of the existing five (Perth, Adelaide, Melbourne, Sydney, and Canberra). The total saving cannot be great, since the combined revenues of all five from governmental sources amount to less than £15,000 per annum: nevertheless, three are to be closed. The Premiers' Conference has asked Sir Thomas Lyle, Dr. A. C. D.

Rivett, and Prof. O. U. Vonwiller to advise it as to (1) the locations of the two to be retained; (2) the disposal of existing equipment; and (3) the probable initial cost, if any, of supplementing existing equipment at the two chosen observatories, the estimated cost of maintenance of these two, and the best means of disposing of outstanding work in connexion with the Astrographic Catalogue, to which work several of the States were committed many years ago. Maybe two institutions, if thoroughly well supported, will be more effective than five inadequately maintained; but many will view with misgiving a decision of this kind based mainly on a desire to save money.

Early Man in East Africa

The conclusions at which Dr. Leakey, Dr. H. Reck, and Mr. A. T. Hopwood arrived in their recent investigation of the Oldoway Beds in relation to the antiquity of the human skeleton found in these deposits would appear to have received confirmation by a find at Kanam, a small native village on Lake Victoria. Here Dr. Leakey, it is reported in a dispatch from Nairobi which appeared in the *Times* of April 19, has discovered a lower jaw of *Homo sapiens* in deposits containing pre-Chellean implements and teeth of the same species of *Deinotherium* as was discovered at Oldoway. At Kanam, however, the beds in which the find was made correspond with the oldest of the Oldoway beds, whereas Oldoway man was found in Bed No. 2. Other finds reported from early Pleistocene deposits at Kanam are fragments of three human skulls, apparently washed out from deposits containing Chellean tools and remains of *Elephas antiquus* and *Hipparion*. At first sight, this find on Lake Victoria carries *Homo sapiens* back a stage further than the Oldoway discovery; but a more detailed account of the deposits and the conditions of the find must be awaited before a certain conclusion is possible. The difficulty of accepting a skeleton found entire, as was Oldoway man, as contemporary with the alluvial deposits in which it occurs—a difficulty already pointed out (Nature, Feb. 27, p. 312)—is stressed in the current number of *L'Anthropologie* (t. 42, p. 214), where it is also suggested that the general conformation of the Oldoway skull points to an affinity with the modern Masai.

Liquid Carbon Dioxide in Ocean Water

In an interesting article (*C.R. Acad. Sci. Leningrad*, 1931), the eminent Russian geochemist, V. Vernadsky, directs attention to the fact that the conditions of temperature and pressure in the depths of oceans should necessitate the existence there of carbon dioxide in a stable liquid state. The chemical interrelations of water and liquid carbon dioxide are as yet unknown, but they must play an important part in the life of organisms at great depths. Their gaseous metabolism should differ greatly from that of organisms inhabiting the surface layers of water, where the expired carbon dioxide can exist as a gas. It is known that the lower limit of plankton is about 200 metres from the surface, while sunrays penetrate very much deeper, and photo-synthesis is theoretically possible for red algæ down to 400-500 metres. They do not, however, occur below 200 metres, which means that the limit of their distribution is not governed by the lack of active light rays, but probably coincides with the zone where the gaseous state of carbon dioxide becomes unstable and the liquid state appears. Again, the conditions of gaseous metabolism of numerous organisms in the mud at the bottom of the oceans should be highly peculiar, the gases present there constituting an atmosphere very different from that in the mud of shallow waters. The interesting fact discovered more than a hundred years ago by Biot that the bladder of deep-sea fishes contains pure oxygen, which, according to later discoveries, is produced by special glands, has always remained a physiological puzzle, but it is possible that this is also connected with their life in the zone where only liquid carbon dioxide exists. It is legitimate to ask, for example, whether the oxygen in the bladder is not the result of decomposition of liquid carbon dioxide. All these considerations and examples serve to stress the necessity of organising systematic investigations on the distribution of gaseous and liquid carbon dioxide in different zones of oceans.

The Willis Navigating Machine

At a recent meeting of the Royal Astronomical Society, the capabilities of this ingenious instrument (aviation type), designed by Mr. E. Willis for the solution of spherical triangles, were demonstrated by Dr. L. J. Comrie, Superintendent, H.M. Nautical Almanac Office. Mechanically, the instrument is a combination of an alt-azimuth and equatorial with five graduated circles corresponding to altitude, azimuth, latitude, declination, and hour angle. The principal problem in nautical astronomy is the calculation of the altitude and azimuth of a heavenly body from given values of the latitude, declination, and hour angle. These quantities are set on the corresponding circles and the machine at once gives the appropriate altitude and azimuth, which can then be used, in conjunction with the altitude from a sextant observation, to give the position line on the chart. This is only one of the many problems that the instrument can solve. In the type of instrument designed for aeronautical navigation, the circles read to five minutes of arc, which is sufficiently accurate in practice, being of the same order of accuracy as readings made with a bubble-sextant. The instrument designed for marine purposes is larger and more accurate; in this type the graduated circles read to one minute of arc. In æronautical navigation, the quick reduction of observations is an essential desideratum, and the Willis machine gives complete satisfaction in this respect. The instruments are manufactured by Messrs. Heath and Co., New Eltham, London, S.E.9.

Insulators for Switchgear and Busbars

At present there is a great demand for insulators for high voltage outdoor isolating switchgear. With a pressure of 132,000 volts and a high mechanical stress, the greatest care has to be used in their design, as any breakdown in the continuity of supply of a

large amount of electric power may disorganise many factories. In the usual design of high pressure insulators, cement is used inside the porcelain to join the shells and the metal parts together. Any expansion of the cement imposes bursting stresses on the porcelain, which often cracks. Some manufacturers, with this danger in view, sacrifice some of the mechanical strength of the joint by inserting elastic layers of bitumastic paint and, in addition, dilute the cement with sand to reduce the percentage expansion. Continental engineers have recently been using insulators in which internal cement layers have been entirely eliminated. They consist of porcelain cylinders carrying suitable projections called rain-sheds and containing no cement layers. The elasticity of the flanges takes up the expansion of the cement. This cylindrical construction has been developed in Great Britain by Messrs. Steatite and Porcelain Products, Ltd., who export them abroad. They now supply 132 kv. cylindrical type switchgear insulators for the substations of the latest section of the British grid. The disadvantage of the wide base customary with this type of insulator has been overcome by the introduction of an ingenious series of flanged castings, so made that all the standard methods of fixing now in use can be applied to the cylindrical insulators. They are so designed that the greatest possible amount of surface is exposed to natural cleaning. The use of these new insulators on the grid will, during the next few years, give an opportunity of comparing them with the older type under working conditions. Their increasing use on lower voltages should help towards the electrician's ideal of complete continuity of service.

Boiler Plant in Power Stations

To the electrical engineer a knowledge of the thermal efficiency, operating costs, and trustworthiness of the boiler plant in his power station is almost as important as a knowledge of his electrical machines. J. Bruce read a lengthy paper on this subject on March 10 to the Institution of Electrical Engineers. He had, however, to omit the discussion of flue gas, dust, and sulphurous fume extraction, as the Chimney Emissions Committee has not yet reported. He pointed out that a study of present-day American conditions leads to the general conclusion that the best American generating stations have a higher thermal efficiency than those representative of the best average British practice. A number of American generating stations produce a kilowatt hour for a heat expenditure of less than 14,000 B.Th.U. This is due to better boiler plant and to the higher grade of employee used in operating it. The Detroit Edison Company, for example, has a boiler-house efficiency of 87 per cent. In the United States, when a station uses high steam pressure, it either uses a pressure of about 600 lb. per square inch or one of about 1300 lb. per square inch. At the present time, there are 15 boiler units operating successfully and with no serious troubles in the neighbourhood of the higher pressure. Large boiler units capable of evaporating one million pounds of water per hour are being successfully operated. The capital cost of the boiler plant required increases rapidly with the pressure when it is above 600 lb. per square inch. Consequently, when coal is cheap the interest on the increased capital cost may more than offset the gain in the heat efficiency. America has the advantage over Great Britain that combustion equipment can be developed for a particular quality of coal owing to the geological characteristics of the coal being uniform over wide areas. British practice, although not obtaining such excellent thermal results, has yet made good progress of recent years.

Manufacture of Electric Lamps

ONE of the exhibits at the Faraday Centenary Exhibition last September which attracted much attention was that showing some of the operations in the manufacture of electric lamps. Only a few of the operations could be demonstrated, but much further information on the subject is contained in an article on "The Mass Production of Electric Incandescent Lamps" in *Engineering* for March 25. The article contains a description of the new Wembley Lamp Factory of the General Electric Co., Ltd., which has a capacity of 25,000,000 lamps a year. All the machines used are illustrated, and many interesting facts are given about the manufacture of the components of a lamp. The tungsten for the filament is obtained from the ore scheelite. It is first prepared in the form of powder, which is subjected to very great pressure and then treated in an atmosphere of hydrogen, first at about 1200° C., and then at about 3000° C. Sixty drawings are required to reduce the original 1 mm. rod to a filament 0·015 mm. in diameter, and a tungsten bar $\frac{1}{4}$ in. square and 10 in. long can be drawn into 15 miles of filament. The leading-in wires, which used to be of platinum, are now of copper-covered nickel-steel. The important operation of exhausting the lamps and then filling them with gas is done on capstan machines, each holding twenty-four lamps. Vacuum pumps reduce the pressure in them to a few thousandths of a millimetre of mercury, heat from an oven drives off moisture and adsorbed gas, and, while still hot, the lamps are filled with a mixture of nitrogen and argon, the internal pressure when cold being about two-thirds of an atmosphere.

The World's Natural History Societies

THE diffusion of scientific interests in the world, as indicated by the numbers and distribution of natural history societies, has been studied by Enrique Sparn (*Bol. Acad. Nac. Ciénc. Buenos Aires*, vol. 31, p. 171; 1931). Confining the inquiry to the larger societies, with a membership of 500 or more, the author finds that the world total amounts to 116 societies, of which 52 are devoted to natural history in general, 34 to zoology, 14 to botany, and 16 to geology. From a geographical point of view, natural history interests would appear to be tolerably restricted, for when we have mentioned 83 European societies with a total membership of 132,182 individuals, and 30 American societies with a membership of 160,947, there remain only 2 societies in Asia with a membership of 1938,

and one in Australia with a membership of 550. In this short note it is impossible to analyse all the naturalist sciences, but since zoology is by far the most populous, it may be taken as illustrating the general trend. Of the 34 great zoological societies in the world, 13 concern themselves with zoology in general (40,178 members), the others are specialist: 10 societies of entomology, with 10,165 members; 7 of ornithology, 10,672; 2 of mammalogy, 1775; one of ichthyology, 650; and one of ecology, 600.

The distribution of the zoological societies gives a glimpse of the Nature-loving character of nations. The United States possesses 12 zoological societies (15,299), Great Britain 7 (19,163), Germany 5 (6110), Holland 2 (7640), France 2 (2400), one each in Belgium, Canada, Hungary, Austria, Australia, and Japan, with membership varying from 10,415 in Belgium to 538 in Japan. The Belgian Société royale de Zoologie d'Anvers is the largest of zoological societies, its 10,415 members indicating perhaps the standard of the simple acquirements which admission demands; next on the list in magnitude are two well-known British institutions—the Zoological Society of London (8200) and the Royal Society for the Protection of Birds (4500). It is curious that zoological societies as things apart did not come into existence until the second quarter of the nineteenth century: Zoological Society of London, 1826; Royal Zoological Society of Ireland, 1832; Entomological Society of France, 1832; Entomological Society of London, 1833; Zoological Society of Amsterdam, 1838; and so on. Four societies of general natural science hail from the eighteenth century—the Society of Natural Sciences of Danzig, 1743; the Society of Natural Sciences of Zurich, 1746; the Linnean Society of London, 1785; and the Society of Natural History of Hanover, 1797. In all, it would appear that at least 295,617 individuals in the world have an interest, more than fleeting, in the natural sciences.

Leonhard Stejneger, Antiquarian and Naturalist

It is fitting that the autumn number (No. 3; 1931) of *Copeia*, a journal of cold-blooded vertebrates published by the American Society of Ichthyologists and Herpetologists, should have appeared as a special tribute to Leonhard Stejneger and his work. For Stejneger is to American cold-blooded vertebrates what G. A. Boulenger is on this side of the Atlantic. Endowed with great personal charm and a willingness to share his profound knowledge, to which the writer of this note has more than once been indebted, Stejneger is a man in whom great diversity of interests and talents has been combined. As Thomas Barbour in a tribute to his friend says, "Being an antiquarian, a classicist, a rarely accomplished linguist, and a naturalist in the widest sense, he possessed a foundation on which with good health and great industry he has built a mighty structure of rarely excellent work". The anniversary number, with its many papers on reptiles, amphibians, and fishes, is a fitting monument to this native of Bergen and graduate of the University of Christiania, who since 1882 has been associated with the Smithsonian Institution and since 1911 has been its head curator of biology.

Reindeer Ranching in Northern Canada

Domestic reindeer were introduced into Alaska from Siberia at the end of the last century and have done so well there, according to Mr. M. A. Earle Kelly in an article in the *National Review* for February (p. 215), that the reindeer ranching industry in Alaska is expected to become more important than mining. Now, he says, the three-year trek of Canada's first herd, of 3000, is nearly at an end, as they will shortly arrive at the Mackenzie delta, there to furnish stock to be established across northern Canada in the interest of the Eskimo, hard-pressed by contact with civilisation, which has destroyed or driven away the animals on which he lived. It is hoped that he will become a reindeer rancher, and four families of the Lapps, so well known in this capacity, have already reached Kittigazuitt in the Mackenzie estuary, in company with Mr. A. E. Porsild, who, with his brother, has been arranging for the purchase and transport of the herd for the Canadian Government. Reindeer have done so exceedingly well in Alaska, which is now even supplying their meat for American markets, that there should be no obstacle to similar success in the contiguous Canadian tundra, which, it is estimated, could carry 12,000,000 of them, where ordinary domestic ungulates could not live.

The Cigarette Habit

At a meeting of the Society for the Study of Inebriety and Drug Addiction on April 12, a paper on the cigarette habit was read by Dr. J. D. Rolleston, who dealt with its history, economics, pharmacology, and clinical aspects. Cigarette smoking appears to have originated in South America, where it was reported by travellers and missionaries in the eighteenth century, and thence to have been introduced to Spain, where it was described by Casanova in a visit to Madrid in 1767. The cigarette was afterwards introduced into France and Italy, but it was not until after the Crimean war (1856), when French and English officers acquired it from their Turkish allies, that the cigarette habit became diffused over Europe. Germany, where the cigar was more popular, was among the last European countries to adopt the cigarette; it did not become firmly established in England until the 'eighties. There has been a great increase of cigarette smoking since the War, especially among women, in all European countries and the United States. Dr. Rolleston pointed out that the cigarette differs from other preparations of tobacco in its nicotine content being lower than that of the cigar or pipe, whereas the amount of carbon monoxide in cigarette smoke is comparatively high. Furfurol, which is usually absent in the smoke of the pipe and cigar and present in only very small amounts in that of the Turkish cigarette, is found in comparatively large quantities in the smoke of the cheaper kinds of Virginia cigarettes and is liable to give rise to symptoms of intoxication. Medical opinion is still divided as to the part played by tobacco in general and the cigarette in particular in the causation of

certain diseases, such as angina pectoris and cancer in various situations, and the risk of laryngeal involvement in smoking by tuberculous patients. General unanimity, however, seems to prevail as to the injurious effects of smoking by the young or by the subjects of cardiac neurosis or peptic ulcer.

Food Preservation by Refrigeration

THE publication, by the Australian Council for Scientific and Industrial Research, of a survey and scheme for research in refrigeration as applied to the preservation and transport of foodstuffs is a matter of importance at a time when attention is being focused on means of improving and extending export trade. The report has been prepared by Dr. J. R. Vickery, who is in charge of the newly created Section of Food Preservation. Information is particularly required as to the possibility of exporting beef in a chilled rather than frozen condition, and since there appears a considerable outlet in Great Britain for Australian bacon pigs, and good ham and bacon can be manufactured from frozen carcases, investigations are needed to determine the best methods of freezing, storing, and thawing them so that the curing process may be most successfully carried out. Fruit, particularly apples and pears, forms another large branch of Australia's export trade, but much loss is sustained annually through wastage during transport. Besides the need for more definite information as to the best type of storage conditions, knowledge is lacking as to where temperature and humidity are particularly important, and how far pre-picking factors such as orchard conditions and degree of maturity of the fruit, etc., may affect its subsequent storage life. The report concludes with recommendations for the establishment of two laboratories with attached cold storage facilities, at Brisbane and Melbourne, the former to study problems in meat export trade and in the transport of tropical fruits, and the latter to investigate the preservation and transport of non-tropical fruits.

Estimation of Food in a Bird's Stomach

THREE methods have been employed in estimating the quantity of food in a bird's stomach, in order to discover whether a bird is beneficial or harmful: the materials found may be weighed; they may be measured by volume; they may be counted. The weighing method is not practicable, because quantities are sometimes exceedingly small, and besides, relative weights of vegetable and insect matter convey no real information about the economic status of the bird. The second method, of estimating by volume beneficial insects and injurious insects, useful vegetation and useless vegetation, has been almost universally adopted, following the practice of the experts in the Bureau of the Biological Survey of the United States Department of Agriculture. A reaction from this method is noticeable in a monograph on the food-habits of the Californian brewer and red-winged blackbirds by Pablo S. Soriano (*California Fish and Game*, 1931, p. 361). Here percentage by volume has been used only in estimating the space occupied by vegetable food or animal food or pebbles in the stomach, since the presence of one limits the presence of the others. But, since the degree of injury or benefit that an animal does depends directly upon the total number of injurious organisms that it destroys, the numerical method, of actually counting the specimens, has been followed in taking the percentage of the different kinds of foods. So an old method, once universally used, but ousted by the volumetric method, returns to favour again.

Advancement of Science in Australasia

THE twenty-first meeting of the Australian and New Zealand Association for the Advancement of Science is to be held in Sydney, during the week commencing Aug. 17. The president is Mr. E. C. Andrews, Government Geologist, Sydney, and the president-elect Sir Hubert Murray, Lieutenant-Governor of Papua. According to the preliminary programme, the following presidents of sections have been appointed: Section A (Astronomy, Mathematics, and Physics), Prof. C. E. Weatherburn, University, Perth; Section B (Chemistry), Prof. L. S. Bagster, University, Brisbane; Section C (Geology), Prof. H. St. J. Summers, University, Melbourne; Section D (Zoology), Prof. G. E. Nicholls, University, Perth; Section F (Anthropology), Mr. E. W. P. Chinnery, Government Anthropologist, Rabaul, Mandated Territory of New Guinea; Section G (Economics, Statistics, and Social Science), Mr. E. C. Dyason, 92 Queen Street, Melbourne; Section H (Engineering and Architecture), Mr. J. R. Kemp, Main Roads Commission, Brisbane; Section I (Medical Science and National Health), Dr. R. W. Cilento, Director of Tropical Hygiene, Brisbane; Section K (Agriculture and Forestry), Prof. J. W. Paterson, University, Perth; Section L (Veterinary Science), Dr. W. A. Robertson, Director of the Division of Veterinary Hygiene, Department of Health, Canberra, F.C.T.; Section M (Botany), Dr. R. S. Rogers, 118 Hutt Street, Adelaide; Section N (Physiology and Experimental Biology), Dr. C. H. Kellaway, Director of the Walter and Eliza Hall Institute, Melbourne Hospital, Melbourne; Section P (Geography and Oceanography), Dr. P. Marshall, Department of Scientific and Industrial Research, Wellington, New Zealand. The honorary general secretary of the Association is Dr. A. B. Walkom, Science House, Sydney.

X-Ray Crystal Analysis and its Applications

THE discourse to be given by Sir William Bragg at the Royal Institution Conversazione on Friday evening, May 6, will be related to the various developments in pure and applied science which have depended on the use of the X-ray methods of analysing crystal structure. In order to supplement the discourse, which cannot refer to more than a few of the more important points, an exhibition is being arranged in the rooms of the Royal Institution which will demonstrate more fully the work that has been done. The contributors will be those who have carried on research work in this subject in various British labora-

tories, so that the result should be interesting and, so far as space allows, comprehensive. Members of scientific societies or senior students of universities and technical institutions, and others interested in this work, are invited to view the exhibits at the Royal Institution, 21 Albemarle Street, London, W.1, between 10 A.M. and 6 P.M. on Monday, May 9, or Tuesday, May 10. The Managers of the Royal Institution would be glad if such visitors would leave their names and addresses.

Announcements

LORD RUTHERFORD will open a discussion on "The Structure of Atomic Nuclei" at the Royal Society on April 28, at 4.30 P.M. It is hoped that the following will take part: Dr. J. Chadwick, Dr. C. D. Ellis, Prof. R. H. Fowler, Prof. J. C. McLennan, Prof. F. A. Lindemann, and Mr. N. F. Mott.

THE first Royal Society conversazione this year will be held in the rooms of the Society, Burlington House, on Wednesday, May 11.

AT the meeting of the London Mathematical Society on Thursday, May 19, at 5 P.M., at Burlington House, Prof. H. Levy will deliver a lecture on "A Numerical Study of Differential Equations". Members of other scientific societies who are interested are invited to attend.

SCIENCE Service announces that Dr. Oscar Rice, of Harvard University, has been awarded the Langmuir prize of one thousand dollars of the American Chemical Society for work on the application of modern theories of physics to chemical problems, including the application of quantum mechanics to reactions between gases, and of modern theories of statistics to the study of metals and electro-capillarity. The award is given to a chemist in North America, man or woman, less than thirty years of age, in recognition of outstanding research in pure chemistry.

HIS MAJESTY THE KING has approved the award of the Royal Medals for 1932 of the Royal Geographical Society as follows: *Founder's Medal* to Mr. H. G. Watkins, for his work in the arctic regions, especially as leader of the British Arctic Air Route Expedition; *Patron's Medal* to H.R.H. the Duke of Spoleto, for his work in the Himalaya as leader of the Karakoram Expedition of 1929. The Council of the Society has made the following awards: *Victoria Medal* to Prof. A. P. Coleman, of Toronto, for his contributions to the geography and geology of Canada; *Murchison Grant* to Dr. K. S. Sandford, secretary of the Commission of the International Geographical Union on Pliocene and Pleistocene Terraces, for his personal work in that investigation during the past six years; *Back Grant* to Mr. Hugh Clutterbuck, for his expedition to Akpatok Island; *Cuthbert Peek Grant* to Miss Gertrude Caton-Thompson, for her investigations in the historical geography of Lake Moeris; *Gill Memorial* to Dr. E. B. Worthington, for his studies of East African Lakes.

A PRELIMINARY programme has been issued of the forty-third Congress of the Royal Sanitary Institute, to be held at Brighton on July 9–16, under the presidency of Lord Leconfield. Among the subjects to be discussed are: prevention of measles mortality, vaccination, birth control, food and nutrition, illumination in industry, mental hygiene, aerobic and anaerobic organisms in sewage treatment, and teaching of hygiene and mothercraft in schools. Prof. C. E. A. Winslow, professor of public health at Yale University, will deliver the lecture to the Congress, and he will take as his subject "Current Tendencies in American Public Health". A Health Exhibition has been arranged in connexion with the Congress in the Dome and Corn Exchange. The Town Clerk and the Medical Officer of Health of Brighton are acting as the honorary local secretaries.

IN connexion with the tours in the U.S.S.R. referred to in NATURE of April 2, p. 503, it has been found that certain of them will clash with meetings of the British Medical Association and the International Physiological Congress at Rome. An additional tour has therefore been organised to leave London on June 18, returning about July 12. This party, however, can only be arranged if sufficient definite applications are received not later than May 20.

MESSRS. Dulau and Co., Ltd., 32 Old Bond Street, W.1, have just issued a catalogue (No. 198) of some 600 second-hand works at popular prices, dealing with the subjects of botany, entomology, ornithology, and general zoology.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A full-time woman assistant pathologist at the Elizabeth Garrett Anderson Hospital, Euston Road—The Secretary, Elizabeth Garrett Anderson Hospital, 144 Euston Road, N.W.1 (April 28). A full-time lecturer in mechanical engineering at the Heanor Mining and Technical Institute—The Director of Education, County Education Office, St. Mary's Gate, Derby (April 30). Two Imperial Chemical Industries' scholars at the Constantine Technical College, Middlesbrough—The Director of Education, Education Offices, Middlesbrough (April 30). A lecturer in geography at University College, Rangoon—The Secretary, Universities Bureau of the British Empire, 88A Gower Street, W.C.1 (April 30). An assistant lecturer in agricultural economics in the University of Leeds—The Registrar, University, Leeds (May 2). An assistant lecturer in chemistry (with subsidiary botany, or pharmacognosy, or pharmacy) at the Belfast Municipal College of Technology—The Principal, Municipal College of Technology, Belfast (May 3). An assistant lecturer in chemistry at the Liverpool Central Municipal Technical School—The Director of Education, Education Offices, 14 Sir Thomas Street, Liverpool (May 6). A woman principal of the Bingley Training College for Women—The Education Officer, County Hall, Wakefield, Yorks (May 9). A woman principal of the Municipal Training College for Women Teachers, Portsmouth—The Secretary for Higher Education, Municipal College, Portsmouth.

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.*]

Light and Diet as Factors in Relation to Sexual Periodicity

IN his recent communication regarding light as a factor in causing sexual periodicity in birds and mammals, Dr. F. H. A. Marshall [1] has directed attention to several examples of the induction of sexual activity in birds by prolonged daily light periods, and to the great rarity of animals not exposed to light variations at some time. Even nocturnal animals are subject to twilight. Not all have the same degree of susceptibility to light in this respect. He also cited conditions in tropical regions, such as the Cameroons, " where environmental conditions are similar throughout the year " and " native birds have no restricted breeding season but breed at any time ".

That this is true only in a very broad sense was shown by Bates,[2] who found that some native birds breed there at any time, others only in the dry seasons, twice a year (in May, June, and July, and in November, December, and January), others only through half the year. Sex glands of both sexes often remain in breeding condition and size throughout the year. This suggests that breeding may be controlled by some factor other than light periods in some or all of these birds, even though comparatively long light periods may keep the sex glands actively producing germ cells.

Moreau [3] pointed out that, in any district, each species of bird has a rather restricted breeding season of about three months, relatively constant for any locality, but differing in neighbouring localities. He also pointed out that length of day is constant throughout the year only on the equator. It varies 40 min. at 6° N. or S.; 70 min. at 10°; and 3 hr. at 23·5°. In this respect, therefore, the transition from equator to poles is gradual throughout, and differences are those of degree only. Light, in its relation to sexual periodism, is a world problem.

Moreau accepts Rowan's hypothesis [4] that longer periods of wakefulness or exercise induce sexual activity in many species in addition to juncos and crows; but finds it of doubtful value in the cases of long migrants, wintering beyond the equator, or on both sides of it. He is of the opinion that food is a controlling factor in breeding periodicity of tropical birds, the breeding seasons of which are seldom longer than three months. At Amani and Zanzibar, these seasons differ for species common to both districts. So the sexual activities of tropical birds are subject to seasonal cycles comparable with those of palæarctic birds. For him, this rules out photoperiodism for these birds, and makes climate and food supply more dominant factors in their sexual cycles. Lynes,[5] Vaughn,[6] Paget-Wilkes,[7] and others agree, and even suggest that rains and bush fires are related to the breeding cycles in Nyasaland.

Recent work by Bissonnette,[8] and Bissonnette and Wadlund,[9] on the modification of the sexual cycle of starlings in America, shows that testis activity is conditioned by daily period, intensity, and wavelength of light. The long wave red rays stimulate, and the shorter wave green rays inhibit germ cell activity. But, no matter how stimulating the light ration used, sexual regression sets in after a variable period of complete sperm formation. This period is shorter in animals brought to the climax quickly, and longer in those activated more slowly. An optimum wave-length, somewhere in the red, and an optimum intensity of light, below 185·6 foot candles of white light and nearer 29 foot candles intensity, are indicated. These results with starlings were obtained when birds were fed on a varied diet, rich in proteins, fats, and vitamins.

On the other hand, some unreported recent studies with starlings in Cambridge, using red light of a potency capable of inducing complete sperm formation in about twenty days on the rich diet used previously, indicate that, on a diet restricted to 'middlings' grain mash, the very stimulating red light is prevented from inducing testis activity, even in 22 days. This shows that, even when the daily light ration is adequate to induce sexual activity, the type of food may be a limiting factor and, under such conditions, control the appearance of seasonal activity. This may be the case with tropical birds, as described by Bates, Moreau, and others, and may account for the apparent correlation of diet with reproductive periodicity. Then, too, light intensity varies as between rainy and dry seasons.

Variations of susceptibility, of members of the same or of different species, to changes in light rations, would cause breeding activity to occur at somewhat different dates, even in the same locality, whether species are permanent residents or migrants.

In studies of mammals in this relation, by Bissonnette,[10] Baker and Ranson,[11] Marrian and Parkes,[12] and Moore and Samuels,[13] light ration and food have been found to influence reproductive activity. When either one of these two factors remains constant and adequate for activity, the resulting activity may be varied by changes in the other factor.

It becomes more evident that, while light ration plays a great part in conditioning the periodicity of sexual cycles in many birds and mammals, it is not the only factor operating. Seasonal changes in type or quantity of food must be reckoned with, in analysing the factors effective in any particular case.

We are still far from a general law in this connexion. But all will agree with Dr. Marshall in maintaining the wide application of this principle of photoperiodism in sexual cycles.

T. H. BISSONNETTE.

School of Agriculture,
Cambridge, March 30.

[1] Marshall, F. H. A., NATURE, **129**, 344, March 5, 1932.
[2] Bates, G. L., *Ibis* (9), **2**, 8, 558-570; 1908.
[3] Moreau, E. R., *Ibis* (13), **1**, 553-570; 1931.
[4] Rowan, Wm., *Proc. Boston Soc. Nat. Hist.*, **39**, 152-208; 1929.
[5] Lynes, H., *Ibis*, **1**, 757-797; 1925.
[6] Vaughn, J. H., *Ibis*, 577-608; 1929, and 1-48; 1930.
[7] Paget-Wilkes, A. H., *Ibis*, 690-748; 1928, and 475-490; 1931.
[8] Bissonnette, T. H., *Am. Jour. Anat.*, **45**, 289-305; 1930: *Jour. Exptl. Zool.*, **58**, 281-319; 1931 *a*: *Physiol. Zool.*, **4**, 542-574; 1931 *b*: *Science*, **74**, 18-19; 1932 *a*: *Physiol. Zool.*, **5**, 92-123; 1932 *b*.
[9] Bissonnette, T. H., and A. P. R. Wadlund, *Jour. Morph.*, **52**, 403-428; 1931.
[10] Bissonnette, T. H., in press.
[11] Baker, J. R., and R. M. Ranson, in press.
[12] Marrian, G. F., and A. S. Parkes, *Proc. Roy. Soc.*, B, **105**, 248-258; 1929.
[13] Moore, C. R., and L. T. Samuels, *Am. Jour. Physiol.*, **96**, 278-288; 1931.

Albertus Magnus as Chemist

THE article by Dr. Greenwood [1] seems to me to lay too little stress on the point that while Albertus Magnus certainly advanced botanical and zoological science by much valuable original observation, yet in the realm of chemistry he contented himself with repetition and interpretation of earlier writings. The opposite impression given by the article seems to be due to the fact that Dr. Greenwood regards " De Alchimia " as authentic. This book is, of course,

included in Jammy's collected edition of Albertus's works (an edition which is unfortunately not critical and often scientifically incomprehensible by reason of numerous textual mistakes), and in the still worse reprint of this edition by Borgnet. However, all Albertus's critics, from his first biographer, Petrus de Prussia, to Quétif, Sighart, and de Loë, down to Pangerl, have all definitely stated that he is not the author of this work; which completely cuts out all that has been repeatedly said about Albertus's personal experimental work.

In the genuine "De Mineralibus" Albertus does indeed refer to the composition of metals and to alchemistic questions, but only from a literary point of view, closely following Arabian writers; and he mentions occasional observations but never any personal tests really worthy of the name of chemical experiments. The phrase from "De Mineralibus", quoted by Dr. Greenwood, "I have tested alchemistic gold . . .", is not quite exactly translated thus; in the original it runs: "experiri *feci*, quod aurum alchimicum, quod ad me devenit, postquam 6 vel 7 ignes sustinuit, statim amplius ignitum consumitur et perditur, et ad faecem quasi revertitur" (my italics). He himself had, therefore, not even made the very simple experiment of testing gold by fire, but had *had* it done.

That in the expression "experiri feci" the word "experiri" means "make an experiment", can be proved by Albertus's usual mode of speech. Compare, for example, the phrase: "Hi autem qui in cupro multum operantur in nostris partibus, Parisiis videlicet et Coloniae et in aliis locis, in quibus fui et *vidi experiri*, convertunt cuprum in aurichalcum per pulverem lapidis qui calamina vocatur". ("De Mineralibus", 11, 2, 6.) Here there can be no doubt regarding the meaning of the word "experiri", so that the actual significance of "experiri feci" as: "I have had experiments performed" becomes clear. When, on the other hand, Albertus has himself made experiments or observations he uses the normal "expertus sum"; for example, "Talpa . . . vermibus pascitur, et *expertus sum* quod libenter pascitur bufonibus et ranis". ("De Animalibus", 22, 143.) Therefore the phrase quoted by Dr. Greenwood is in itself the best proof that Albertus was *not* an experimental chemist.

Perhaps it would not be superfluous here to add that in British and American literature about Albertus—for example, in the well-known works of L. Thorndike and E. J. Holmyard—"De Alchimia" is always referred to respectfully, obviously on account of its inclusion in the collected edition, in spite of its rejection by all competent scholars—though few go so far as Dr. Greenwood, who does not even mention any doubt as to its authenticity. It should be specially emphasised here that the one feeble claim hitherto made for the genuineness of "De Alchimia" has recently been quashed. In one of the earliest inventories of Albertus's authentic works, the so-called "Stams Catalogue", a book "De Alchimia" is actually listed. It can now, however, be shown, in agreement with Petrus de Prussia and the conjectures of Pangerl, that the writing thereby meant was none other than a part of the book "De Mineralibus", which had originally appeared separately; this section is by chance still preserved in a collective manuscript, in the middle of medical writings, as an independent "tractatus de metallis et alcimia".[2] (It is known of several other of Albertus's writings that parts of them appear in other manuscripts as independent books under their own titles.) Neither from its style nor contents can the much-later work "De Alchimia", included by Jammy and Borgnet in the collected edition, be ascribed to him; this was clearly recognised and affirmed by Hermann Kopp, in his studies of the history of chemistry, as well as by all expert Albertus scholars. In consequence, therefore, of the spuriousness of this book "De Alchimia", much that Dr. Greenwood quotes as Albertus's chemical knowledge must also be struck out; only the much smaller amount to be found in "De Mineralibus" can serve as a measure of it.

Albertus apparently never experimented chemically. As head of the German Dominican Order, having to inspect all its monasteries (then including those in Holland, Hungary, and Poland), and for a while as crusade-preacher, most of his life was spent in wandering on foot (according to the rules of his Order); he had therefore ample opportunities for making botanical and zoological observations, but not for chemical experiments. It is incompatible to think of this Nature-loving yet scholarly monk spending long attentive hours with crucible and furnace in a laboratory. Even the numerous thick quarto volumes (always quoted by his admirers as evidence of his scientific eminence, whereas their very prolixity—as now preserved, at least—actually diminishes their scientific value) could be cited as still further proof that all his spare time must have been very fully occupied in writing in his study, as his biographers tell us.

Besides the critically revised editions of Albertus's botanical and zoological works, which we owe to the labours of Ernst H. F. Meyer, O. Jessen, and H. Stadler, a further scholarly edition of "De Mineralibus" is much to be desired, free from the sense-destroying faults of the collected editions, which were edited by scientifically-illiterate people. The verdict upon Albertus would not, however, be thereby materially altered: in biological science he was an original worker of a high order, but, on the other hand, in chemistry a mere speculative philosopher, wholly dependent on the Arabs.

FRITZ PANETH.

Chemisches Institut der Universität,
Königsberg i. Pr.,
March 20.

[1] NATURE, **129**, 266; 1932.
[2] See F. Paneth, *Archiv für Geschichte der Mathematik, der Naturwissenschaften und der Technik*, **12**, 33 and 408; 1930.

Electrochemical Periodicities

IN the course of experiments on the anodic polarisation of platinum electrodes in dilute sulphuric acid solutions saturated with hydrogen, we have observed, at small current densities, some striking periodicities.

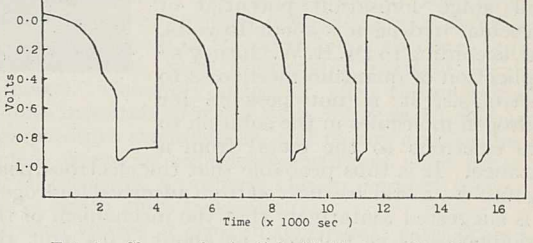


FIG. 1.—Change of potential with time; $c = 50 \times 10^{-7}$.

The change of potential difference with time in a typical experiment is shown in Fig. 1. In this case the electrode potential falls continuously with a marked break at $E_H = +0{\cdot}4$ volt, to about $+1{\cdot}0$ volt, and then begins to rise slowly. At $+0{\cdot}9$ volt it suddenly jumps back to its initial value. This process appears to repeat itself indefinitely. In one experiment, with a current density of 62×10^{-7} amp./cm.^{2},

we observed eighteen such periodicities in about 18,000 seconds, and the phenomenon showed no signs of coming to an end. With greater current densities the return to the initial value, which is near the reversible hydrogen potential, takes place at about + 0·5 volt, and only a limited number of periodicities is observed. Fig. 2 (IV) is an example, obtained with a current density of 150×10^{-7} amp./cm.^{2}. The number of peaks is indefinite and varies from experiment to experiment. At high current densities no periodicities

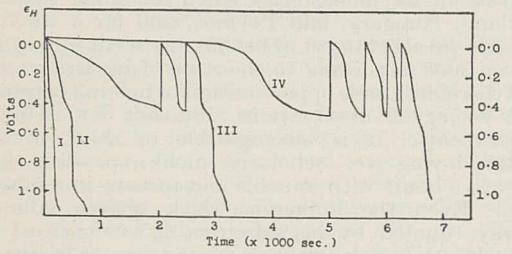


FIG. 2.—Change of potential with time; $c = 150 \times 10^{-7}$.

are observed, but we have photographic records showing small peaks with a period of 0·2 sec. using a current density of 3500×10^{-7} amp./cm.^{2}.

It is significant that these periodicities are never observed during the first anodic polarisation of the electrode. This is illustrated by curves I, II, and III (Fig. 2). After the first anodic polarisation (I) the current is stopped when the potential has reached about + 1·2 volt, and the potential rises to its original value without the passage of any current. On subsequent anodic polarisations, curves II and III were obtained. In these experiments the electrode was given a constant amount of cathodic polarisation prior to each anodic polarisation. We found later that this was not essential, and that the condition necessary for the appearance of the periodicities could be produced by anodic polarisations alone.

In these experiments, potentials at which oxygen can be liberated are never reached, since the reversible oxygen potential is + 1·2 volt and a considerable over-voltage is necessary even with a minute current density.[1] The transfer of electricity across the electrode boundary must therefore occur by some process other than the discharge of negative ions. The only substance which can give electrons to the electrode under these conditions thus appears to be hydrogen. The final stage ionisation potential of molecular hydrogen is about 15 volts, and, according to Dr. R. W. Gurney's [2] application of quantum mechanics to electrolysis, it is not possible for hydrogen molecules in the solution to give electrons to the metal from a distance. It is thus probable that the electrons passing into the metal are derived from adsorbed hydrogen. It is suggested tentatively that the mechanism of the periodicities is as follows: at about + 0·4 volt the first stage ionisation of adsorbed hydrogen molecules occurs, according to the equation

$$H_2 = H_2^+ + \epsilon \quad . \quad . \quad . \quad (1)$$

Since the dissociation energy of the H_2^+ ion (in the gaseous state) is only 2·6 electron-volts and the hydration energy of H^+ is of the order of 8ϵ-volts, it is probable that in contact with the solution H_2^+ is unstable and dissociates, the hydrogen ion becoming hydrated and the hydrogen atom passing into the electrode. There are now two processes whereby the transfer of electricity from the solution may occur, namely, by (1) and by the process

$$H(Pt) = H^+(aq.) + \epsilon(Pt) \quad . \quad . \quad (2)$$

It is suggested that, for some reason which is at present obscure but may possibly be connected with the mechanism of diffusion of hydrogen atoms into platinum, the rate of process (2) may suddenly increase to a value greater than that necessary for the passage of the constant current. The potential difference will then rise, until the rate of (2) is adjusted to the current passing. The subsequent slow fall marks the gradual depletion of hydrogen in the metal. Ultimately potentials are reached at which process (1) occurs and the sequence begins again.

We are examining the phenomenon in detail in the light of this hypothesis, and we intend to find if similar effects can be obtained with other metals.

J. A. V. BUTLER.
G. ARMSTRONG.

King's Buildings,
West Mains Road, Edinburgh,
March 9.

[1] Bowden, *Proc. Roy. Soc.*, A, **126**, 107; 1929.
[2] *Proc. Roy. Soc.*, A, **134**, 137; 1931.

Water-jet affected by Tobacco Smoke

A HOLLOW spindle-shaped water-jet (Fig. 1, *A*) may be produced by discharging the water through a cylindrical nozzle attached centrally to the bottom of a cylindrical vessel, in which the water is made to revolve by attaching a pair of inlet tubes tangentially to the top of the vessel. When a plate is placed horizontally at a proper distance below the nozzle and the rate of discharge suitably adjusted, a conical jet

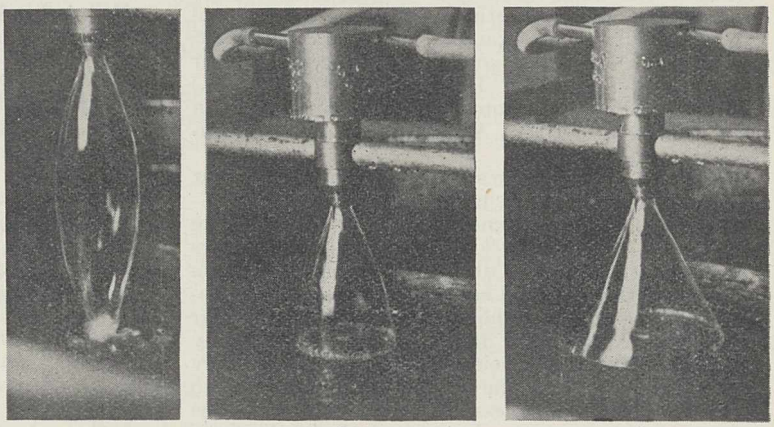


FIG. 1.

(Fig. 1, *B*) is formed, which tends to contract in diameter, if left undisturbed. The contracting cone expands and resumes its original size if it is disturbed and broken by any obstacle. If, again, a thin glass tube be inserted through the skirt of the cone and air be blown into the cone, the jet-cone becomes expanded, especially near its lower margin, such that the jet assumes a form like a trumpet. If a puff of tobacco smoke is blown gently towards the jet, the cone, previously assuming a form as in Fig. 1, *B*, is expanded suddenly into the form as shown in Fig. 1, *C*.

The gradual contraction is due to the decrease of pressure in the inside of the cone. The effect of

smoke may be explained by the decrease of the surface tension of water.

Detailed experiments were carried out by one of us (K. Itô) regarding the effects of the rate of discharge, as well as the size and shape of the nozzle, upon the form of the jets, and the results will be published later in the Report of the Aeronautical Research Institute.

TORAHIKO TERADA
SIN TANAKA
KYÔZI ITÔ.

Aeronautical Research Institute,
Imperial University, Tokyo.

Upper Air Temperatures and Humidities in the Indian Peninsula

SINCE October 1928, more or less regular ascents of sounding balloons have been carried out from Poona and Hyderabad (Deccan) with meteorographs of the Dines type manufactured at the Upper Air Observatory, Agra. The ascents at Hyderabad were made from

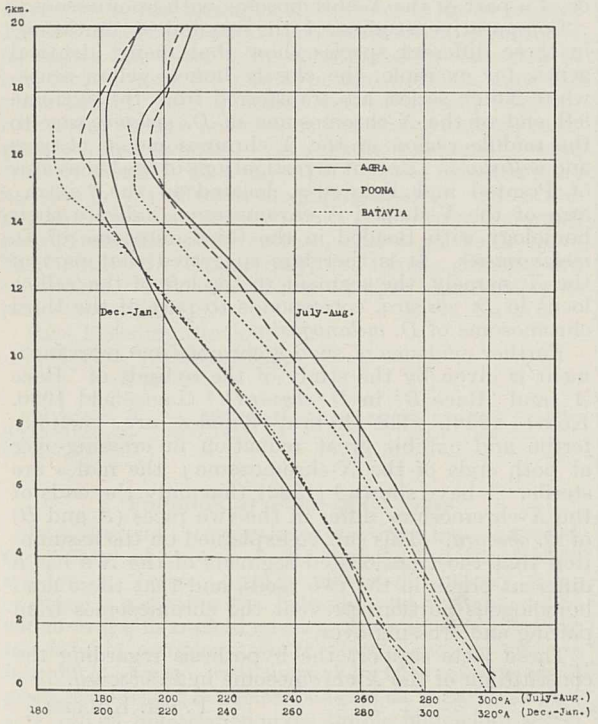


FIG. 1.—Upper air temperature over Agra, Poona, and Batavia.

the Nizamiah Observatory, Hyderabad, with the kind co-operation of its director. It may be of interest to summarise here some results of outstanding importance obtained as a result of these soundings.

(1) During the monsoon months, July and August, the atmosphere over the Deccan is invariably colder than that over Agra in northern India, up to a level of about 14 geodynamic kilometres—the maximum mean difference of temperature being 7° C. at a level of 10 gkm. Temperatures over Batavia in these months are lower still. The level of the tropopause in this season is about the same, or slightly lower, and its temperature higher in the Deccan than in northern India (Fig. 1). Considering the troposphere as a whole, the thermal equator over Indian longitudes lies over northern India at a latitude of about 25° N.

These results are specially interesting in view of the westerly to north-westerly movement of monsoon depressions. The normal upper winds are consistent with the temperature distribution.

During the months July-September, the relative humidity in the air over the Deccan generally shows a maximum (saturation) between 1·5 gkm. and 3·5 gkm., and is followed by a more or less rapid fall, extending over one or two kilometres, and at still higher levels by a rise. In about half the number of available records, the humidity falls off above 6-8 km., the fall being gradual. The decrease of humidity above the lower level of maximum humidity is sharper and larger during times of weak monsoon. It may be mentioned that the westerly winds of the monsoon give place to the easterlies of the inter-tropical circulation normally between 6 km. and 8 km.

(2) Conditions are markedly in contrast in the winter. In the period November-February, temperatures over northern India are lower than those over Poona up to 13 gkm., and above that level higher. Between 4 gkm. and 14 gkm., there is little difference between the temperatures over Batavia and Poona, but the tropopause is higher nearer the equator, and colder.

(3) The semi-permanent anticyclone in the upper air over the central parts of India during the months November-January shows itself in the temperatures over Poona as a well-marked region of small lapse-rate extending over 0·5-1 km., and starting at a level ranging from 2·5 km. to 3·5 km. The trajectories of air movement in the upper air show that the air below the inversion usually comes from the Punjab and northern Rajputana through east Central India and the Central Provinces; while above the inversion, the air supply is from a direction varying from north to west, and has, in general, a higher velocity. The air below the inversion is surface-heated continental air from higher latitudes, and has a high lapse-rate. As may be expected, there is a maximum of humidity at the top of the lower convective layer.

K. R. RAMANATHAN.
K. P. RAMAKRISHNAN.

Meteorological Office,
Poona 5, Jan. 29.

Errors in Thermal Measurements

IN some recent investigations on adsorption [1] it seems to have been established that erroneous conclusions have been reached on account of errors unsuspected by the experimenters and arising from the time lag of thermometric apparatus. Workers with experience in thermal measurements are well aware of the possibility of such errors, and in particular the extreme care which must be exercised in the use of platinum resistance thermometers, more particularly when these are wound on insulating supports and enclosed in tubes. The application of such thermometers requires not only extreme care in avoiding thermometric forces in the circuit, but also in making certain that the very appreciable thermal lag is eliminated. Generally speaking, such thermometers are quite unsuitable for use when fairly rapid changes of temperature are involved, and in any case are best avoided, except by experienced workers. For practically all purposes, a properly chosen mercury thermometer is much more trustworthy.

Another source of error in such work, fully investigated by Prof. R. A. Millikan and by myself many years ago, is the impossibility of making any kind of cooling or heating corrections with time in the case of fine metal wire thermometers suspended in a gas in the proximity of large masses of metal or other conductors. The large interference in the temperature measurements with such apparatus, owing to radiation and conduction, cannot be eliminated by any method of extrapolation, even when a very rapid galvanometer,

such as a string galvanometer, is used. It has also been well established that the temperature coefficient of fine platinum wires is abnormal, and may vary appreciably during experiments if there is any possibility of movement of the wire, so that it is very unsafe to attempt to make temperature measurements by the use of any formula supposed to express the variation of resistance of the wire with temperature. Another apparently unsuspected source of error is involved in the use of a gas of good thermal conductivity, such as hydrogen or helium, in the calibration of apparatus in which heat transfer is involved, and the use of this apparatus for gases such as oxygen or nitrogen, the thermal conductivities of which are much less than that of the gas used in the calibration experiments.

Much greater confidence could be felt in results if experimenters would bear these simple and well established facts in mind.

J. R. PARTINGTON.

East London College, University of London,
London, E.1.

[1] Garner and McKie, *Trans. Faraday Soc.*, **22**, 461; 1926. Bull, Hall, and Garner, *J. Chem. Soc.*, 837; 1931. H. S. Taylor, Kistiakowsky, and Flodsdorf, *J. Amer. Chem. Soc.*, **49**, 2200; 1927. H. S. Taylor and Kistiakowsky, *Z. physikal. Chem.*, **125**, 341; 1927. Schwab and Brennecke, *ibid.*, **16** B, 19; 1932.

Hydrogen Peroxide and the Kolbe Reaction

A "RESEARCH Item" in NATURE of March 19 (p. 442) has directed our attention to a paper by Matsuda,[1] in which it is shown that hydrogen peroxide is formed in the course of the anodic oxidation of acetate solutions. The amount of peroxide obtained is correlated with the simultaneous production of ethane by the Kolbe reaction. As a result of a comprehensive study of electrolytic oxidation reactions, now in progress, we have independently arrived at the conclusion that hydrogen peroxide plays a very important rôle in certain anodic processes, although our point of view concerning the origin and influence of the peroxide is fundamentally different from that of Matsuda. It is hoped very shortly to publish the results of some of the experiments on which our views are based.

S. GLASSTONE.
A. HICKLING.

Chemistry Department,
The University, Sheffield,
March 23.

[1] *Bull. Chem. Soc. Japan*, **7**, 18; 1932.

Constitution of the *X*-Chromosome in *Drosophila obscura*

THE recent discovery of *Px*, the allelomorph of the "Pointed" mutation in *Drosophila obscura*, *m*1, a sex-linked intensifier, and *m*2, an autosomal modifier, have enabled me to analyse the constitution and possible origin of the V-shaped *X*-chromosome in *Drosophila obscura*.

The great similarity in the morphological expression of Pointed in *D. obscura* and Beaded in *D. melanogaster*, and the similarity of their behaviour in the presence of modifying factors, proves their homology. The difference between the physiological effect of Pointed and Beaded, consisting in the fact that Beaded is lethal when homozygous and Pointed is not, is presumably due to their position in different genic systems.

The comparison of other corresponding genes in *D. obscura* and *D. melanogaster* such as yellow, white and eosin, shows that these genes do not exhibit their effects in the same degree in the two species, presumably because of the different genic systems in which they are placed.

If Pointed and Beaded are homologous, then we may explain their different position in the linkage groups by the translocation of the chromosome segment bearing the gene for these mutations. This assumption receives strong support from the comparative study of the chromosome complements in the related *Drosophila* species. The *X*-chromosome in *melanogaster*, *virilis*, and *simulans* is rod-shaped; in *obscura* and *willistoni* it is V-shaped and large as compared with the autosomes. Lancefield[1] (1922) and Metz[2] (1922) suggested that one arm of the V-shaped *X*-chromosome in these latter species corresponded to the rod-shaped *X* in *D. melanogaster*. If this is the case, it is reasonable to assume that the other arm of the V-shaped *X*-chromosome corresponds to a segment of one of the autosomes in the species with a rod-shaped *X*. This kind of condition would have been brought about by translocation, either of part of an original autosome to the *X*-chromosome or of a part of the *X*-chromosome with an autosome.

Comparative studies of the sex-linked mutations in these different species show that many identical genes, for example, the closely linked yellow-scute-white-Notch series, are transferred from the extreme left end of the *X*-chromosome in *D. melanogaster* to the middle region of the *X*-chromosome in *obscura* and *willistoni*. Recent investigations of the behaviour of Pointed and Pointed-*x*, located in the 'extra' arm of the V-shaped *X*-chromosome, indicate their homology with Beaded in the third autosome of *D. melanogaster*. It is therefore suggested that part of the *X*, namely, the segment to the left of the yellow locus in *D. obscura*, corresponds to part of the third chromosome of *D. melanogaster*.

Further evidence of such a chromosome rearrangement is given by the study of the hybrids of 'Race *A*' and 'Race *B*' in *D. obscura*[1,3] (Lancefield 1930, Koller 1932). The hybrid females are partially fertile and exhibit great reduction in crossing-over at both ends of the *X*-chromosome; the males are sterile. I have shown[3] (1932) that only the ends of the *X*-chromosome differ in the two races (*A* and *B*) of *D. obscura*. This can be explained on the assumption that the translocated segment of the *X*'s has a different origin in the two races, and that these non-homologous portions prevent the chromosomes from pairing and crossing-over.

These facts support the hypothesis regarding the constitution of the *X*-chromosome in *D. obscura*.

P. CH. KOLLER.

John Innes Horticultural Institution,
London, S.W.19,
March 10.

[1] Lancefield, D. E. Linkage relation of the sex-linked characters in *Drosophila obscura*. *Genetics*, **7**, 335-384; 1922. A genetic study of crosses of two races or physiological species of *Drosophila obscura*. *Z. ind. Abst. Vererbung.*, **52**, 2/3, 287-317; 1929.

[2] Lancefield, R., and Metz, Ch. The sex-linked group of mutant characters in *Drosophila willistoni*. *Amer. Natur.*, **56**, 211-241; 1922.

[3] Koller, P. Ch. The relation of fertility factors to crossing over in the *Drosophila obscura* hybrid. *Z. ind. Abst. Vererbung.*, **60**, 2/3, 137-151; 1932.

Mutation in Rice

THE incidence of mutation has not been infrequently reported in the common rice plant, *Oryza sativa* L. Most of the reported mutations in this crop plant are without any agronomic merit.

Matsuura,[1] in his monograph on plant genetics, mentions most of the mutations reported in rice. According to him, a case of dominant dwarf mutation originating from a common recessive rice was reported by Sugimoto (1923). Akemine (1925) and Nagai (1926)

mention cases of recessive dwarf mutations. Gene mutations resulting in various kinds of sterility have also been observed. Terao (1917, 1921), Kondo and Ono (1923), and Nagai (1926) record cases of complete or partial sterile mutants in rice. Terao (1922) mentions also a case of a 'large-grain' mutant from a common race of paddy.

During the rice season of 1931, I noted in the seedling stage after transplanting the appearance of three variant plants in a paddy culture of hybrid origin. These three plants were conspicuous by their short, compact, bushy growth and brevi-foliate appearance, while the remainder were tall with characteristic morphological features of an ordinary rice plant. Both the parents of the culture are normal tall plants with long leaves, and during the last eight years that the culture has gone through, no such off-type plants were ever observed.

These three plants, believed to have originated by mutation in the preceding generation, are characterised by shortened internodes, the culms ranging from 52 cm. to 60 cm. in height, in contrast to the average of 124 cm. of normal plants. The leaves are much reduced in length, but there is no corresponding reduction in breadth, as both the new type and normals show the same range. The spikelets showed normal development, and though anthesis occurred, the anthers completely failed to burst. As a result, the panicles were entirely sterile. This indicates that the mutated gene has also fatally affected the male gametes. One of the mutant plants was crossed with pollen from a normal plant from the same culture, and some seeds have been obtained. Apparently, the female gametes are functional. The inheritance of this abnormality is under investigation.

B. S. KADAM.

Rice Breeding Station,
Karjat, Kolaba, India,
Jan. 28.

[1] Matsuura, H., "A Bibliographical Monograph on Plant Genetics (Genic-Analysis)", 1900–1925, pp. xi+497. (Tokyo: Imperial University, 1929.)

Fatuoids or False Wild Oats

IN a study of the segregates of a cross made between the tetraploid species *Avena barbata* and the diploid species *A. brevis*, certain points of interest have emerged concerning the behaviour of the characters which in the hexaploid species *Avena sativa* constitute the fatuoid complex. In the latter species, when a fatuoid is crossed with normal or cultivated type of grain the fatuoid complex behaves as a partial recessive and in inheritance gives simple Mendelian segregation; there is no break-up of the complex, and no crossing-over takes place. In the *Avena barbata-Avena brevis* cross, however, these same associated characters, of articulation, basal pubescence, and awn, behave in the F_1 as partial dominants, particularly so in respect of the character of the articulation of the grain. Moreover, in the later generations there is a break-up of the fatuoid complex, and cross-over types are produced. Segregates have appeared in this cross in which the basal articulation and basal pubescence characters of the *A. barbata* parent occur in association with the awn and grain-apex of *A. brevis* type, and conversely segregates with typical *A. barbata* awns and the glabrous and normal or solidified base of *A. brevis*.

Chromosome counts in the root-tips of some of these cross-over types taken from the F_3 generation made by Dr. B. L. Sethi * have shown them to be of diploid chromosome constitution.

The occurrence of crossing-over in the progeny of this tetraploid-diploid cross is regarded as being highly important from the point of view of its bearing upon the chromosome constitution of fatuoids in hexaploid oats, and consequently upon theories relating to the origin of fatuoids in oats.

On the theory of the origin of fatuoids by 'chromosome aberration' as advanced by Huskins,[1] the chromosome constitution of the di-triploid group concerned with the fatuoid phenomenon is represented by the formulæ $\frac{ABC}{ABC}$, $\frac{ABC}{ABB}$, and $\frac{ABB}{ABB}$ for homozygous normal, heterozygous fatuoid, and homozygous fatuoid respectively (where B represents the chromosome bearing the fatuoid or *fatua* factors and C the chromosome bearing the factor or factors for normal or cultivated type of grain). On analogy with the *A. barbata-A. brevis* cross, if a chromosome bearing *fatua* or fatuoid factors pairs with a chromosome bearing a factor or factors for normal or cultivated grain, that is, if B pairs with C, as in the heterozygous fatuoid formula above, crossing-over should occur. Much fatuoid segregating material has been studied by different investigators, but so far no cross-over types have been recorded.

On the other hand, on the basis of the theory of the origin of fatuoids by mutation, as put forward by Jones,[2] and supported by Nishiyama,[3] in which the di-triploid group is represented by the formulæ $\frac{ABC}{ABC}$, $\frac{ABC}{ABC_1}$, and $\frac{ABC_1}{ABC_1}$ for homozygous normal, heterozygous fatuoid, and homozygous fatuoid respectively (C_1 representing a mutational change in the C chromosome), no cross-over types are theoretically expected, and, as already stated, none so far have been found.

It appears to me, therefore, that the occurrence of crossing-over in the tetraploid-diploid cross (*Avena barbata-A. brevis*) gives further support to the hypothesis that fatuoids in hexaploid oats arise by mutation rather than by chromosome aberration.

E. T. JONES.

Welsh Plant Breeding Station,
University College of Wales,
Aberystwyth, April 2.

[1] Huskins, C. L., *J. Genetics*, **18**; 1927.
[2] Jones, E. T., *J. Genetics*, **23**; 1930.
[3] Nishiyama, I., *Japanese J. Genetics*, **7**; 1931.

Molecular Dissociation by Electron Impact

ABOUT two years ago I noticed [1] that the positive ions generated along the path of an electron beam nearly all came out of the electron beam at right angles to it with energies of the order of 1 or 2 volts, that is, considerably higher than their thermal energies. I found that this was due to a radial potential gradient being set up around the electron beam by concentration gradients in the electron gas surrounding the beam. The presence of these radial potential gradients would introduce considerable difficulties into the accurate measurement of the kinetic energies of the dissociation products formed by electron impact in a molecular gas, for the dissociation products possess energies of only the same order of magnitude as the energy gained in falling through the potential gradient set up by the electron beam.

In a recent investigation by Tate and Lozier [2] of the energies of the dissociation products of nitrogen and carbon monoxide formed by electron impact, no account has been taken of the possible existence of these radial potential gradients. It is not possible to determine from my work the value of the potential gradient in Tate and Lozier's investigation, for they worked at lower pressures, and the effect of pressure on the value of the potential gradient has not been

* Formerly post-graduate student at the University College of Wales, Aberystwyth.

investigated. There is, however, little doubt that such a radial potential gradient existed in their work, for it would account for the fact, mentioned on p. 261 of their paper, that N_2^+ ions were able to reach the collector, whereas they should not have been able to do so if they possessed only their thermal energies.

Tate and Lozier find for carbon monoxide the following two processes:

$$CO \longrightarrow C^+ + O \quad . \quad . \quad . \quad (1)$$
$$CO \longrightarrow C^+ + O^- \quad . \quad . \quad . \quad (2)$$

If the energy given to the molecule by the impact is V_i and the kinetic energy with which the atoms separate on dissociation is V_f, then $V_i - V_f$ (which is equal to $U_2 - U_1$ in Tate and Lozier's notation) should be less for the second process by the electron affinity of oxygen. Tate and Lozier find that it is *greater*, and suggest that this may be due to excitation of the products of dissociation, but point out that no excitation level of the correct energy is known. For process (1) they find $V_i - V_f = 20{\cdot}5$ volts, and for process (2) $V_i - V_f = 22{\cdot}2$ volts.

Since the ions collected are oppositely charged in (1) and (2), it is clear that a small radial potential gradient around the beam would decrease the experimental value of $V_i - V_f$ for process (1) and increase it for process (2). If we assume a radial potential gradient of 1·2 volts to exist, we find for the corrected values

$$V_i - V_f = 20{\cdot}5 + \frac{7}{4}\,1{\cdot}2 = 22{\cdot}6 \text{ volts for (1)}$$

$$V_i - V_f = 22{\cdot}2 - \frac{7}{3}\,1{\cdot}2 = 19{\cdot}4 \text{ volts for (2)}$$

giving an electron affinity for oxygen of 3·2 volts.

From another dissociation process which they detected, namely, $CO \longrightarrow C + O^-$, Tate and Lozier deduce an electron affinity for oxygen of zero (or 0·5 volt, assuming, as they do, an experimental error of 0·5 volt) if the products of dissociation are unexcited. If we again assume a radial potential gradient of 1·2 volts, the electron affinity for oxygen deduced from this dissociation process comes out at 4·9 volts. Values for the electron affinity of oxygen quoted by other investigators range from 3·2 volts to 8·9 volts.

Besides giving a reasonable value for the electron affinity of oxygen, the assumption of a small radial potential gradient of 1·2 volts gives better agreement between the heats of dissociation calculated from Tate and Lozier's results and the spectroscopic values given by Birge and Sponer. The heat of dissociation of the normal carbon monoxide molecule is raised from 9·3 volts to 11·4 volts, and the heat of dissociation of the ionised molecule is raised from 6·4 volts to 8·5 volts. The values given by Birge and Sponer are respectively 10·3 volts and 9·8 volts.

F. L. ARNOT.

The University, St. Andrews.
March 8.

[1] *Proc. Roy. Soc.*, A, **129**, 361; 1930.
[2] *Phys. Rev.*, **39**, 254; Jan. 15, 1932.

Intensity Ratio of Fluorescent X-Ray Lines

HEVESY and Alexander have recently [1] published some very interesting figures on the variation of the relative intensities of the $L\beta_2$ and $L\beta_3$ lines of silver under fluorescent excitation by primary X-radiations of varying frequency. $L\beta_2$ is $L_{II} \rightarrow N_V$ and $L\beta_3$ is $L_I \rightarrow M_{III}$. The reported change in the intensity ratio is from 100 : 25 at 2·6 A. to 100 : 60 at 1·3 A.

This change is, as the authors point out, in the same direction as that previously noted by Skinner, and in the direction indicated by my work on X-ray electrons. I have, unfortunately, no data which are directly applicable to this particular case, but from earlier published work and from more recent unpublished experiments I have been able to construct a rough curve which allows a rather hazardous extrapolation to be made to the region covered by Hevesy and Alexander's work. From this curve I should expect the intensity ratio of $L\beta_2$ to $L\beta_3$ to change by not more than about 30-40 per cent between 1·3 and 2·6 A.—very appreciably less than the 140 per cent reported by Hevesy and Alexander.

I am surprised that the discrepancy should be so large. Hevesy and Alexander's measurements are more direct and, I should imagine, more exact than mine in this particular respect, and I shall be interested to see the detailed account of their work. I hope that I may shortly be able to extend the measurements further in this direction by the photoelectric method, and possibly get some clue to the reason for this discrepancy between the two results. Some degree of extrapolation is inevitable, for technical reasons, in the photoelectric method, but I may say that my extrapolated curve agrees as well as can be expected with Kellström's measurements of the silver L absorption discontinuities.[2]

H. R. ROBINSON.

East London College,
Mile End Road, E.1,
March 23.

[1] NATURE, **129**, 315; Feb. 27, 1932.
[2] *Z. f. Physik*, **44**, p. 269; 1927.

The Highest Oxide of Rhenium

IN the course of an investigation of the oxides of rhenium in progress in these laboratories, we have sought to repeat the preparation of the highest oxide described by I. and W. Noddack,[1] Re_2O_8, which was obtained by them on heating the heptoxide below 150° in a stream of oxygen. The yellow heptoxide used in the Noddacks' preparations melted at 220° and gave rise to a white sublimate at 150° described as Re_2O_8 and possessing the property of decolorising acidified potassium permanganate. The melting point of our specimens of heptoxide has invariably been about 300°,[2] and this material failed to give any evidence of a white sublimate when heated in a stream of oxygen to temperatures below its melting point. Moreover, quantitative experiments repeatedly showed that its formation was unattended by any increase in weight. The sublimate was identical in crystalline form with the heptoxide, was decidedly yellow, and melted to a yellow solid, also indistinguishable from the heptoxide.

It has been known to us for some time that the melting point of the heptoxide is depressed by traces of moisture, and a specimen the melting point of which had thus been lowered approximately to 150° was found to give a white sublimate of the non-crystalline form illustrated in the Noddacks' paper, though there was no gain in weight through the conversion. In no case did any of the sublimates when carried in an oxygen stream into dilute permanganate show the slightest decolorising effect, and we are compelled to the conclusion that, in the absence of further evidence, the heptoxide must be regarded as the highest oxide of rhenium stable under ordinary conditions. A full account of this work will be published elsewhere.

H. V. A. BRISCOE.
P. L. ROBINSON.
A. J. RUDGE.

Armstrong College,
University of Durham,
Newcastle-upon-Tyne, March 14.

[1] *Z. anorg. Chem.*, **181**, 37; 1929.
[2] Biltz and Lehre, *Nachr. Ges. Wiss.*, 191; 1931.

Research Items

A Choctaw Account of the Flood.—The Smithsonian Institution has issued a summary of a report to be published in due course by Dr. J. R. Swanston on an investigation of the culture and legends of the Choctaw Indians, which includes an account of the Flood—a tradition which the Choctaw shared with other south-western Indians. It gives an account of the destruction of mankind by the waters because of their wickedness. The form of the tradition as given here preceded the advent of the white missionaries. Later versions were modified to conform with the account in Genesis. A divinely pre-warned prophet went from village to village, proclaiming the coming of the flood; but no one heeded. Darkness, cold, and thunder came and the food of the Indians became mouldy and unfit to eat. Wild animals from the forest gathered around the camp-fires. Great waters rushed over the land from the north and destroyed everything. The prophet alone was saved. He made a raft of sassafras logs, upon which he floated for many weeks. A black bird circled over his raft, but when the prophet asked for help, it sailed away. Then a blue bird with red eyes guided him to an island in the direction of sunrise. The prophet landed and lay down in the mud to sleep. When he awoke, he found the island covered with all kinds of animals. Among them were the black bird and the blue bird. The black bird became the raven, a bird of ill-omen ever afterwards; but the blue bird became a beautiful woman, the mother of the new race of men. The Choctaw believe in a 'Great Spirit', which is closely associated with the sun, but can assume human form. Every man has two souls, of which one, identical with the shadow, is left behind after death and wanders about its former abode howling; while the other, "the inside shadow", goes to Paradise, an Elysium on earth of eternal springtime and perpetual youth, reached by crossing a yawning chasm by a slippery log.

Influence of Pituitary on the Ovaries.—It is now well known that one or more hormones from the anterior lobe of the pituitary gland regulate the functions of the ovaries in mammals. The evidence has been obtained almost entirely by transplantation or injection of extracts of the gland, since operative removal in mammals is difficult. L. Hogben, E. Charles, and D. Slome have now supplemented the previous evidence by showing that, in *Xenopus lævis*, removal of the pituitary gland or of the anterior lobe alone produces involution of the ovaries, as well as a lowering of the serum calcium and cessation of skin secretion (*J. Exp. Biol.*, 8, 345; 1931). *Xenopus* was chosen for the experiments since it survives hypophysectomy for a prolonged period. After the complete operation the animals remain pale on a black background, the melanophores being permanently contracted; after removal of the anterior lobe alone, however, the animals remain dark even when subjected to conditions which would otherwise produce pallor. The involution of the ovaries occurs after either operation, but is more marked after removal of the anterior lobe alone. Conversely, it was found that ovulation could be induced midway between breeding seasons by injections of extracts or by implantation of the anterior lobe: also, injection of extracts, especially of the posterior lobe, induces a copious secretion of slime from the skin after a few minutes. Hence it may be concluded that the anterior lobe of the pituitary has a functional influence on the ovaries throughout the vertebrate series.

Immunology in Reptiles.—The immunological reactions of certain reptiles have recently been investigated by E. Grasset and A. Zoutendyk (*Publ. South African Institute for Medical Research*, vol. 4, p. 377; 1931). The results indicated quantitative rather than qualitative differences from the responses of mammals; and different species of reptiles showed very varying degrees of susceptibility. Thus lizards and chameleons are, in general, the most susceptible to tetanus toxin, and may be killed by a dose almost equal to that which kills guinea-pigs, although the incubation period is much longer. One species of lizard, the leguaan, however, was quite resistant to both tetanus and diphtheria toxins. Crocodiles, snakes, and tortoises show increasing degrees of resistance to tetanus toxin, but crocodiles and tortoises are as susceptible to diphtheria toxin as mammals; the lizards, and especially the snakes, being resistant. Reptiles are usually resistant to dysentery and typhoid. Intoxication is the more readily produced the higher the temperature to which they are exposed. Although differences in susceptibility to different toxins are common among mammals, the processes involved in the immunity reactions appear to be different in mammals and reptiles. Reptiles show a very low and extremely slow response to the introduction of antigen, whether they are susceptible or resistant to the toxin. The sensitivity of the cells for toxin does not have as its corollary an aptitude for the production of antibodies. Hence immunity appears to follow the evolution and specialisation of the animal species, which result in a higher differentiation and sensitivity of the specialised cells. These, so far as immunity phenomena are concerned, are characterised by a higher and more rapid aptitude of response, which has as its object the protection of the organism.

Nephridiostome of the Earthworm.—Prof. E. S. Goodrich (*Quart. J. Micr. Sci.*, vol. 75, pt. 1; 1931) has critically re-examined the structure and development of the funnel or nephridiostome of *Lumbricus*. He gives a detailed description of the upper and lower lips of the funnel and of the relations and structure of the canal-, gutter-, central, and marginal cells. The account of the development of the funnel is traced from the time when the nephridium consists of a post-septal string of cells reaching obliquely backwards from the septum to the epidermis and ending anteriorly in a large funnel-cell bulging forwards through the cœlomic epithelium of the septum into the next segment. The whole nephridiostome (excluding the covering of cœlomic epithelium and the connective tissue) is shown to arise from the nephridial rudiment, wholly or partly from that part of the funnel-rudiment which is derived from the funnel-cell. Upper, lateral, and lower lips are all developed from the funnel rudiment, in which the lumen, appearing first as a notch between upper and lower lips, becomes pierced. There is no evidence that the cœlomic epithelium contributes any part of the nephridiostome. The view sometimes put forward that the excretory organ of *Lumbricus* is a nephromixium such as is present in some families of Polychæta is not founded on sound evidence. A. Meyer, who gave an account (1929) of the development of the funnel in *Tubifex*, concluded that the nephridioblast from which the whole nephridium developed was situated on the anterior surface of the septum among the cells of the cœlomic epithelium and was derived from this epithelium. Prof. Goodrich, who has seen Meyer's preparations, is convinced that Meyer is mistaken and

that he failed to trace the origin of the nephridioblast, and he adds: "There seems to be no justification for Meyer's extraordinary theories concerning the general morphology of nephridia and genital ducts in the Annelida".

Inhibition of Potato Sprouting by Ripe Apples.—A novel and simple means of preventing potatoes from sprouting even up to so late as June, was recently described by Dr. O. H. Elmer of the Kansas Agricultural Experimental Station, in a *Science Service Bulletin*. Tests have shown that if ripe apples are stored with potatoes in a well-closed bin, sprouting is prevented, the tubers remaining firmer and of better quality than those stored without the apples; and in experiments with previously sprouted tubers, provided the shoots were within 'smelling distance' of the apples, their growth was checked. The nature of the substance which is responsible for this effect is not known, but it evidently occurs in ripe apples only, for neither green nor rotten fruit was able to bring about the same result. Further, the substance does not occur in the skin only, for peeled apples were equally efficacious. Apparently only apples and closely related fruits, such as pears, possess this property, for neither bananas nor oranges were found capable of exerting the same influence on the potatoes.

***Puccinia Malvacearum*, a Homothallic Rust Fungus.**—The work of Craigie on the heterothallism of certain rust fungi has stimulated much research into the behaviour of other species of the Uredinales. Miss Dorothy Ashworth has adopted a very ingenious method of single-spore inoculation and has shown that the object of her study is homothallic ("*Puccinia Malvacearum* in Monosporidial Culture", *Trans. Brit. Mycol. Soc.*, vol. 16, parts 2 and 3, pp. 177-202, Dec. 1931). There appears to be an autœcious mechanism for diploidisation similar to that described for *Coprinus* by Buller and others. Three or four haploid cells are formed from the diploid sporidium shortly after its entrance into the host, and each sends out a thin vegetative mycelium which ramifies extensively in the mesophyll of the host leaf. Diploidisation of this vegetative structure is brought about by nuclear migration and by division without the formation of a septum. It takes place in numerous distinct patches, the sites of the future teleutospore sori. No fusion of cells has been observed.

Vacuum Pump Liquids.—The search for more suitable liquids for use in diffusion pumps on the lines suggested by Mr. C. R. Burch in these columns (NATURE, **122**, 729) and continued by Messrs. K. C. D. Hickman and C. R. Sanford (Patent 329,918) has led Drs. M. von Brandenstein and H. Klumb of the Physical Institute of the University of Berlin to devise a special form of pump for such liquids, and an account of their work has now been published (*Physik. Z.*, Jan. 15). They conclude that it is possible with both oils and fats of low vapour pressure to produce vacua of the order 10^{-3} dynes per sq. cm. The Eastman Kodak Co. has published a list of suitable liquids with low vapour pressure, and Prof. P. W. Bridgman has investigated the compressibilities of a number of them in the Jefferson Physical Laboratory of Harvard University (*Proc. Amer. Acad. Arts Sci.*, vol. 67). He finds that as the number of OH groups in an organic molecule increases, the compressibility decreases; that glycerine is the least compressible, and that organic liquids of other groups have compressibilities from three to five times as great.

Supposed Spontaneous Transformation of Helium into Radiation.—Dr. L. H. Gray and Mr. G. T. P. Tarrant have contributed a short paper to the January number of the *Proceedings of the Cambridge Philosophical Society*, describing an attempt to detect the spontaneous transformation of helium into penetrating radiation. If this occurred it might, as Sir James Jeans has shown (NATURE, **127**, 594; 1931), account for the existence of the extremely penetrating rays found by Regener by measurements in deep lakes. In the present experiments, an ionisation chamber containing nitrogen at a pressure of 100 atmospheres was exposed to five kilograms of helium at a mean distance of 45 cm., but instead of increasing the ionisation, presence of the helium reduced it to a slight extent, since the containers of the gas acted as additional shields protecting the chamber from the cosmic radiation and from γ-radiation from the walls of the room. After allowing for these effects, no ionisation remained which could be attributed to the helium. The limit of accuracy in the measurements was equivalent to a half period for the destruction of helium in this way of more than 10^{18} years, or expressed alternatively in terms of the observed penetrating radiation from cosmical sources, the upper limit for the ionisation which might be produced if the whole of matter in interstellar space were helium is about two hundred times that actually produced at the surface of the earth by the penetrating radiation.

Photographs of Fast Protons.—A pamphlet published by the Carnegie Institution of Washington (Feb. 28), which deals with work done in its Department of Terrestrial Magnetism by Messrs. M. A. Tuve, L. R. Hafstad, and O. Dahl, contains a photograph of cloud trails of fast protons which had been produced by ordinary electric means. The full detail of this work is not described, but there are some excellent photographs of the lay-out of the apparatus and of the Tesla coil used. The proton trails given are too crowded to show their individual features, but seem to be fairly homogeneous in length, and to have an appearance not obviously to be distinguished from close sheafs of α-particles, such as have been photographed by Meitner. It appears that this is the first occasion on which tracks of massive particles, as distinct from electrons, produced by other than radioactive methods, have been obtained.

Ortho- and Para-Hydrogen.—In No. 29 of the *Conférences d'actualités scientifiques et industrielles* (Paris: Hermann, 1931) Prof. E. Darmois gives a very clear account of the theories underlying the existence of the two forms of molecular hydrogen and of the experiments which led to their detection and isolation. He points out that their existence was inferred from observations on the secondary spectrum, due to the molecule of hydrogen, the alternation in intensities in the lines of which was pointed out by Mecke in 1924. McLennan and McLeod showed in 1929 that the existence of two kinds of molecules in the liquid was indicated by the Raman spectrum, and Dennison in 1927 had inferred the same result for the gas on the basis of its specific heats, which could not be brought into line with the moment of inertia of the hydrogen molecule, found spectroscopically by Hori in the same year, without an assumption of two kinds of molecules. The isolation of the two forms by Bonhoeffer and Harteck in 1929, by making use of the catalytic effect of charcoal at low temperatures, confirmed all these results, and in particular the abnormal specific heat curve of hydrogen. Eucken and Hiller in 1929 were able to reproduce this curve from those of ortho- and para-hydrogen. The paper includes a short bibliography.

Physico-chemical Study of Rare Earth Sulphates.—Prof. B. Brauner, with Dr. E. Švagr, has contributed

a lengthy paper to the *Collection of Czechoslovak Chemical Communications* (February 1932) on the sulphates of the rare earth metals, scandium, yttrium, lanthanum, praseodymium, neodymium, samarium, gadolinium, terbium, erbium, ytterbium, and thorium. The salts were prepared from the purest materials available and most of them have been used for atomic weight determinations by conversion into the metal oxide through ignition. The results are compared with those of Hönigschmid, Štěrba-Böhm, Baxter, Urbain, and other investigators, and the possible sources of error are discussed. The conclusion is reached that the classical sulphate method, which serves well for orientation in the fractionation of rare earth mixtures, is not exact enough for atomic weight determinations. One source of error which has probably not hitherto been taken into account is that the oxides, after glowing and cooling, absorb oxygen from the air and thus become heavier and give a figure for the atomic weight which is too high. Among the physico-chemical investigations carried out by the authors were determinations of the conductivities of the aqueous solutions of the normal and acid sulphates. Estimations of basicity were studied by the inversion of cane sugar and by the rates of hydrolysis of methyl acetate. Thorium sulphate, $Th(SO_4)_2$, $9H_2O$, and the acid salt, $Th(SO_4) . (SO_4H)_2$, the only thorium hydrogen sulphate obtained in these researches, showed anomalous behaviour compared with the other rare earth sulphates. This the authors attribute to the tetravalence of thorium.

Corrosion Fatigue of an Aluminium Crystal.—The results of a life-test on an aluminium crystal, subjected simultaneously to an alternating shearing stress and to corrosion by tap-water, have been described by H. J. Gough and D. G. Sopwith (*Proc. Roy. Soc.* for March). It withstood in all more than 23 million cycles before fracturing, which was due to profuse cracking. Plastic deformation was observed only in the initial stages, but there was a continual growth of small surface pits, which tended to run together, and although they did not lead to failure in this case, might conceivably have done so. The main cause of failure proved to be corrosion on the site of previously formed slip bands. Due to this a large number of big cracks developed, and a multitude of smaller ones, in nearly every case parallel to the traces of the operative slip planes, and most thickly concentrated in the region of maximum resolved shear stress intensity. These were, in general, the results anticipated, and the experiments are now to be extended to an iron crystal, with the applied cycle of stress such as would not normally produce plastic deformation.

Astronomical Topics

Houghton's Comet.—Prof. H. E. Wood has computed the following orbit of this comet, which was telegraphed by Dr. Spencer Jones to the I.A.U. Bureau at Copenhagen:

T	1932 April 20·080 U.T.	
ω	1° 44′	1932·0
Ω	205 41	
i	75 39	
log q	0·06472	

Ephemeris for 0h U.T.

	R.A.	N. Decl.	log r.	log Δ.
April 23	12h 27m 16s	27° 30′	0·0650	9·3219
27	12 22 24	42 48	0·0667	9·4526
May 1	12 19 24	51 17	0·0696	9·5665
5	12 17 28	56 21	0·0737	9·6606
9	12 16 52	59 37	0·0789	9·7592
13	12 17 12	61 48	0·0852	9·8055
17	12 18 24	63 20	0·0924	9·8624

The comet passes within some 15 million miles of the earth, and may be faintly visible to the naked eye; its northward motion is extremely rapid, owing to the high inclination. It moves nearly from pole to pole in two months. The elements bear considerable resemblance to those of comet 1849 II, which may indicate a common origin; identity is not possible, as that comet was observed for five months and its orbit was slightly hyperbolic.

The Delporte Planet.—The planetary nature of this body is now established, and it has been given the designation 1932 EA_1, pending the assignment of a permanent number later on. The orbit is a difficult one to compute, and the period is not yet known with precision. The following elements by Dr. A. C. D. Crommelin use observations up to April 11, and are probably not very far from the truth:

T	1932 April 4·808 U.T.	
ω	25° 18′ 49″	1932·0
Ω	171 8 51	
i	12 10 16	
ϕ	26 38 17	
Period	2·767 years	
log q	0·03617	

The least distance from the earth's orbit is about ten million miles, which is only two-thirds of that of Eros. Unfortunately, the discovery came too late to utilise the present approach, which is the most favourable one possible, for a parallax determination. On many nights, observations were taken at intervals of several hours; these, when corrected for the motion in the interval, indicate a horizontal parallax in the neighbourhood of 80″. These parallax determinations helped in deducing the distance from the earth, and in deciding against a parabolic orbit.

It is very desirable that large instruments should follow the object as long as possible, to facilitate its recovery at the next favourable opposition; it will probably only be observable when opposition occurs fairly near perihelion.

The following ephemeris is for 0h U.T.:

	R.A.	N. Decl.	log r.	log Δ.
April 25	16h 41m 12s	38° 27′	0·0453	9·2910
27	16 45 24	38 18	0·0471	9·3063
29	16 50 12	38 4	0·0490	9·3214
May 1	16 54 12	37 46	0·0510	9·3358
3	16 57 6	37 28	0·0532	9·3497
5	16 59 24	37 9	0·0556	9·3633
7	17 1 46	36 46	0·0580	9·3763
9	17 3 44	36 23	0·0605	9·3890

Annual of Catania Observatory for 1932.—This annual publication gives, in addition to the usual contents of an astronomical almanac, a useful list of periodic comets, notes on the eclipses, and the planetary phenomena of the year. There is a special chapter on Eros, of which many photographs were secured at Catania both in 1900–1 and at the recent apparition. A portion of one of the latter plates is reproduced, a number of short exposures being given on the same plate, a sufficient time-interval being given to separate the images of Eros owing to its rapid southerly motion. A table shows that steady progress is being made in the publication of the zone of the astrographic catalogue undertaken by the observatory; some of the reductions are being carried out at Naples. Solar spectroscopic work is also carried out. Drawings of four of the most interesting prominences observed in 1931 are given: the dates are March 1, April 10 (two prominences), and May 24. There are also drawings of sunspot groups on Feb. 23 and March 12.

Research in Textiles

IN a recently issued report on the work carried out in the Clothworkers' Departments, University of Leeds, under a research scheme established in 1928 by means of a grant of £3000 a year from the Worshipful Company of Clothworkers, reference is made to the value of the scheme not only in promoting a research plan, which has already a number of fundamental discoveries to its credit and holds promise of further work of outstanding scientific and technical importance, but also in providing industry with scientifically trained men. The report presents a survey of the three years' working of the scheme and is not confined to a statement on a single year. It is pointed out that the scheme has led directly to the creation of a school of textile research in Great Britain which has already attracted advanced workers from other countries. It is hoped that the recent creation of an honours degree of B.Sc. in textiles will assist in discovering students who will devote themselves to continuous work in this field, and it is strongly urged that the research grants for fellowships or scholarships in colour chemistry should be put on a permanent basis in 1932. The importance of adequate research scholarships being available in periods of industrial depression is specially stressed.

The survey of work in textile physics stresses the value of the results obtained by the application of X-rays methods, to which frequent reference has been made in NATURE. The combined evidence of chemical and X-ray analysis has led to the conclusion that the structure and properties of common industrial fibres are based on three main fundamental principles : long, thin crystalline or pseudo-crystalline particles, with their long dimensions inclined at a constant angle to the fibre axis, as in cotton, or parallel to the fibre axis, as in ramie, silk, wool, etc. If the molecular chains are inextensible the fibres can be stretched only by making the molecular bundles slip over one another, examples being cellulose fibres, natural silk, stretched wool and other animal hairs, and stretched rubber. If, as in cellulose and silk, the straight molecular state is the normal state, there is only a limited power of recovery from extension. If, however, the molecular chains are themselves extensible, as in unstretched wool, hair, and unstretched rubber, the fibres can be stretched to abnormal dimensions and afterwards recover their original length exactly.

Further investigations have shown that by various methods wool can be contracted to half its original length, while X-ray studies on the permanent set of stretched wool and hair have revealed that steam acts on the extended molecules so as to prevent their contraction to the folded state. The process is analogous to the vulcanisation of rubber, and detailed results of the ' setting ' of wool by steam will shortly be published. X-ray analysis of fibres has not only supplied strong evidence in support of the chain theory of protein structure but also is now furnishing important information about the actual growth of cellulose in Nature, and X-ray photographs of the wall of *Valonia ventricosa* promise to throw light on one of the greatest problems in botany and agriculture. X-ray photographs of the structure of feathers have also shown that feathers and tortoise-shell give a common X-ray photograph which is different from that of wool and hair, and accordingly the classification of their fibrous protein with the keratin of wool, hair, horn, etc., in most textbooks is incorrect.

On the physico-chemical side, the studies of the elastic properties of wool which have already indicated the underlying causes of the permanent setting of hair have now led to the discovery, of far-reaching importance for wool-finishing processes, that the ' set ' imposed at any one temperature is permanent only to water at a lower temperature than that at which it was imposed. This and the subsequent discovery that caustic soda solutions have the same property of being able to eliminate permanent set have led to the development of two new finishing processes for producing crêpon effects.

Investigations on the relation of rigidity to the amount of moisture present in the fibre and to atmospheric humidity showed that while the breaking load of wool fibres is only reduced in the ratio 1·5 : 1 by a change from absolute dryness to saturation with water, the rigidity changes in the ratio 15 : 1, and thus afforded an explanation why artificial humidification is essential for spinning mills but relatively unimportant at other stages of manufacture. Further explanation of variations in the spinning properties of wool has been found in the discovery that the affinity of wool for water decreases as the temperature at which it is dried increases.

These investigations not only make an important contribution to the knowledge of the structure of wool but also afford explanations of important technical points, such as fastness to rubbing. Most wool dyes are smaller in particle size than the pores of the swollen wool fibre and penetrate to the interior of the fibre. Dye molecules or particles which are larger in size than the pores of the swollen fibre can only be absorbed at its external surface, and the dye is accordingly readily removed by rubbing.

Other recent work has shown that acids have the property of attacking and subdividing the micelle structure itself, rendering the fibre easier to stretch. The further discovery that wool is completely immune to attack by acid and alkali over a wide range, known as the *p*H stability region, not only affords a striking and independent confirmation of Svedberg's results on soluble proteins, but is also of considerable significance in relation to wool scouring. It has also been possible to establish definitely the nature of one of the linkages in the wool molecule and thus to show that the combination of wool with acids and acid dyes is a strictly chemical process. The further discovery that at high temperatures the wool micelles are subdivided by water alone has a profound significance for the acid dyeing of wool. Space does not permit further reference to numerous other more technical researches which among other points have established the importance of perfect elasticity as well as surface scale structure for milling shrinkage.

Standardisation of Screw Threads

IN the *Human Factor* (vol. 6, No. 2) there is an interesting article by W. F. Watson, a working mechanic of thirty years' experience, describing the conflict between the duodecimal and decimal systems of measurement in his domain. He surveys the history of the two systems of measurement in the various countries, and the gradual success of the decimal, except in England. He illustrates the trials of the turner and manufacturer, by a study of screw threads.

The first attempt at securing uniformity in screws was made by Sir Joseph Whitworth in 1841, and in the course of twenty years the Whitworth system

was the recognised standard for general engineering purposes. Prior to that, each firm had its own 'standard' set of screwing tackle, the existence of which made engineering repairs costly and inconvenient. Owing to the pre-eminent position occupied by British engineering, the establishment of a British system was very favourable, and no difficulty was experienced in securing the adoption of Whitworth screws in Germany and the United States.

The two great attacks made on the Whitworth system came from the Franklin Institute in 1864, when the Sellers thread was adopted and recommended to American engineers, and in 1873, when Delisle of Karlsruhe initiated a metric system. In 1918 the International Screw Thread Congress adopted the international metric screw thread. Now the metric system of screw threads is standardised on the continent of Europe, America has its Sellers standard, whilst Great Britain retains the Whitworth system.

It is said that the threads now recognised as standards are included in about eight great systems, but a popular handbook gives details of no fewer than thirty different kinds of screw thread. As an example of the practical confusion arising, Mr. Watson says that if we place side by side a half-inch American screw, an English half-inch screw, and a 12 mm. screw (2 mm. pitch), it is not easy to note the difference. The American screw has, however, 13 threads to the inch, the English 12, and the metric 13·7, and the angles are 60°, 55°, and 47·5° respectively; therefore each must have its special nut. As in these days engineers are constantly handling the products of other countries, and as two different systems of screws may be employed on the same machine, much time is wasted in finding the standard used and in trying to get a screw conforming to that standard.

A similar difficulty is experienced in wire and sheet metal gauges. It may be suggested that the time is ripe for the various bodies concerned to examine all sides of the question, with the view of securing the adoption of an international system of measures for all commercial purposes.

Embryology of the Slime Eels*

THE Myxinoidea or slime eels have been the subject of inquiry and discussion by many investigators in both Europe and America. Much difference of opinion for a long time existed, and even yet remains, with regard both to the facts concerning them and to their interpretation. So little were these animals at first understood that the earliest investigators classified them with the worms. This error was early rectified, but great controversy continued to centre round such questions as whether the Myxinoids are or are not parasitic, whether they are primitive or degenerate, and whether they should be classified as Gnathostomata or Agnathostomata.

On the last question agreement had almost been reached, most morphologists and embryologists having placed them in the former group, when recently a sole investigator who has arisen in the field of myxinoid palæontology, stoutly claims for them a place in the latter. The excretory system has been described by some workers as a pronephros, by others as a pronephros which eventually becomes transformed into a mesonephros, and by still others as a small pronephros and a posterior segmental mesonephros which develops in the usual manner. The reproductive system, too, has been very extensively studied. Because of peculiarities in the structure of the generative organ, the myxinoids have long been believed to be *functional* hermaphrodites—in fact, they are still definitely stated to be so in even the most recent textbooks.

For many years the assistance of embryology in solving these and other problems connected with this difficult group was denied, because no one was able to find embryos developing in their natural environment or to obtain them by keeping the 'eels' in captivity. Neither did palæontology contribute towards their elucidation, for until quite recently no fossil cyclostome had been found—with the possible exception of *Palæospondylus*, supposed by some to be a Devonian lamprey. This belief, however, was firmly rejected by Dr. Bashford Dean, by whom many valuable contributions to our knowledge of the Myxinoidea were made during the time that he was professor of zoology at Columbia University.

From examination of his notebooks, it seems quite certain that this industrious and talented investigator had intended some day to publish still further information which he had gleaned, especially on the genital system of *Bdellostoma*. It is particularly fitting, therefore, that the Bashford Dean Memorial Volume on "Archaic Fishes" should contain this section on the Myxinoidea based on the unpublished data left by Dr. Dean in the form of notes, graphs, tables, and sixteen excellent drawings. This contribution to the volume is written by Prof. Leroy Conel, who for twelve years was associated with Dr. Dean in his work.

This author, before presenting Dr. Dean's notes and data (dealing mainly with the reproductive system of *Bdellostoma*), gives a brief but very useful review of the previous literature on the subject, in which the problems which Dr. Dean set out to solve are clearly indicated. *Myxine glutinosa*, the representative of the group mainly studied by previous workers, was stated by Nansen (1887) to be a functional protandric hermaphrodite. Cunningham (1891), though disagreeing with some of Nansen's observations, came to the same conclusion. In 1899 Dr. Dean published a paper in which he expressed grave doubts as to the truth of this assumption—doubts which were later supported in the publications of A. and K. E. Schreiner (1904–8). These authors held that, though undoubtedly hermaphrodite in structure, *Myxine* is functionally dicœcious.

On account of this uncertainty concerning the true state of affairs in *Myxine*, Dr. Dean, in search of further evidence, turned his attention to other members of the group, *Bdellostoma stouti* and *B. burgeri*. In these he found the gonad of each individual examined to be definitely either a testis or an ovary, and concluded that both species of *Bdellostoma*, at least, are very rarely, if ever, hermaphrodite at any stage of their life history. This finding, he contended, made it still more difficult to believe that the closely related *Myxine* is a functional hermaphrodite. In 1896, in order still more fully to investigate the life history of the Myxinoidea, Dr. Dean sought for, and succeeded in finding, a large number of embryos of *B. stouti* at Pacific Grove, in Monterey Bay, California—the first fairly complete series of myxinoid embryos ever collected. This material enabled him, in 1899, to publish an account of the embryological development of this species. In 1900 and 1901 he made a similar, though less successful, attempt to

* The Bashford Dean Memorial Volume. "Archaic Fishes." Edited by E. W. Gudger. Article 3: The Genital System of the Myxinoidea; a Study based on Notes and Drawings of these Organs in *Bdellostoma* made by Bashford Dean. By Prof. J. Leroy Conel. Pp. 63-102+4 plates. (New York: American Museum of Natural History, 1931.)

collect embryos of *B. burgeri* along the coast of Japan.

While searching for embryos, Dr. Dean recorded in his field notes many observations which contribute towards answering the question of the breeding season and spawning period of these species. From the data thus collected he came to the conclusion that the spawning time of *Bdellostoma* is during late August, all of September, and the first three weeks of October. This finding is completely at variance with a statement made by him in 1899, in which he says that "embryos can be obtained during the late fall and early winter in stages which enable me to extend the known season of ovulation throughout the whole year. A time of optimum spawning probably occurs; and this I believe to be the last of spring and the first month of summer." In the absence of more definite data from other workers, these two differing views serve but to emphasise the fact that the spawning time of the Myxinoidea is still unknown.

All investigators in these and allied fields of research will be exceedingly grateful to Prof. Conel for collecting and arranging these notes, graphs, and drawings of the late Dr. Dean, and to the trustees of the American Museum who have made possible their publication. Here and there in the paper the writer has added some of his own observations and conclusions. For the purpose of presenting more clearly and of emphasising the significance of Dr. Dean's work, this was perhaps necessary—even inevitable. Nevertheless, although Prof. Conel's contributions consist chiefly of corroborations of Dr. Dean's observations, it is unfortunate that not infrequently the reader is provided with insufficient clues to enable him to decide which of them is responsible for a given observation or deduction. G. A. S.

University and Educational Intelligence

LONDON.—The degree of D.Sc. in Chemistry has been awarded to Mr. A. A. Goldberg (Imperial College—Royal College of Science) for a thesis consisting of three papers entitled (1) "The Synthesis and Orientation of Trichloroanthraquinones and Amino Disulphonates of Anthraquinone", (2) "The Rational Synthesis of 1 : 3 Dichloroanthraquinone", and (3) "The Reduction of Nitroanthraquinone Sulphonic Acids" (*J. Chem. Soc.*, 1931–32).

OF the State school supervisory agencies used by local education authorities in America one of the most important is the circular letter. A collection of specimen letters, addressed chiefly to rural school teachers, is published as *Bulletin* No. 19, 1931, of the Office of Education, Washington. They give some idea of how the wheels of the State school machine go round, and of the multifarious duties that fall to the lot of the school superintendents, some thousands of whom assembled in February at Washington under the auspices of the National Education Association. The February number of *School Life*, the organ of the Federal Office of Education, is devoted largely to topics of special interest to them.

THE "Hygiene and Physical Education" chapter of the forthcoming Biennial Survey of Education in the United States, 1928–1930, has been issued as *Bulletin* No. 20, 1931, of the Office of Education, Washington, and almost simultaneously has appeared "White House Conference, 1930: a condensed report of America's children, their health, education, training handicaps, etc., as analysed by 1200 experts working on 150 committees", obtainable (price 50 cents) from the office of the White House Conference on Child Health and Protection, Interior Department Building, Washington, D.C. There has recently been conducted in connexion with this conference an investigation, such as has not taken place since 1923, of American public school medical and dental work and health and physical education, and the results of the investigation are summarised in this bulletin. It appears that in such matters as high school playgrounds, gymnasia and swimming-pools, and health examination of children attending, or soon to attend, elementary schools, there has been during the past seven years a marked improvement. In universities and colleges the answer to "the insistent demand that students should know more about wise living and the care of their bodies" seems to have been in most cases rather perfunctorily met by optional courses in hygiene, and college entrance requirements have, through lack of recognition for entrance credit of physiology and hygiene, tended to distract attention from the needs of health teaching in secondary schools. There has been in recent years a remarkable development of interest on the part of colleges, universities, and teachers' colleges in summer camps and the opportunities they offer of health cultivation.

Calendar of Geographical Exploration

April 25, 1900.—Italian Polar Expedition

Capt. Cagni reached 86° 34′ N. in 65° 20′ E. The Italian expedition of H.R.H. Prince Luigi, Duke of the Abruzzi, had sailed in 1899 in the *Stella Polaris* by way of Franz Josef Land. The winter was spent in Teplitz Bay, Rudolf Island, and in the spring an attempt was made to reach the north pole by sledging over the ice. Frost-bite disabled the Duke, and Capt. Cagni therefore led the northern party, starting on March 10, 1900, with ten men and nearly a hundred dogs. Before losing sight of Rudolf Island, three men turned back—and were never seen again. A second party returned safely from lat. 83° 10′ N., but Cagni, with three companions, reached the above point: no land was visible at the farthest north. Cagni had to turn back because the food supply was giving out; the return journey took sixty days, as against forty-five for the outward. Much had been achieved, though the pole itself had not been reached.

April 26, 1848.—A. R. Wallace and H. W. Bates

A. R. Wallace and H. W. Bates left Liverpool for Para, where they stayed for eighteen months, and thence made excursions to the Tocantins, Cameta, and the junction of the Rio Negro and the Amazon. Thence Wallace went to the Orinoco, and returned to England in 1852. Bates proceeded up the Amazon to Ega, where he remained for a year. In October 1857, Bates again set out from Para, and settled at Santarem for three and a half years, from which point he made numerous expeditions. For another four years he was at Ega, and then set out on an expedition to the foot of the Andes; but at Fonteboa he was compelled by illness to return, after having travelled 1400 miles up the great river. His book, "The Naturalist on the Amazons", is not only of scientific value, but also has a charm which still attracts the general reader. During his eleven years' stay he collected 8000 species of insects new to science. Wallace's collections, except for some sent on in advance, were lost in a fire at sea on the return journey. In 1854–62, Wallace made a tour in the Malay Archipelago. He divided it into two groups, according as their zoological affinities were Oriental or Australian. A narrow belt of sea, known as 'Wallace's Line', between the Oriental Borneo and

Bali on one side and Celebes and Lombok on the other, indicates an emphatic divergence between the indigenous mammalia of the respective regions.

April 27, 1404.—Clavijo in Samarkand

Ruy Gonzales de Clavijo, a nobleman of Madrid, left Trebizond. He had set out from Spain in 1403 as an envoy of Enrique III., King of Castille and Leon (1390–1406), to the court of Timur. He was a keen and intelligent observer and kept a detailed record of his travels. From Trebizond he journeyed by land to Tabriz, crossed the Kara Kum desert, and reached Samarkand. He described the 'Iron Gates', the pass through which alone Samarkand could be approached from Afghanistan and the tribute which Timur was thus enabled to exact, and compared it with the 'Iron Gates' near Derbend, which controlled the trade from Persia and was also in Timur's hands. He referred to the entrance of the Oxus into the Caspian, though he himself did not visit this region: a Persian traveller of the period makes the same statement, but the question of the previous course of the Oxus is still unsettled.

April 27, 1896.—H. H. P. Deasy in Central Asia

Capt. H. H. P. Deasy left Srinagar on the first of a series of expeditions which he continued until 1899. He explored part of the Upper Yarkand valley and a large area south of the Kuen Lun and east of Pagong Lake and Rudok, everywhere making careful surveys and thus doing much to fill in spaces previously blank on the map of Tibet.

April 28, 1806.—The Arctic Ice

Capt. Scoresby, in the *Resolution*, an English whaling boat, entered the ice in 76° N., penetrating it by means of ice saws, and found the open sea beyond. He reached 81° 30′ N. in 19° E., the ice being fixed and solid to the north, with open sea to east-north-east and south-east. On board was Scoresby's seventeen-year-old son, William Scoresby, who took command of the *Resolution* in 1811. In 1813 he established the fact that the deep-sea temperature of the polar ocean is higher than the surface temperature. In 1822 he pushed his way through the ice floes that encumber the approach to the coast of east Greenland, and surveyed and charted 400 miles of that coast between 69° 30′ and 72° 30′ N. He later carried out researches on terrestrial magnetism, and in 1856 made a voyage to Australia to collect data on that subject. The work of the two Scoresbys threw new light on seasonal ice movements in the arctic.

Societies and Academies

London

Optical Society, March 10.—**R. A. Houston**: Absorption of light. The intensity of a beam of light at a point in an absorbing medium decreases exponentially as the distance travelled (Bougwer-Lambert law). It holds only for monochromatic radiation, and the ratio of the intensities at two given points is independent of the absolute intensity. This independence might be expected to break down when the intensity is very great, but experimental proof for this is surprisingly slight.—**E. Gifford**: Note on refractive indices. A comparison between the refractive indices and dispersions of certain glasses is made with those of certain specified liquids.

Mineralogical Society, March 15.—**F. A. Bannister**: The distinction of pyrite from marcasite in nodular growths. X-ray single crystal and powder photographs show that nodules from the Chalk in the south of England are pyrite. Examination of polished sections of a number of these nodules by reflected polarised light confirms this work; in no case of nodular pyrite yet examined is there evidence of an intimate intergrowth of marcasite and pyrite. Both methods have also been applied to the study of nodules from other localities, including the true marcasite nodules from Wisconsin, United States, and pyrite nodules in shales. Nodular pyrite is far more common than was formerly supposed, whereas nodular marcasite is comparatively rare.—**L. Hawkes** and **H. F. Harwood**: On the changed composition of an anorthoclase-bearing rock-glass. The vitreous contact facies of a felsite dyke contains anorthoclase insets which cannot have grown in a liquid represented by the glass. The glass, which shows no outward sign of alteration and exhibits strain birefringence, has taken up soda and water and lost potash and silica. Glasses are more liable to metasomatic change than crystalline rocks.—**A. E. Mourant**: The spherulitic rhyolites of Jersey. The spherulites present a variety of structures. These are described and their origin is discussed, and particular attention is paid to rhythmic growth, of which there are good examples in some of the spherulites.—**Frederick Walker**: An albitite from Ve Skerries, Shetland Isles. A specimen collected from this almost inaccessible group of rocks proves to consist of albite 90 per cent, chlorite (replacing biotite ?) 2 per cent, quartz 2 per cent, with accessory titaniferous magnetite and apatite. Texture granitoid. Specific gravity 2·64. Chemical analysis compares closely with those of albitites from the Ural Mountains and from the Assynt district, Sutherland.

Dublin

Royal Dublin Society, Jan. 26.—**Paul A. Murphy** and **R. McKay**: The compound nature of crinkle and its production by means of a mixture of viruses. The naturally occurring potato virus disease known as crinkle is shown to be due to the presence of two viruses, the virus of simple mosaic and a new virus *A*. When simple mosaic is inoculated into healthy-looking plants of Irish Chieftain, which normally contain virus *A*, crinkle is produced, and the same result follows when the two constituent viruses are separately introduced into virus-free plants of other varieties. The synthetic disease appears to possess all the characteristics of natural crinkle. A mixture of streak and virus *A* also produces a form of crinkle, but this is shown to be due to a simple mosaic which generally accompanies streak. The latter has no part in the constitution of crinkle.—**Paul A. Murphy**: A critical review of some recent work on the occurrence of virus complexes in the potato. The view that such naturally occurring virus diseases of the potato as crinkle, mosaic, and streak are compounds of the same *X* and *Y* viruses, as suggested by K. M. Smith, and are therefore closely related, has not been established. Differences are pointed out between the *Y* viruses derived from these three diseases, and explanations are offered to account for them. The *Y* virus obtained by analysis of streak in Up-to-Date is derivable in part from the simple mosaic which seems to accompany streak invariably, and probably in part from the streak element. Determination of the constitution of virus complexes by analysis is much more liable to error than determination by synthesis. The disease secured from crinkle in certain of Salaman's experiments is shown to have been simple mosaic, and not a reduced crinkle. The possible identity of crinkle and rugose mosaic is discussed.

EDINBURGH

Royal Society, Feb. 15.—J. Walton and Jessie A. R. Wilson: On the structure of *Vertebraria*. During the latter part of the Palæozoic period the most abundant plant in the southern hemisphere was *Glossopteris* with its tongue-shaped leaves. Along with these leaves, and, according to some workers, occasionally found attached to them, are peculiar stems. A study of these stems (*Vertebraria*) shows that in structure they agree more with stems of seed plants than with ferns or any other group of plants. Since *Glossopteris* has long been suspected of being a seed plant and not a fern, and in view of the supposed connexion between *Glossopteris* and *Vertebraria*, the structural evidence derived from *Vertebraria* is suggestive and is in favour of the supposed connexion between these two plant fossils.—G. Bond: The effect of malnutrition on root structure. An earlier investigator reported that decotylation results in an elimination of the pith from the part of the root afterwards formed in *Vicia* and *Phaseolus*, and further induces a reduction in the number of protoxylem rays in *Vicia*. These statements have not been confirmed.—Isobel M. Case: The development of the sorus in some species of *Nephrolepis*, together with some observations on points of anatomical interest. Within the genus *Nephrolepis* the final position of the sorus varies considerably, from almost marginal to distinctly intramarginal types. There is, however, no corresponding difference in point of origin of the sorus, this being in each case slightly superficial, the first sign of soral development being evident at a point five to six cells back from the marginal cell. The vascular system of the stem is of an advanced dictyostelic nature. The leaf trace is horseshoe shaped, and consists of a number of separate strands. The method of pinna-trace formation is marginal throughout the entire length of the frond.—E. Boyd: The pigmentary system and the dopa reaction. By the term 'pigmentary system' is meant the chromogen and a catalytic enzyme or enzymes, which by their interaction produce melanin in pigmented living tissues, and the cellular elements in those tissues which influence or are influenced by the reaction. It is suggested that the pigment in differently coloured mammalian hair (reds, browns, and black, etc.) is identical, the varying visible colours being the result of differences in physical structure or in deposition and disposition of the melanin in the fibre, while variations in the accomplished degree of oxidation of the basal chromogen may also influence the colour perceptible to the naked eye. Evidence is produced to support the nuclear theory of the origin of melanin, in the finding of nuclear pigment caps in the epidermal cells of various breeds of sheep. In sections from dominant white sheep no dopa-positive cells can be found in the Malpighian layer, in the fibre sheath, or in the hair bulb; sections from white sheep heterozygous for brown give a diffuse yellowish brown coloration with a few dopa-positive cells; in recessive browns a single layer of small dopa-positive cells is demonstrated in the Malpighian layer and there are other differences. It may therefore be possible to evolve a quantitative test to enable a genotypic white to be distinguished from phenotypic white sheep.

COPENHAGEN

Royal Danish Academy of Science and Letters, Oct. 30.—August Krogh: Secretion of salt through the gills of fishes. Processes involving the transport of dissolved substances against a head of pressure are, no doubt, of common occurrence in living organisms, but only in a few cases is it possible to study such processes both qualitatively and quantitatively. The experiments undertaken by A. B. Keys show that salts are given off from fish blood with $\Delta = 0{\cdot}6°$ C. through the gills to sea water ($\Delta = 1{\cdot}9°$ C.). The mechanism and energetics of this process are discussed.

Nov. 27.—Harald Bohr: Distribution of values of the zeta-function of Riemann.

CRACOW

Polish Academy of Arts and Letters, Nov. 9.—Georges Bouligand: Some applications of the theory of ensembles to infinitesimal geometry.—L. Chamard: The Cantor-Minkowski construction.—A. Kordylewski: Occultations of stars by the moon observed at Cracow 1923–30.—W. Swietoslawski: The application of the phenomenon of azeotropism to the determination of small quantities of impurities.—W. Swietoslawski and Mlle. J. Szmigielska: The determination of the proportion of water in alcohol and in the azeotropic carrier.—Mlle. A. Dorabialska, T. Niwinski, and Mlle. E. Turska: The specific heats of some radioactive minerals. Measurements with the adiabatic microcalorimeter.—A. Skapski and J. Kamecki: The influence of temperature on the trend of the electrocapillary curve.—A. Skapski: The meaning of the action coefficient of neutral salts according to Szyszkowski, from the point of view of the modern theory of electrolytes.—W. Jacek: The velocity of solution of marble in acids (2).—Mme. W. Solodkowska and Mlle. K. Rudowska: The determination of the heat developed in the course of the germination of seeds.—K. Dziewonski and A. Kleszcz: Studies in the fluorene series (4). Synthesis of 1·2-diacetofluorene.—A. Swaryczewski: The crystallisation of ammonium chloride with cadmium chloride.—M. Ksiazkiewicz: The tectonic of the southern part of the Cieszyn zone between the Olga and the Vistula.—R. Roslonski: The value of the annual evaporation in the San basin.—J. Samsonowicz: The supposed appearance of the Carboniferous in the west of Volhynia.—Cz. Kuzniar: The geological structure of the potash deposits at Stebnik.—W. Domagalski: The motor and separating tissues of the floral peduncles of *Sparmannia africana*.—K. Kaniewski: The origin of new species in crosses between tetraploidal types of wheat.—Mlle. J. Siwakówna: *Ancyrocephalus vistulensis*, a new trematode parasite of *Silurus glanis*.—E. Kryszczynski: The absorption of the mineral compounds of the urine in the cloaca of birds.

Jan. 4.—S. Dobinski: The dielectric polarisation of solutions of sulphur in carbon disulphide.—K. Dziewonski and Sz. Piasecki: Researches on the oxidation of α-acetoacenaphthene.—K. Dziewonski and J. Schweiger: The synthesis of ketones: 2-propionylfluorene and 2·7 dipropionylfluorene.—St. Kozik: Zinc diammino-bromide. Crystallographic study.—J. S. Ruszkowski: The cycle of evolution of the cestode *Drepanidotœnia lanceolata*.

GENEVA

Society of Physics and Natural History, Dec. 3, 1931.—W. H. Schopfer: (1) A new technique for preparing and mounting the zygotes of Mucorineæ. The author describes a technique for preserving, mounted in glycerol-gelatine on a microscope slide, all the strains of zygotes arising from a series of experiments.—(2) A physiological separation of the phenomena of growth from those of sexuality in a fungus (*Phycomyces*). The author has made a series of experiments from which he concludes that conditions of culture exist which can inhibit sexuality in a non-

definitive and reversible manner, and this without interfering with vegetative development or inversely.—M. Grosjean and J. J. Pittard: New methods and classification for the rapid determination of minerals. The authors construct synoptic tables of minerals in which appear their essential physical properties; colour, hardness, density, fusibility, colour of the streak, and finally the principal chemical and crystallographic properties. After a little practice, these tables allow of a rapid determination, by the application of the principle of dichotomic tables.

Dec. 17.—A. Liengme: Contribution to the study of the human blood groups in hæmophilia. From studies made on two families, the author concludes that, contrary to the view now generally held, the character for hæmophilia is not connected with the blood group.—E. Friedheim: Pyocyanine and biological oxidations. Pyocyanine, the blue pigment of the pyocyanic bacillus, represents a reversible system of oxidation-reduction. Thanks to this property, this pigment has the function of a catalyst in the respiration of living cells such as the pyocyanic bacillus, staphylococcus, pneumococcus, red blood corpuscles of mammals, and cancer cells. The increase of respiration observed reaches 2400 per cent.—J. and L. Deshusses: Some insects specially harmful to French-Swiss agriculture. Besides parasites already known, the authors have recognised seven new species which, in their districts, attack celery, *crône*, fuchsia, apple tree, pear tree, certain varieties of peas, and hothouse plants.

MELBOURNE

Royal Society of Victoria, Nov. 12.—Gerald F. Hill: Australian termites (Isoptera). Biological notes and new species. This paper contains notes on the biology, distribution, and synonymy of several species of Australian *Calotermes*, *Coptotermes*, *Heterotermes*, and *Eutermes*. Four new species, *Calotermes spoliator*, *Coptotermes tillyardi*, *Heterotermes intermedius*, and *Eutermes dixoni* are described.—Bernard C. Cotton and C. J. Gabriel: Australian Unionidæ. The authors comment on the difficulty of classifying the Australian forms, owing to the variability of the individuals which constitute a species and the tendency of one species to merge into another. Ten species and a variety are enumerated, and two new genera, *Propehyridella* and *Protohyridella*, are suggested.—A. B. Edwards: The geology and petrology of Warburton. This includes an acid suite of igneous rocks (rhyolites, dacites, and granodiorites). The igneous rocks intrude a series of Silurian sediments, and being contiguous with similar igneous rocks in the Blackspur area, are considered to be of Upper Devonian age. The granodiorite is interesting on account of the presence of quartz nodules.

ROME

Royal National Academy of the Lincei, Dec. 6.—G. Fubini: A theorem of Severi for analytic functions of two variables.—E. Bompiani: Intersection invariants of two oblique curves.—Enea Bortolotti: Allied connexions associated with an $(n+1)$-pla of congruences in an n-dimensional variety.—G. Barba: Metric transports.—P. Tortorici: Maxima and minima of convex functions.—Vladimiro Bernstein: Ultra-convergence of certain series of Dirichlet (2).—L. Godeaux. An algebraic surface.—M. Kourensky: The integration of equations which determine the conjugated functions of Beltrami.—Maria Previatti Bortolozzi: The equation of the asymptotic of a V_2 with σ_2 of three dimensions.—Luigi Crocco: A maximum value of the coefficient of heat-transmission by a plane lamina to a flowing fluid. The ordinary theory of heat transference between a plane lamina and a flowing fluid ignores entirely the influence of the heat developed by friction on the temperature gradient adjacent to the lamina and on the coefficient of transmission. With high velocities this frictional heat is not negligible, and consideration of this case shows that the heat transference is governed by the law that holds when the frictional heat is negligible, provided that the temperature of the fluid is taken to be that to which it would be carried by adiabatic arrest.—A. Belluigi: Further consideration of the gravimetric depressions in the Paduan valley.—E. Segrè: Quadrupole lines in X-ray spectra. All the known forbidden lines of X-ray spectra may be explained as quadrupole irradiation, which, in the case of X-ray spectra, is much greater than with optical spectra, and preponderates over all other causes for the appearance of forbidden lines. It is, therefore, considered that the forbidden lines of X-rays are to be attributed to quadrupole transitions.—L. Mascarelli, D. Gatti, and M. Pirona: Contribution to the knowledge of diphenyl and its derivatives. (10) Influence of certain substituents in the 2′-position on some reactions of NH_2 in the 2-position.—A. Ferrari and C. Colla: Chemical and crystallographic investigations on complex nitrites. (2) Double nitrites of potassium and nickel and of potassium and cobalt. The compounds to which the formulæ $6KNO_2$, $3Co(NO_2)_2$, H_2O and $2KNO_2$, $Co(NO_2)_2$, H_2O have been attributed, are merely the cobaltinitrite contaminated with cobalt hydroxide. This hydroxide is probably formed in the hydrolysis of the cobaltous nitrite, which gives also the nitrous acid causing the oxidation of the bi- to ter-valent cobalt and hence the formation of the cobaltinitrite. The compound $K_4Ni(NO_2)_6$ is monometric with a lattice of side $a=10{\cdot}49$ A.; that of potassium cobaltinitrite is $a=10{\cdot}32\pm0{\cdot}02$ A. The close approximation between the values of the unit cell constants and the positions of the photogram lines for these two compounds indicate the existence between them of a close isomorphous relationship, in spite of the different numbers of atoms in the two molecules.—L. Sanzo: Egg and first larval stages of *Myctophum Gemellari* Cocco (=*Scopelus Gemellari* C. and V.).—G. Brunelli: New contributions to the biology of lagoons.—A. Orrù: Observations on the water-content of the white and yolk of hens' eggs during the development of the embryo. During the incubation period, the white of hens' eggs undergoes gradual dehydration until the twelfth or thirteenth day, after which it increases in water-content continuously to almost the original value just before the shell breaks. On the other hand, the yolk takes up water for twelve days and later suffers rapid dehydration, but not to such an extent as to bring the moisture content to the value it has in the quiescent egg.—Ettore Marchiafava: Obituary notice of Antonio Dionisi.

VIENNA

Academy of Sciences, Dec. 17.—J. Kisser, R. Stasser, E. Kiffe, and S. Göllner: Researches on bending due to wounds in dicotyledon seedlings and their material causes. To one-sided injuries the seedlings react by bending, the reaction being greatest with stems in active growth. A growth substance is formed in the end-buds of dicotyledon seedlings. Removal of these end-buds inhibits growth, but growth is stimulated again on replacing the end-buds or by agar into which the growth-substance has diffused. There appears to be also a wound-substance the action of which is contrary to that of the growth-substance.—J. Kisser and P. Popp: Growth and differentiation processes in dicotyledon

seedlings after continued removal of buds. After removal of buds in *Helianthus* the leaves grew notably; this was due to growth in size of the leaf cells.—J. Kisser and M. Lorenz: Chemical stimulation of the germination of *Pisum* and *Triticum* under optimum germination conditions. As stimulants the best were manganese salts and ethyl alcohol.—J. Kisser: Critical remarks on the nature and the concept of seed germination.—A. Jagersberger: Measurement of light transmission through cathode-sputtered silver films.—L. Schmid and R. Falke: Measurements of the viscosity of carbohydrates in liquid ammonia, in formamide and in water.—A. Köhler: (1) Granite of type Eisgarn from the north-western Waldviertel. (2) The monzonitic quartz-mica-diorite of Dornach in Upper Austria.—H. V. Graber: Comparative observations on the eruptive rocks of the circum-Adriatic arc.—E. Haberfelner: Graptolites from the Upper Silurian of the Carnic Alps (2).—O. Reithofer: Report on the conclusion of the rift measurements in the wider neighbourhood of Köfels in the lower Oetz valley.—O. Sickenberg: Geological researches in the northern Osterhorn group (Salzburg).

Forthcoming Events

FRIDAY, APRIL 22

ROYAL ANTHROPOLOGICAL INSTITUTE (Human Biology Research Committee), at 5.30.—Prof. J. B. S. Haldane: Present Knowledge concerning Blood Groups.

SOCIETY OF CHEMICAL INDUSTRY (Chemical Engineering Group) (Annual General Meeting) (at Waldorf Hotel, Aldwych), at 6.45, followed by dinner at 7.30.—Sir Robert Horne: Currency and Prices (Address).

ROYAL INSTITUTION OF GREAT BRITAIN, at 9.—Prof. J. B. S. Haldane: Hereditary Transmission of Acquired Characters.

SATURDAY, APRIL 23

INSTITUTION OF ELECTRICAL ENGINEERS (Irish Centre—Dublin).—Prof. J. K. Catterson-Smith: Everyday Uses of Electricity (Faraday Lecture).

MONDAY, APRIL 25

ROYAL SOCIETY OF ARTS, at 8.—Prof. J. C. Drummond: Recent Researches on the Nature and Function of Vitamins (Cantor Lectures) (2).

WEDNESDAY, APRIL 27

ROYAL SOCIETY OF MEDICINE (Comparative Medicine Section), at 5.—Annual General Meeting.

NEWCOMEN SOCIETY FOR THE STUDY OF THE HISTORY OF ENGINEERING AND TECHNOLOGY (simultaneously in London and New York) (at the Science Museum), at 5.30.—W. W. Mason: Trevithick's First Rail Locomotive.—Hon. Charles L. Chandler: Early Shipbuilding in Philadelphia.

LEICESTER LITERARY AND PHILOSOPHICAL SOCIETY (Chemistry Section) (at Museum, Leicester), at 7.30.—Annual General Meeting.

ROYAL SOCIETY OF ARTS, at 8.—H. Ramsbotham: Education for Commerce (Lecture).

THURSDAY, APRIL 28

ROYAL SOCIETY, at 4.30.—Discussion: The Structure of Atomic Nuclei. To be opened by Lord Rutherford, followed by, probably, Dr. J. Chadwick, Dr. C. D. Ellis, Prof. R. H. Fowler, Prof. J. C. McLennan, Prof. F. A. Lindemann, and N. F. Mott.

INSTITUTION OF CIVIL ENGINEERS (Birmingham and District Association) (at Chamber of Commerce, Birmingham), at 6.—Annual General Meeting.

AT B.M.A. HOUSE (Tavistock Square).—Dr. J. H. Sequeira: The Educational Aspect of Public Health Work in the Tropics (Chadwick Lecture).

FRIDAY, APRIL 29

ROYAL ASTRONOMICAL SOCIETY, at 4.30.—Geophysical Discussion: The Maintenance of the Earth's Electric Field. To be opened by Dr. F. J. W. Whipple, and continued by Dr. G. C. Simpson and others.

ROYAL INSTITUTION OF GREAT BRITAIN, at 9.—Prof. H. Hartridge: The Rival Theories of Hearing.

Official Publications Received

BRITISH

Proceedings of the Geologists' Association. Edited by G. S. Sweeting. Vol. 43, Part 1, 30th March. Pp. 96. (London: Edward Stanford, Ltd.) 5*s*.

Thirty-second Report of the Felsted School Scientific Society, 1930–1931. Pp. 42. (Felsted.)

Proceedings of the Linnean Society of London, Session 1931–32. Part 2: Containing Account of the Centenary Celebration of Robert Brown's Discovery of the Nucleus of the Vegetable Cell. Pp. 17-56. (London: Linnean Society.) 1*s*. 6*d*.

Department of Agriculture: New South Wales. Science Bulletin No. 38: The Control of Ked (Tick) in Sheep, including Report of Investigations by Dr. H. R. Seddon and C. Blumer. Pp. 28. (Sydney: Alfred James Kent.)

Record of the Industrial Bursars of the Royal Commission for the Exhibition of 1851, 1911–1929. Pp. 58. (London: Royal Commission for the Exhibition of 1851.)

The Journal of the Royal Anthropological Institute of Great Britain and Ireland. Vol. 61, July to December 1931. Pp. xii+287-519+18+45+plates 38-57. (London: Francis Edwards.) 15*s*. net.

Quarterly Journal of the Royal Meteorological Society. Vol. 58, No. 244, April. Pp. 89-216. (London: Edward Stanford, Ltd.) 7*s*. 6*d*.

Proceedings of the Royal Society. Series A, Vol. 135, No. A828, April 1. Pp. 511-705+xx. (London: Harrison and Sons, Ltd.) 12*s*. 6*d*.

Annual Reports on the Progress of Chemistry for 1931. Issued by the Chemical Society. Vol. 28. Pp. 443. (London: Chemical Society.) 10*s*. 6*d*. net.

Biological Reviews and Biological Proceedings of the Cambridge Philosophical Society. Edited by H. Munro Fox. Vol. 7, No. 2, April. Pp. 89-179. (Cambridge: At the University Press.) 12*s*. 6*d*. net.

Department of Scientific and Industrial Research. Index to the Literature of Food Investigation. Vol. 3, No. 2, September 1931. Compiled by Agnes Elisabeth Glennie. Pp. iv+183. (London: H.M. Stationery Office.) 2*s*. 6*d*. net.

Report of the Rugby School Natural History Society for the Year 1931. (Sixty-fifth Issue.) Pp. 43. (Rugby: George Over, Ltd.)

The Journal of the Institute of Metals. Vol. 47: Metallurgical Abstracts and Index to Volumes 45, 46 and 47 of the Journal. Edited by G. Shaw Scott. Pp. viii+854. (London: Institute of Metals.) 80*s*.

Annals of the Cape Observatory. Vol. 10: Spectroscopic Researches. Part 9: The Spectrum of Nova Pictoris, 1925. By Dr. H. Spencer Jones. Pp. 532+6 plates. (London: H.M. Stationery Office.) 50*s*. net.

Observations made at the Royal Observatory, Greenwich, in the Year 1930, in Astronomy, Magnetism and Meteorology, under the direction of Sir Frank Dyson. Pp. viii+A102+B9+Cix+C102+D64+10 plates+E48+17. (London: H.M. Stationery Office.) 37*s*. 6*d*. net.

Transactions of the Optical Society. Vol. 32, 1930–31, No. 5. Pp. ii+165-212+xv. (London: Optical Society.) 10*s*.

FOREIGN

Scientific Papers of the Institute of Physical and Chemical Research. Nos. 355-356: Über die Polymerisierung der Methylester höherer ungesättiger Fettsäuren, X: Einfluss der Erhitzungstemperatur und des Zusatzes des Verdünnungsmittels, von Kiichiro Kino; Chemische Untersuchungen in der Saponinreihe, Mitteilung 3: Über die Sapogenine von *Panax repens* Maxim. und *Aralia chinensis*, L. var., von Munio Kotake und Yorisaburo Kimoto. Pp. 77-96+2 plates. (Tōkyō: Iwanami Shoten.)

U.S. Treasury Department: Coast Guard. Bulletin No. 19: The *Marion* Expedition to Davis Strait and Baffin Bay under direction of the United States Coast Guard, 1928. Scientific Results, Part 1: The Bathymetry and Sediments of Davis Strait. Pp. vii+81. (Washington, D.C.: Government Printing Office.) 50 cents.

Ministry of Finance, Egypt: Mines and Quarries Department. Report on Boring for Oil in Egypt. By Dr. T. Sutton Bowman. Section 3: Eastern Desert and adjoining Islands. (With Index to Sections 1, 2 and 3.) Pp. xvi+353+39 plates. (Cairo: Government Press.) 30 P.T.

Collection des travaux chimiques de Tchécoslovaquie. Rédigée et publiée par E. Votoček et J. Heyrovský. Année 4, No. 3, Mars. Pp. 97-144. (Prague: Regia Societas Scientiarum Bohemica.)

Zoologica: Scientific Contributions of the New York Zoological Society. Vol. 13, No. 3: Bermuda Oceanographic Expeditions, 1931—Individual Nets and Data. By William Beebe. Pp. 37-45. Vol. 13, No. 4: Nineteen New Species and Four Post-Larval Deep-Sea Fish. By William Beebe. Pp. 47-107. Vol. 13, No. 5: New Burmuda Fish, including Six New Species and Forty-three Species hitherto unrecorded from Bermuda. By William Beebe and John Tee-Van. Pp. 109-120. (New York City.)

State of Illinois: Department of Registration and Education: Division of the Natural History Survey. Forestry Circular No. 5: Care of Trees. By L. E. Sawyer. Pp. ii+7. (Urbana, Ill.)

U.S. Department of Agriculture. Technical Bulletin No. 275: The Biology and Control of the Blueberry Maggot in Washington County, Me. By F. H. Lathrop and C. B. Nickels. Pp. 77+14 plates. (Washington, D.C.: Government Printing Office.) 25 cents.