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History in Science

SPEAKING at Oxford a few days ago in connexion with the celebration of the 250th anniversary of the Old Ashmolean, Sir Frederick Gowland Hopkins, president of the Royal Society, made a strong plea for increased attention to the history of science in secondary schools and universities in Great Britain. He suggested that

"the history of science—the history of the gradual development of the fundamental ideas and conceptions, perhaps its effect upon civilisation—might form the subject of school teaching and take the place of the purely technical teaching of science which the schools at present give. That would turn out not only men who are going to take up science as a career, but the right sort of teaching would give that sympathy with and understanding of science which we would fain have in our public men and in our citizens generally."

Two main ideas seem to be expressed in Sir Frederick Hopkins' words—one that the usual science teaching in schools is too specialised for the educational equipment of the rank and file : the other, that historical aspects of scientific achievement and progress afford a suitable means of creating interest in them without technical details. Both propositions have been given much consideration in recent years, and the results are to be found in various reports as well as in modern textbooks, a number of which are now available providing courses of general or everyday science, while others, dealing with specific branches of science, devote much more attention to the historical side than was formerly done.

These developments are all to the good and represent a reaction against the type of school science which seemed to assume that every pupil was to become a chemist, physicist or engineer. For the rank and file of pupils in secondary schools, who will not in most cases proceed to scientific careers, something more is needed than laboratory training in scientific method, and it can be found in descriptive lessons and reading on everyday applications of scientific discovery, such as are exemplified in industrial history, on the establishment of great principles, and on many interesting aspects presented by the broad field of natural fact and phenomena.

On account of pressure of school examination requirements, there are practical difficulties in making the science course extensive as well as intensive, but a way to overcome them is indicated in a report on "The School Certificate Examina-

tion" which was the subject of an article in these columns of February 18 last. The recommendation made in this report was that every candidate who presents himself in science in the School Certificate examination should take an obligatory paper covering an extensive field, of a general scientific knowledge character, and should take, in addition, special papers on physics or chemistry or biology, but if these three papers are taken then the candidate can be excused the general science paper. It is greatly to be hoped that the university authorities responsible for the conduct of School Certificate examinations will give serious consideration to this scheme and will introduce syllabuses which will encourage its adoption in schools.

In a general science course of the kind contemplated, the history of science would, however, only be incidental. The main aim would be to encourage intelligent interest in the objects and manifestations of Nature and the endeavours of men of science to understand and use them. The place of history in the development of a particular branch of science is another matter. Precise knowledge of the subject itself is required to understand the significance of the steps by which particular discoveries have been reached, and such details are inappropriate to a general science course.

Fifteen years ago, when Sir. J. J. Thomson was president of the Royal Society, he presided over a Government committee which produced a valuable report on "The Position of Natural Science in the Educational System of Great Britain". Among the chief recommendations of that committee was one on the importance of increased attention to the history of science. It was suggested that such courses are particularly suitable for students not specialising in science, and that they should deal, not only with the history of specific branches of science of general interest, but also with the development of scientific ideas, the lives and work of scientific men, the bearing of scientific inventions on industrial progress, and the method and philosophy of science historically treated. Among the subjects which come appropriately under one or other of these heads are historical considerations of the development of views on the constitution of matter; the conservation of energy; the doctrine of evolution; methods of transport by land, water, and air; means of communication, such as telegraphy, telephones, broadcasting; methods of lighting; and the schools of thought represented by Aristotle, Archimedes, Galileo and Newton, as well as the work of Pasteur, Lister, Faraday, Darwin and Mendel and other experimental philosophers. Courses of this kind give special opportunities to teachers who combine some knowledge of history with a knowledge of science, and they appeal to students with historical tastes.

Many science teachers to-day realise the value of courses in which the humanising aspects of history and biography are combined with the practical study by which the meaning of experimental method is appreciated. It is, however, one thing to point out the stepping stones which have been the path of scientific progress in a particular subject and another to show the bearing of discoveries upon the advance of civilisation. To the student of chemistry the relative contributions of Priestley and Lavoisier to the discovery of oxygen and its bearing on the phlogiston theory are of interest and importance, but in human history the discovery itself is not so significant as the use of oxygen in medicine, aviation and the arts.

The history of science may, indeed, be approached from two points of view. It may be regarded purely as growth of knowledge of natural objects and phenomena along the corridors of time, or it may be viewed selectively according to its influence upon social and economic conditions. Hitherto these two provinces have been surveyed by different groups of students, and only occasionally have the qualities required for the effective description of both been possessed by a single worker. The result is that we have on one hand histories of astronomy, chemistry, biology, and other branches of natural science, none of which discusses the relation of the knowledge to social conditions or effects, and on the other hand histories of countries and periods giving scant attention to scientific genius and its influence upon human life and institutions.

What is wanted is a closer co-ordination of these separate points of view in works on general history. No one now supposes that a descriptive catalogue of kings and the intrigues of their courts and governments constitutes the history of a country. The determining factors in social development may be rulers or governments or peoples or scientific knowledge; and the power exerted by these respective influences decides the extent and character of the national or international changes effected. Just as, in mechanical science, work is not considered to be done until the point of application of the force is moved, so history is being made only when the power used produces an effect. Regarded in this way, science in the

history of civilisation becomes a study of scientific causes and human consequences, and not a continuous chronological record of the growth of natural knowledge.

For the education of most young citizens, therefore, whom Sir Frederick Hopkins appears to have in mind, we suggest that what is wanted is not the history of science as such but of its social and industrial influences. "No one," said Comte, "can be really master of any science unless he studies its special history, which again is bound up, at every step, with the general history of humanity." We have often been reminded in recent years of these social and economic contacts; and it is upon them that the chief emphasis should be placed when attention to the history of science is being advocated for students in schools or universities.

Preservation of Wild Life in India

AN appeal made by the Association for the Preservation of Game in the United Provinces of India, in the first report of the Association recently issued (Agra: Hasan Manzil, Shahganj) shows the need for concentrated and swift action in its support. For long years this area of India has suffered heavily; in part from the toll of life taken by sportsmen, and in part by the natives under one pretext or another. It is not only the existence of the larger mammals which is threatened, but also of bird-life, especially of the ducks, which have been, and are being, destroyed by thousands either by shooting or by netting.

The existing close-season regulations are more honoured, we are told, in the breach than in the observance, while the issue of licences to all and sundry is reckless; and these include not merely ordinary firearms but quick-firing and magazine rifles. A plea is urged for a revision of the present system of licensing and an embargo on shooting from motor-cars, over water-holes and salt-licks, and between the hours of sunset and sunrise. It is proposed to reduce the abuses which now exist in licences for the protection of crops. Here, as in Africa and elsewhere, this need for 'protection' has again been advanced for commercial ends.

Having regard to the innumerable devices which exist in the United Provinces for the slaughter of game, there is no occasion for surprise at the note of alarm which has been sounded. In some areas which were once prolific, game has been absolutely wiped out. All good sportsmen, we feel sure, will deplore the state of affairs which now exists, and will join hands with those who are anxious to beat out the fires of destruction before they spread further, for there is still a remnant of a glorious heritage to be saved.

More than this; the members of this Association realise that they are the trustees for posterity. The present generation has no right to slay until the slaying stops for lack of victims. It is their duty to see that this does not happen; and this not so much in order that generations yet unborn may have something left to shoot, but that those who come after us may be able to make amends for our own abuse of the opportunities presented for the right use of this game.

Hitherto, game has been simply exploited, either to serve the ends of 'sport', or of commerce. Of the haunts and habits of these creatures, all that has come to light only suffices to guide those bent on killing to their prey. The tiger knows as much. What is needed is a concentrated study of the various types of game as they live their daily lives, unsuspecting the presence of man. Here we shall find the key to the problems presented by their evolution—what governs their choice of food, and its abundance, what governs their coloration, and their 'behaviour' in varying circumstances, their adjustments to their environment, and a hundred other similar problems.

These aspects in the life-history of game-animals never entered the heads of the older sportsmen: they are beyond the ken of the native *shikaree*. But they will be of vital importance to those who come after us; and we have no right to deprive them of their birthright, merely to satisfy the thirst for securing records, and 'trophies'.

The United Provinces, and the world at large, owe a debt which cannot easily be repaid, to His Excellency the Governor, Sir William Malcolm Hailey, the patron of the Association, and to its founders, the joint honorary secretaries, Major J. Corbett and Mr. Hasan Abid Jafry, who are sparing no efforts not merely to secure the necessary legislation, but also, what is quite as important, to spread a knowledge of the wild-life of India among the rising generation, by propaganda work. The Association seems at present to be the only one of its kind in India, but as conditions in the United Provinces apply also to many other parts of the country, it may be hoped that similar organisations for the preservation of game will be established.

Evolution Up to Date

The Mechanism of Creative Evolution. By Dr. C. C. Hurst. Pp. xi+365. (Cambridge: At the University Press, 1932.) 21*s.* net.

BY reasoning and reasonable men, evolution is now generally accepted as an article of faith. For though it cannot be proved in the sense of a mathematical proposition, the circumstantial evidence in its favour is overwhelmingly strong. When, however, we come to inquire into the manner in which it has come about, we are at once beset with difficulties. In the earlier days of evolution, and to some extent even to-day, these difficulties resulted merely in differences of opinion. For the doctors attempted to meet them by "argument about it and about", and the seeker after knowledge "evermore came out by that same door wherein he went". To-day this is all changed: or should be. Evolution may still be an article of faith, but heredity and variation, the so-called 'principles' on which it rests, have long since become matters of definite experimental inquiry.

In the last edition of "The Origin", Darwin stated that "the laws governing inheritance are for the most part unknown", and at the same time freely confessed to "our ignorance of the cause of each particular variation". With the rise of genetics, heredity has become an exact science, even as chemistry or physics, and the worker can plan out his experiments, knowing that in the fullness of time he will obtain a definite answer to a definite problem. The study of variation, too, has made immense progress in the past few years. Definite variations have, in many cases, been tracked down to definite alterations in the chromosomal content of the cell, sometimes alterations of addition, sometimes of subtraction. Moreover, the geneticist, no longer content merely to analyse what Nature offers, is producing variation by artificial means. Just as bombardment by X- and other rays is used by the physicist to analyse the constitution of the atom, so in a milder manner is such bombardment now being used by the geneticist to analyse the constitution of the chromosome and of the gene.

All this fresh influx of knowledge concerning the processes of heredity and variation must of necessity affect profoundly our conception of the manner in which evolution has come about. New and stimulating facts have been flowing in so rapidly that no worker yet appears to have had either the leisure or the inclination to set them out in a manner which can be readily comprehended by the general reader.

This gap Dr. Hurst has essayed to fill in the volume before us. It is a volume that should make an instant appeal to all who wish to know what is going on in one of the most rapidly progressing and exciting lines of present-day biological research. It is written with a lucidity that should render it easy reading even to those whose knowledge of this branch of science is relatively small. The author has reduced his use of technical terms to a minimum, and even where they cannot be avoided, their use should present no difficulty to the uninstructed reader of ordinary intelligence.

The aim of the book is to explain how the problems of evolution appear through the new genetical spectacles. It starts with a brief account of the nature of Mendel's discovery, and of the manner in which the facts of the geneticist fit in with those of the cytologist, showing that our conception of the constitution of the living creature is largely to be expressed in terms of the chromosomes and their contained genes, which are included in its living cells.

The bearing of all this on the nature of species is more clearly realised when the author comes to a discussion of hybridisation and polyploidy, a subject on which he is an admitted expert. Experimental mutation provides an attractive chapter, as also do the somewhat speculative ones on the nature of the gene and its relations to the smallest living organisms such as the viruses and the bacteriophages.

Taking it altogether, Dr. Hurst may be congratulated on an adequate and clear, semi-popular account of a subject advancing so rapidly that to treat of it in this manner is a matter of no little difficulty. If the book obtains its deserts, a new edition should be called for at no distant date, and for that reason we may direct attention to a few minor defects. Some of the figures, for example, Figs. 42 and 47, could well do with a little more explanation. The phenomenon of 'translocation' (p. 68) would be rendered clearer if illustrated with a good diagram. 'Deficiency', though illustrated by a diagram (Fig. 52), would be clearer for a rather fuller account in the text. Though Harrison's account of the appearance of melanic *Selenia* on treatment with certain chemicals is referred to and illustrated, no mention is made of McKenny Hughes's more recent failure to confirm that account. There are a few obvious misprints,

for example, *Rhœa* for *Rhœo* (p. 78 and index), *Solensbia* for *Solenobia* (p. 259), *cerviciæ* for *cerevisiæ* (p. 274), *Collozoun* for *Collozoum* (p. 301). These, however, are minor blemishes in a book that is admirably printed and sumptuously illustrated. Though it may be rather on the expensive side, the purchaser can be assured that he will be obtaining a really beautifully produced book for his money.

Talking Pictures and Picture Telegraphy

(1) *Handbuch der Bildtelegraphie und des Fernsehens: Grundlagen, Entwicklungsziele und Grenzen der elektrischen Bildfernübertragung.* Bearbeitet und herausgegeben von Prof. Dr. Fritz Schröter. Pp. xvi+487. (Berlin: Julius Springer, 1932.) 58 gold marks.

(2) *Tonfilm: Aufnahme und Wiedergabe nach dem Klangfilm-Verfahren.* (System Klangfilm-Tobis.) Herausgegeben für die Klangfilm G.m.b.H., Berlin, von Dr. F. Fischer und Dr. H. Lichte. Pp. xi+455. (Leipzig: S. Hirzel, 1931.) 27 gold marks.

(3) *Einführung in die Tonphotographie: photographische Grundlagen der Lichtton-Aufzeichnung.* Von Prof. Dr. John Eggert und Dr. Richard Schmidt. Pp. vi+137. (Leipzig: S. Hirzel, 1932.) 7 gold marks.

(1) PROF. SCHRÖTER and the authoritative collaborators whom he has gathered round him for this important book have done a great service to the study of the scientific and technical foundations of picture telegraphy and television. This is no mere compilation from the scattered literature of these two aspects of a single problem; it is a well-knit collection of original discussions, by recognised experts of wide experience, of the fundamental physics of the subject and of the practical engineering progress achieved. It clears television of much of the empiricism and wrong thinking which has characterised the somewhat unhappy history of that most attractive of subjects; it might have been modelled on the best interpretation of the startling but, within the implied limits, perfectly fair sentence which Prof. Karolus uses in his introductory note to the book, "Es gibt nichts Wunderbares".

The eleven chapters of the book deal in turn with: the methods of image dissection in phototelegraphy; the methods of image dissection in television (telecinematography); laws, problems, and limitations of scanning; photoelectric cells; picture recording and light modulation; synchronisation of picture telegraph apparatus; the picture amplifier; wireless picture transmission; wireless picture reception; picture transmission by line; and the forms and applications of the apparatus. There is a short but useful appendix of photometric and optical data, a specially convenient name index, and an adequate subject index. In a work in which all is well done, it is perhaps invidious to select items for special mention, but Prof. Schröter's own chapters on scanning or image dissection (chaps. i and iii), seem specially valuable because of their philosophical balance.

The specimens of transmitted pictures might lead a cynical critic to ask why those mountains of scientific knowledge and technical ingenuity are made to bring forth these mice, but such an inquiry would lead beyond the bounds of technology, possibly into entanglements with technocracy, without the promise of intellectual or æsthetic satisfaction in the end. One is convinced that the picture-telegraph engineer is much less interested in the fashion-plate or finger-print he sends across continent and ocean than in the joy of sending; that the æsthetic pleasure is in the process and not in the picture.

The book is produced in the best traditions of German scientific publishing, and its somewhat high cost in sterling is fully justified by its intrinsic merit.

(2) This description of the Klangfilm-Tobis system of sound-film working, edited by members of the staffs of the Siemens-Halske concern and of the Allgemeine Elektrizitäts Gesellschaft, has much in common with the book noticed above. Both books deal essentially with alternating current technique over a wide frequency range, and both find common ground in electro-optics. Within its narrower limits of subject matter, this book has the same width of scientific outlook, the same determined attack on fundamentals before technical tricks are discussed, and the same success in bringing together practically all the material required for a full understanding of the system. Drs. Fischer and Lichte have fulfilled their aspiration towards "a comprehensive scientific work in which all questions of the modern sound-film development are treated".

The first 250 pages of the book are devoted to the physical principles of the Klangfilm system. This section opens with short discussions on the Kerr cell, the oscillograph, the optical systems for

the variable density and the variable area methods, the selenium cell, the photo-cell, the wax-disc recorder and the pick-up. Then follow chapters on the photographic principles of the variable density method, on microphones and loud speakers, amplification with special reference to tone correction, linear and non-linear distortion conditioned by the photographic process and by the apparatus, and the audibility of non-linear distortions. Adequate references by footnote and by bibliography are attached to the individual chapters.

The second half of the book contains a very full and very fully illustrated description of the individual parts of the complete Klangfilm apparatus, and ends with a short chapter on architectural acoustics and a description of the Neu-Babelsberg sound-film studios of the Ufa concern.

The copiousness of the pictorial aids to exposition is shown by the fact that the 450 pages of the text contain 378 illustrations.

(3) Prof. Eggert and Dr. Schmidt, writing from the scientific central laboratory of the photographic section of the I.G. concern, "Agfa", write in the tradition of the two works already noticed; their acknowledgments to Dr. Lichte underline the complementary relationship between this work and that of Fischer and Lichte. The book is devoted to a careful study of the part which the photographic processes play in the ultimate fidelity of reproduction from the sound-film. In the first fifty pages the authors summarise briefly but adequately the acoustic and mechanical foundations of sound-film technique; in the next fifty pages they deal with the photographic principles and processes.

The authors discuss the important differences among the characteristics of photographic response to weak illumination for several seconds, as in sensitometry, to moderate illumination for substantial fractions of a second, as in ordinary 'instantaneous' and cinematograph exposures, and to strong illumination with exposures of the order of 30 microseconds only as in sound-film photography, and show that the relative response as between the first and third cases is independent of the time of development, in a given developer. The resulting 'ultra-short-time' factor and the factor relating response to the diffuse light of sensitometry with the different response to the nearly parallel light of the sound-film processes are important in the practical control of these processes. The next section of the book deals with the frequency response characteristics of film materials, while the last section discusses the special properties of the range of "Agfa" films available for sound-film work.

The book ends with a list of references in which it is significant that the specific references to German, American and British sources are as 32 to 15 to 1, while the general list of journals dealing with sound-film questions contains three German, three American, one French and no British publications.

All three books are to be recommended to those interested in the remarkable development of the new arts based on electro-optics and electro-acoustics, and also to any who require reassurance as to the sure scientific foundations on which these typical modern industries are built, and as to the scrupulously quantitative technical knowledge which is embodied in every detail of their working.

Scott's Own Expedition

A Very Gallant Gentleman. By L. C. Bernacchi. Pp. 240+8 plates. (London: Thornton Butterworth, Ltd., 1933.) 8*s*. 6*d*. net.

COMMDR. BERNACCHI is a suitable writer for the first biography of Capt. Oates because he himself sledged over the Ross Barrier in Antarctica where the Scott tragedy occurred. He was physicist on the first expedition that wintered in the southern continent; he was also physicist in the *Discovery*, and he has introduced a little natural science into the biography. The science is well 'sugar-coated', for the book is popular though well-written. It also raises the question of publicity, commonly confused with merit, in connexion with recent expeditions; some of the best work has been done by explorers who are averse to the limelight.

Two subjects are treated in the book: the short life of Oates, and Scott's last expedition; they were closely connected, but the expedition occupies more space than the biography, which is the ninth volume inspired by this expedition, in addition to other writings and a wonderful film. Such profuse publicity is not objectionable unless it misleads those who do not know the work of other explorers.

"A Very Gallant Gentleman" is one of the best of the nine volumes for the ordinary reader, because most of its predecessors were larger and because Commdr. Bernacchi is a powerful writer.

The scenes, as he depicts them, live before the reader as vividly as in a film, even though there is little that is new; and the story was worth telling for the seventh time. The style is virile, and the pages of the book are adorned with some fine phrases and passages. Aesthetes may find the colour-tones strong, though others should not complain. There are, however, pages of irrelevant, if interesting, matter such as the description of Byrd's expedition; and there are a few inaccuracies. The *Discovery* expedition was not Capt. Scott's; he was appointed to its command. Sixty-five miles is by no means a three days' journey with dogs; Rasmussen drove ninety-four miles in one day, and 41 miles with 185 dogs on another day. In 1912 he drove four sledges, with 53 dogs, 296 miles in six days to end a journey of 630 miles in 26 days. Dog transport should not be classed with fancy sledging as if the necessity for cutting down weights to the last ounce existed. The average height of the Barrier usually accepted is 150 feet, not 200 feet above sea level.

There is also some repetition; but the book is well able to bear these small defects, and it shows that Oates was a fine character, worthy of a biography. He was lame from a wound received in South Africa where, incidentally, he was not the only officer to earn the title 'No surrender'. This book should be read by every boy as an inspiration to high endeavour, and it is hoped that the day will never come when such heroism as it depicts will be forgotten. Most of the illustrations are Mr. Ponting's. J. G. H.

Growth of Space Chemistry

Stereochemie. Von Prof. Stefan Goldschmidt. (Hand- und Jahrbuch der chemischen Physik, herausgegeben von A. Eucken und K. L. Wolf, Band 4.) Pp. xiii+311. (Leipzig: Akademische Verlagsgesellschaft m.b.H., 1933.) 29 gold marks.

FOR a long period Alfred Werner's classical "Lehrbuch der Stereochemie" (1904) held undisputed sway as the standard work on this branch of science. With the passage of time, and more particularly during the last few years, the need has become manifest for a fresh and up-to-date treatment of a rapidly expanding field of science which now claims the interested attention of chemist and physicist alike. Accordingly, several books dealing with the subject of spatial chemistry have appeared lately in rapid succession. None of them can be held to be entirely satisfying.

A glance at the list of contents of Prof. Goldschmidt's volume conveys the impression that he has fully covered his extensive field. There are sections on the stereochemistry of carbon, nitrogen and other elements; optical rotatory power and chemical constitution; and spatial configuration and reaction-velocity; while Dr. R. Bloch contributes a concluding section on the relationships existing between stereochemistry and crystallography. It may be said at once that the major part of the book can be read with pleasure and profit, and that it constitutes a useful contribution to the literature of stereochemistry.

After undertaking a detailed examination, however, one is left with the impression that the book falls between the two stools of a students' textbook and a work of reference. Moreover, although some of the sections do not call for serious criticism, others are unbalanced and show signs of hurried and uncritical compilation: here, much unnecessary information has been included, and there, the account is flimsy. In general, also, scant justice has been done to the work of British stereochemists.

The weakest part of the book is the treatment of methods of optical resolution—a subject of primary importance in a treatise on stereochemistry. The description of the method of spontaneous separation contains no mention of Purdie's fundamental work on inoculation—in fact, Purdie's name does not appear in the book. The particularly interesting example of the *iso*hydrobenzoins also passes unnoticed: but for this, the author would probably have modified his earlier statement (p. 18) that "experimentell nicht sicher geklärt ist die Frage, ob die Spiegelbildlichkeit der Moleküle auch *stets* in der Asymmetrie der Kristalle zum Ausdruck kommt" (compare *J. Chem. Soc.*, 2307; 1929). Here, as is so often the case in recent publications on stereochemistry, the author reproduces an opinion or statement from an earlier work without revising it in the light of later research. McKenzie's activation of racemic acid with *l*-malic acid has no bearing upon the work with which the author associates it in this section.

The description of Pasteur's second method of optical resolution and its extensions is similarly lacking in essentials. Some of the optically active camphor acids are mentioned, it is true; but there is no direct indication of the enormously important part these fundamental stereochemical reagents have played in the development of this branch of science. Incidentally, the formation of partial racemates in this type of resolving process

is much commoner than the author supposes ; and he does not mention other difficulties, such as the frequent formation of solid solutions, and the great tendency towards racemisation when the asymmetric molecule contains fewer than three carbon atoms. The method of resolving *dl*-alcohols by direct esterification—probably the most effective of all—is not noticed.

Hydroxymethylenecamphor, a stereochemical reagent of outstanding interest and value, is not referred to in the book. The ordinary use of this substance as a resolving agent is well known ; but perhaps the most striking example of an optical resolution achieved by the so-called dynamic modification of Pasteur's second method is that of *dl-ac.*-tetrahydroquinaldine with *l*-hydroxymethylenecamphor (1913). The reaction is almost instantaneous ; the two diastereoisomeric products are formed in the approximate proportion of 3 : 2 ; and the excess of one of them is easily removed. This remarkable optical resolution has found no mention in any textbook of stereochemistry known to the reviewer.

The note—for it is little more—on the biochemical method of optical resolution is quite inadequate. Indeed, the biochemical aspects of stereochemistry receive surprisingly little attention in any section of the book, and this strange neglect extends even to the brilliant series of investigations conducted in this field during recent years by Neuberg. The statement that *Penicillium glaucum* destroys only the *d*-component of ammonium racemate is another example of failure to correct an earlier and inaccurate opinion.

In the account of spirane derivatives (p. 40) the omission of Pope and Whitworth's *spiro*-5, 5-dihydantoin (1930) is regrettable, as this substance is the most interesting optically active compound of the class. Reference should have been made also to diamino-*spiro-cyclo*heptane (1932), the optical resolution of which is more impressive than that of the related *spiro-cyclo*heptanedicarboxylic acid. A somewhat similar remark applies to the omission of the diphenylethylene oxides (1930) in a discussion of the diagnosis of *trans*-forms by optical resolution (p. 118). In a different field, some attention should have been devoted to the numerous interesting publications by McKenzie and his coworkers in the last few years on the retention of optical activity during the migration of groups in de-amination and dehydration processes directly affecting the sole final asymmetric carbon atom in the system. The name of Tiffeneau does not occur in the narrative at all ; and there is no reference to the optically active benzoins, with their important bearing upon the preparation of glycols and upon racemisation. The treatment of racemisation, asymmetric synthesis, and the Walden inversion is inadequate and partly incorrect : for example, at least four inaccuracies occur in the allusions to asymmetric synthesis on page 29, and the reference on the following page to the work of Marckwald and McKenzie is unintelligible.

A failing which this book shares with other recent Continental publications on chemistry is the gross carelessness shown in quoting names of investigators. We meet in Prof. Goldschmidt's pages such metamorphosed colleagues as W. Markwald, M. Lowry, F. Armstrong, A. N. Champbell, W. Cloogh, M. St. Lesslie, S. Patterson, P. Jakobson, H. Pillips, M. Jaeger and W. S. Keutish ; H. Pickard in the text reverts to R. H. Pickard in the footnote (p. 24) ; W. J. Pope and S. J. Peachey appear in their normal guise on p. 83, but reappear later in sundry disguises, such as J. Pope and St. J. Peachey and W. J. Pope and J. Peachy ; sometimes only one author is quoted for a collaborative paper ; O. Jones publishes in the "Pr. Cambridge Soc." ; another investigator is made to disprove his own work after his decease (p. 167) ; and the present reviewer is resolved into a dual personality, both in text and index, owing apparently to his having undergone a Walden inversion, resulting in a change from the *R*- to the *L*-form !

Such mistakes, if sometimes trivial, are irritating and indefensible ; moreover, they appear to pass from one book to another. Inaccuracies in such points are unworthy of a book of the kind under notice, and they are apt to undermine the confidence of the reader. As examples of more serious errors, the following may be noted : "β-phenylethylamine" appears for "α-phenylethylamine" throughout the book ; mandelic acid is not converted by nitrous acid into phenylaminoacetic acid (p. 94) ; no such compound as that indicated at the foot of p. 24 was described by Pasteur ; and the alkaloids originally used by Pasteur in the optical resolution of racemic acid (1853) were cinchonicine and quinicine, and not cinchonine, as stated (p. 23).

The book is excellently produced, and the numerous diagrams are neat and effective. The index could be improved. The price, which at the present rate of exchange is about £2, is high.

JOHN READ.

Short Reviews

(1) *Logarithmetica Britannica: being a Standard Table of Logarithms to Twenty Decimal Places.* By Dr. Alexander John Thompson. Part 5: *Numbers 50,000 to 60,000.* (Tracts for Computers, No. 17.) Issued by the Biometric Laboratory, University of London, to commemorate the Tercentenary of Henry Briggs' publication of the *Arithmetica Logarithmica*, 1624. Pp. iv+100. (Cambridge: At the University Press, 1931.) 15*s.* net.

(2) *Primes and Factors.* Computed by Emma Gifford. Pp. vi+94. (Manchester: Printed by Abel Heywood and Son, Ltd., 1931.)

(3) *The Nomogram: the Theory and Practical Construction of Computation Charts.* By H. J. Allcock and J. Reginald Jones. (The Specialists' Series.) Pp. viii+209. (London: Sir Isaac Pitman and Sons, Ltd., 1932.) 10*s.* 6*d.* net.

(1) PART 5 (the fourth to be published) contains the logarithms of the integers from 50,000 to 60,000. The frontispiece is a photographic reproduction of the title page of Briggs' "Arithmetica Logarithmica" (1624).

(2) Every prime number which is greater than 10 is included in the form $N = 6x \pm 1$. This volume gives all values of N from $x = 2$ to $x = 16{,}731$ together with the factors, if any. The table therefore contains all primes between 11 and 100,379. The terminal digits of each group of eight consecutive numbers are 1, 3, 7, 9, 3, 9, 1, 7 in this order. Each column of the table contains 56 numbers. With this arrangement, all numbers N in the same horizontal line have the same terminal digit. It is thus easy to find and factorise any number which falls within the limits of the table. The pages are well arranged and clearly printed. The volume should prove very useful.

(3) Alignment charts and other forms of nomogram are now widely used for rapidly obtaining approximate values of a number which is given by means of a formula containing several variables. The present volume combines successfully a study of the theory with practical directions for the construction and use of computation charts. The theory is based upon the determinant, the evanescence of which expresses the condition of collinearity of three points. The method is easily apprehended and readily applied. L. M. M.-T.

My Life and Thought: an Autobiography. By Albert Schweitzer. Translated by C. T. Campion. Pp. 288+8 plates. (London: George Allen and Unwin, Ltd., 1933.) 10*s.* 6*d.* net.

THIS book makes large demands on the reader, who is left to discover for himself the real eminence of Schweitzer alike as preacher or theologian, as musician, as doctor and as philosopher. In spite of the wealth of material for a romantic and heroic biography, there is little of the wide appeal of Schweitzer's narratives of his work in Lambaréné—"On the Edge of the Primæval Forest" and "More from the Primæval Forest". Apart altogether from the interest which any such attempt to face the fundamental problems of civilisation, to relate ethical and moral with material progress and values must possess, a rare and unmistakable honesty pervades the book which should give it added interest to the scientific worker. Here is a man of fourfold eminence facing frankly some of the fundamental problems of this generation, and, in his exposition of philosophy, giving us the clue to the understanding of the preacher, the musician, the physician.

Schweitzer's consideration of the relations between civilisation and ethics and attempt to discover the causes of the world catastrophe in a false world view, or sense of values, is somewhat pessimistic and leads him to conclude that there is no natural order of life values which man can discover. He adopts in consequence the principle of reverence for life as the only guide, and attacks the spirit of the age for its disdain for thinking, for the discouragement given to the individual to arrive at his convictions by his own thinking. "Renunciation of thinking," he declares, "is a declaration of spiritual bankruptcy. Where there is no longer a conviction that men can get to know the truth by their own thinking, scepticism begins." He attributes the difficulties of the machine age to the absence of a world view capable of counteracting tendencies destructive of civilisation. A challenging note, an almost passionate effort for honesty and sincerity of thought, breaking through the pessimism of the thought, like the inspiration of the man's personality no less than of his achievements, relieves the sombreness of what is near to being a disappointing book. Schweitzer writes shrewdly on problems involved in the relations of the backward races of Africa and European civilisation and his sense of service and missionary outlook are never allowed to deflect his scientific observation or judgment. R. B.

(1) *Ergebnisse der kosmischen Physik.* Herausgegeben von V. Conrad und L. Weickmann. Band 1. (Gerlands Beiträge zur Geophysik, Supplementband 1.) Pp. xi+448. (Leipzig: Akademische Verlagsgesellschaft m.b.H., 1931.) 46 gold marks.

(2) *Atmospheric Electricity.* By Dr. B. F. J. Schonland. (Methuen's Monographs on Physical Subjects.) Pp. vii+100. (London: Methuen and Co., Ltd., 1932.) 2*s.* 6*d.* net.

(3) *Die Aufrechterhaltung der elektrischen Ladung der Erde.* Von Prof. Dr. Egon Schweidler. (Probleme der kosmischen Physik, herausgegeben von Prof. Dr. Christian Jensen und Prof. Dr. Arnold Schwassmann, Band 15.) Pp. iv+68. (Hamburg: Henri Grand, 1932.) 5 gold marks.

(1) THE title of the first of these books is somewhat misleading, its subject being geophysics, and having

only incidental connexions with extra-terrestrial phenomena. The book is a contribution of exceptional value to the compilation-literature of science. It opens with an admirably comprehensive and concise account (86 pages) of auroræ, by C. Størmer, which is beautifully illustrated. Then follow two articles on special aspects of the penetrating radiation, namely, the barometer effect and the absorption coefficient, by W. Kolhörster and L. Tuwim; an account of atmospheric ozone, by P. Götz, and of abnormal sound-propagation in the atmosphere, by P. Duckert; and articles on geodesy, by F. Hopfner, and upon waves in air, water, and on sand, by F. M. Exner. The book is well bound and well printed, but its high price is regrettable.

(2) and (3) The present undue costliness of books published in Germany is emphasised by the other two books here noticed; they deal with substantially the same subject, and with about equal authority. The English book, unlike the German one, is bound, and is printed on equally good paper; it is in slightly smaller type, but contains about 25 per cent more words than the other; its price, even apart from the depreciation of sterling, is about half that of the German book.

Schonland's book gives an admirable short review of the electrical phenomena of the lower atmosphere, up to 10–15 km., and includes a chapter on the penetrating radiation. Schweidler limits his account to one special (but central) problem of atmospheric electricity, the maintenance of the earth's charge; he is more diffuse than Schonland, and while the latter does not cover every topic discussed by Schweidler, his book is undoubtedly the better introduction to the subject.

Blackboard Coloured Diagrams: Biological Series. Rana temporaria (The Common Frog). 44 in. × 31 in. *Rana temporaria* (Skeleton). 44 in. × 31 in. *Rana temporaria* (Brain and Nervous System). 44 in. × 31 in. (London: Sidgwick and Jackson, Ltd., 1933.) Mounted on cloth, eyeletted, 10*s*. 6*d*. each.

THESE diagrams are printed upon a black background as if drawn upon a blackboard and the actual area covered by the illustrations is 40 in. × 29 in. on each sheet. No names or key letters are provided and this is in some ways an advantage since it allows the instructor to give as many or as few technical names as may be thought desirable and enables them to be used for questioning. From their size they are adapted for use with small classes, say up to 50 but not to large lecture theatres accommodating 200–300 students. Even then, some of the smaller drawings, as, for example, the end-on view of the atlas vertebra and the diagram of the relationship of the dorsal and ventral nerve roots to the skin and a piece of muscle, are so small that they could only be seen properly in the front rows and would need to be examined at closer range by the students.

The diagrams are not all of the same standard. That of the skeleton is the best and reaches a high standard. The general illustration of the viscera is not quite so good nor is that of the nervous system, even allowing for the fact that they are not such satisfactory subjects for treating in this manner as a skeleton. In the former, some of the viscera are rather 'wooden' in appearance, for example, the fat bodies, and in the latter the general drawing of the nervous system is much like that of Ecker, which is very diagrammatic and exhibits an arrangement of the sympathetic nerves unlike that seen in ordinary dissection. Apart from these relatively minor points, the diagrams are well drawn and executed and should prove useful in schools and institutions where the classes are not large.

Reports of the Progress of Applied Chemistry. Vol. 17, 1932. Pp. 728. (London: Society of Chemical Industry, 1933.) 12*s*. 6*d*.; to Members, 7*s*. 6*d*.

THE volume of reports on the progress of applied chemistry during 1932 has appeared with customary promptitude and again reaches a high standard. This annual publication is one which few progressive chemists neglect to study. Many regard it as among the most useful books in their own libraries, and none can afford to ignore it. Moreover, dealing as it does with the general outline of progress in the various chemical industries and of industries in which chemistry enters as an aid to control and development, as well as describing very many of the more important technicalities underlying present and future progress, it appeals to the interest of the non-technical man who desires to keep *au fait* with the march of events in extremely important branches of the world's work.

The reports are presented in familiar form, are fully annotated with references to original papers and summaries to be found in "British Chemical Abstracts", and are provided with name and subject indexes. The report on explosives covers the years 1931 and 1932, and that which formerly dealt with fibres, textiles, cellulose and paper has been expanded into two separate reports. A. A. E.

Wanderers Wetterbuch: Einführung in das Verständnis der Wettervorgänge. Von Dr. Otto Myrbach. Pp. vi+184. (Leipzig: Verlag Berg und Buch, n.d.) n.p.

To anyone with a love of Nature and a moderate knowledge of German, this book should make a definite appeal. The reader is introduced step by step to the elements of weather, the movements of air masses, clouds, rain and fine weather. Official forecasts and their application to local conditions are explained and this chapter is supplemented by one on local weather signs, but the largest and most interesting part of the book deals with weather in the mountains, ending with a four-act drama of a storm on the Zugspitze.

Forest Fires in Relation to Soil Fertility

By PROF. F. P. WORLEY, Auckland University College, New Zealand

WHEN the early colonists arrived in New Zealand, the greater part of the present cultivated land of the North Island and much of that of the South Island were covered with dense forests, which have since been removed by burning, the general practice being to remove millable timber, fell the remainder, burn out as completely as possible and sow with grass. Much of the forest was, however, burned without felling, sometimes by accident but often intentionally.

Although large areas of native forest still remain, the bush in the South Island is largely confined to mountainous regions. In the North Island, although the greater part of the remaining bush is on mountain ranges, there is still a large area of bush land that will gradually be brought into cultivation. The method of forest removal is not far removed from the primitive methods employed by some African native tribes.

Although it may be conceded that burning is the only practicable method of bringing bush land into cultivation, far too little consideration appears to have been given to the influence of forests on soil fertility and to the possible damage to the soil by the methods of burning employed. It is very obvious in numerous cases that areas formerly covered by luxuriant bush frequently have surprisingly low fertility. It has only to be recalled that the poor 'gum lands' of the North Auckland peninsula were once covered by dense kauri forests full of rich undergrowth. In other parts of the country, hillsides formerly covered by good bush, such, for example, as the coastal districts north of Wellington, have a fertility sadly below that to be expected from the luxuriance of the former bush.

It is necessary to inquire whether this apparent deterioration of fertility may be due to the method of forest removal and, for this purpose, consideration must be given to certain aspects of the part played by the forest in bringing virgin rocky land into a condition of fertility. The process can be observed on the volcanic island of Rangitoto at Auckland, where a formerly barren island of rough basalt is in process of being converted by the bush into rich, fertile land. It is not known how many hundreds of years it has taken for the island to reach its present degree of fertility, or how long it will be before the rocks are covered with fertile soil, but the process of humus formation is plainly obvious. What is not obvious, however, is the process of bringing to the surface and making available for plant growth the mineral constituents of the rocks.

The only artificial fertilisers intentionally applied to the land for agricultural purposes, apart from lime, are those supplying potassium, phosphorus and nitrogen. It is now recognised, however, that most of the other common elements occur in plants, though generally only in minute amounts, and that some of these minor constituents are essential to plants and to animals. Some may be present only fortuitously, but it is impossible to deny that they may have specific functions. Manganese and copper, for example, have been found in all plants investigated and are associated with rapidly growing parts, such as buds and leaves, and probably have a functional importance.

The small amounts of such elements in the soil are extracted by the roots of trees and transported to the growing parts, being eventually shed in the falling leaves, thus enriching the surface soil. This enrichment of the surface soil at the expense of the deeper soil by trees was clearly shown in the case of manganese by Bishop[1], and further investigations of a similar nature are desirable. Maquenne and Demoussy[2] examined the distribution of copper in a number of cultivated trees and shrubs and found the copper concentrated in the actively growing parts. Analyses of various parts of the native karaka tree have shown that the copper is concentrated in the leaves and seeds of this tree, and the same will probably be found in the case of other native trees. Copper is present normally only in minute amounts in the soil, but is gradually brought to the surface, like manganese, by tree growth. It is obvious that forests, besides building up a surface layer of humus, exercise the very important function of bringing to the surface various chemical elements extracted from the deeper soil. This process is cumulative and may extend over many hundreds of years.

In view of these considerations, it is possible to appreciate the damage that may be done by forest fires. Not infrequently the burning is sufficiently thorough to burn away the humus. On hilly ground the ash may be almost entirely washed away by rain, with the result that the beneficial cumulative work of the forest carried on over vast periods may be destroyed in a day. Unless the ash and the humus can be retained, the work of the forest has been not only in vain, but even actually detrimental, in that the soil to the depth of the tree roots will have been impoverished in minor mineral constituents essential to healthy growth of plants and animals.

On flat land the floor of the forest is usually damp. Here there is less likelihood of complete destruction of humus by fire and of ashes being washed away either mechanically or in solution, except on very porous soil, but on hill and mountain-side the destructive effects of bush fires may be disastrous.

The comparative infertility of the gum lands north of Auckland is probably due very largely to the destruction of the forests and the surface soil of the hills by great fires. In the low-lying and swampy gum lands a layer of ashes, covered

often by many feet of black peat, overlies the remains of a kauri forest. Frequently, at a lower level there is another layer of ashes above the roots of a still earlier kauri forest. The prehistoric fires that destroyed these forests doubtless destroyed the forests on the hilly ground, where kauri gum occurs very near the surface. The humus on the sloping ground was apparently destroyed and the ashes washed down into the sea. In recent years the scrub has been burnt off by gum diggers and others and further damage done to the fertility of the soil.

On very porous soil the mineral constituents of ash derived from forest fires may be washed down through the soil. Should there be a tendency towards any mineral deficiency in such soil, this deficiency may be greatly intensified by leaching. On soil of this nature it would appear desirable to grow deep-rooting crops to bring to the surface the small amounts of essential minerals, and to produce a retentive layer of humus. Much working, with consequent drainage and leaching of the surface soil, should be avoided.

It appears probable that humus may have mineral as well as biological importance and more analyses are desirable of its mineral content, particularly for those elements that occur only in minute amounts in underlying soil or rock. It is obvious that if the normal soil and rock is in any way deficient in minor mineral constituents essential to the full health of plants or animals, this deficiency will become serious if the humus in which such constituents have become concentrated is destroyed and the ashes removed.

[1] *Australian J. Expt. Biol. Med. Sci.*, **5**, 125; 1928.
[2] *C. R. Acad. Sci.*, **170**, 87; 1920.

Canadian Water Power Development in 1932

By DR. BRYSSON CUNNINGHAM

THE strides by which Canada continues to advance in the exploitation of the water power resources of the Dominion for the generation of electricity are as remarkable as the abundance of the resources themselves. According to a report[1] recently issued by the Water Power and Hydrometric Bureau of the Department of the Interior, the total turbine installation at the end of 1932 amounted to more than seven millions (7,045,260) horse power, showing an increase of 378,923 horse power over the corresponding figure for the previous year. This gives an average of 670 horse power per 1,000 of population, a ratio which places Canada in an outstanding position among the water power-using countries of the world.

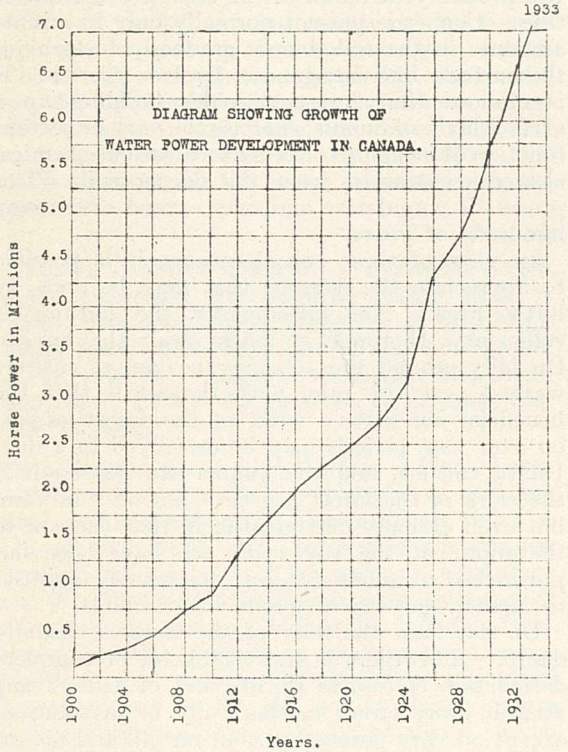

FIG. 1.

The remarkable character of the progress which has been made since the commencement of the present century will be best appreciated by a glance at the graph in Fig. 1, reproduced from the report. In 1900, the quantity of power realised was less than a quarter of a million horse power: it was still less than a million ten years later. By 1920, however, it had reached $2\frac{1}{2}$ millions, and in 1930, $5\frac{3}{4}$ millions. Between 1928 and 1930, progress was at the rate of half a million horse power per annum, and practically the same rate prevailed up to the beginning of 1932. Last year, there was a slight falling off, but this does not necessarily imply any relaxation of effort, since the additional power is only recorded on completion of the particular undertaking from which it emanates, and anything from two to five years may be required for the execution of individual projects. Various schemes are at present under way, most of which had their inception three or four years ago, before the general suspension, or retardation, of industrial expansion, due to the world-wide financial depression set in. In common with the experience of nearly all countries, there has been of late years a definite decrease in the demand for power, which reached its greatest intensity in the middle of 1931. A recent statement[2] of the Minister of the Interior, the Hon. Thos. G. Murphy, gives, however, a hopeful impression. "More stable conditions," he says, "now appear to have been established, since the figures for the first ten months of 1932 indicate that electric energy produced for use in Canada is practically the same as for the corresponding period in 1931—an encouraging feature being that in August, September and October, the last three

months for which statistics are available, an increase has been recorded."

The additional installations brought into operation during the last twelve months were located in five different provinces, but more than 97 per cent of the power was limited to three of them, and the largest of all the installations was made in the province of Quebec. The Beauharnois Light, Heat and Power Corp., Ltd., of Montreal, completed an initial instalment on the St. Lawrence River of 200,000 horse power (Fig. 2), forming part of a programme of half a million horse power designed to be realised in the course of the next few years, with a possible ultimate extension to two million horse power. This notable enterprise was begun in August 1929. It includes the construction of a canal (Fig. 3) about fifteen miles long into which is diverted about a quarter of the flow of the St. Lawrence, which averages some 220,000 cu. ft. per second. In addition to developing hydro-electric power, the new waterway, which is 3,000 feet wide, with a channel for shipping 600 ft. wide and 27 ft. deep, will complete the canalisation for deep-water navigation of all the wholly Canadian sections of the St. Lawrence, with the exception of a single reach round the Lachine Rapids at Montreal. The western entrance is on the southern bank of Lake St. Francis, a mile or two from the town of Valleyfield, whence it follows a wide curve until it enters Lake St. Louis near the town of Beauharnois, where the power house is situated. The fall at this point is 83 ft., representing the total difference in level between the two lakes. The power house contains accommodation for the reception of ten units of generating plant, each of a capacity of 50,000 horse power, and four of these machines are now in operation. Provision has been made for the extension of the building to a length of 3,000 ft., if and when it is called upon to take the entire flow of the river. The cost of the 500,000 horse power scheme has been estimated at a little less than 13 million pounds sterling.

The foregoing particulars have been extracted, and the diagrammatic sketch map in Fig. 3 reproduced, by kind permission, from a brochure issued by the Beauharnois Light, Heat and Power Corp., Ltd., of Montreal.

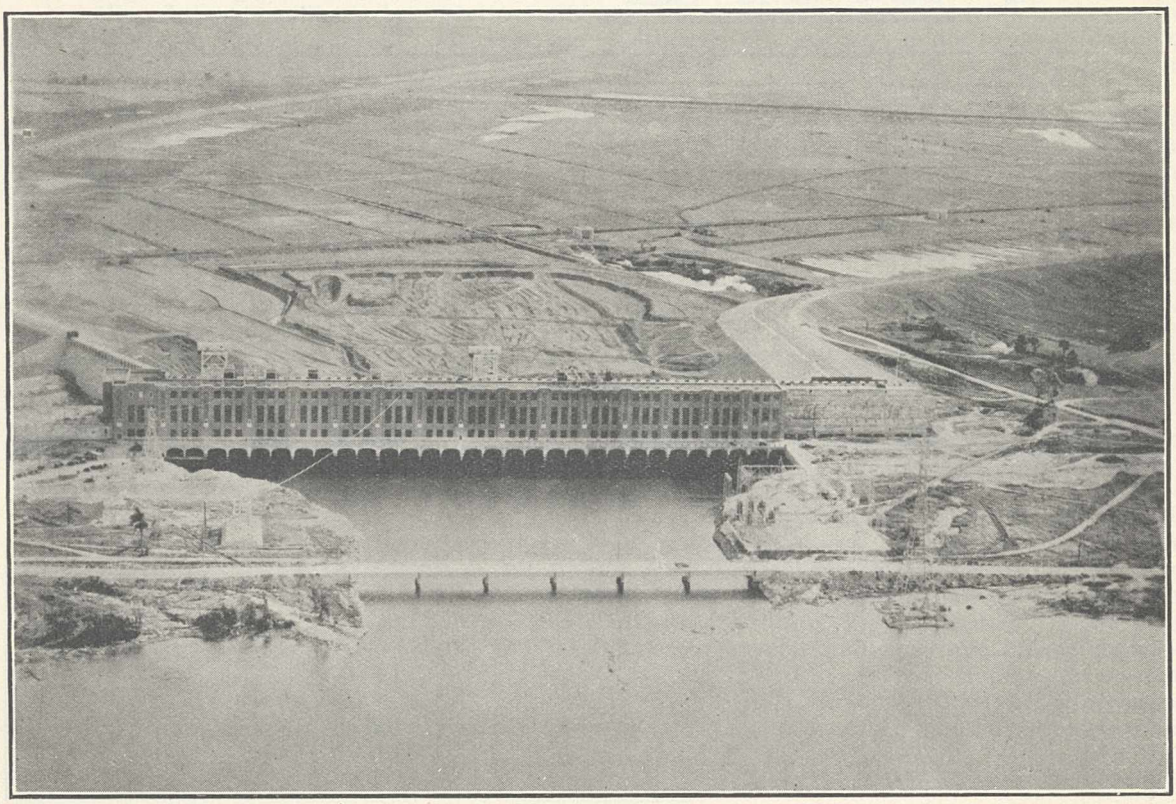

FIG. 2. Beauharnois Development, St. Lawrence River. By courtesy of the High Commissioner of Canada.

Of the other two major installations, one of 56,000 horse power was the joint development of Chats Falls by the Ottawa Valley Power Co. Ltd., and the Hydro-Electric Power Commission of Ontario, and the second of 57,000 horse power at Corra Linn on the Kootenay River in British Columbia.

The accompanying table, which appears in the report under consideration, shows the available and developed water power in the whole of the Dominion, as recorded on January 1, 1933. The figures in columns 2 and 3 are minimum values,

Available and Developed Water Power in Canada, January 1, 1933.

Province	Available 24-hour power at 80 per cent efficiency		Turbine Installation, H.P.
	At ordinary min. flow, H.P.	At ordinary six months flow, H.P.	
(1)	(2)	(3)	(4)
British Columbia	1,931,000	5,103,500	713,792
Alberta	390,000	1,049,500	71,597
Saskatchewan	542,000	1,082,000	42,035
Manitoba	3,309,000	5,344,500	390,925
Ontario	5,330,000	6,940,000	2,208,105
Quebec	8,459,000	13,064,000	3,357,320
New Brunswick	68,600	169,100	133,681
Nova Scotia	20,800	128,300	112,167
Prince Edward Island ..	3,000	5,300	2,439
Yukon and North-west Territory	294,000	731,000	13,199
Total ..	20,347,400	33,617,200	7,045,260

is capable of producing an economy of more than 35 million tons of coal per annum.

The actual saving in any year depends, of course, upon the actual kilowatt hour output of the plants during the year. Based upon the actual output of central electric stations, it is estimated in the report under consideration that the equivalent electrical production of the total water power installation in 1932 was approximately 18,300,000,000 kilowatt hours. Applying to this a moderate figure of 1·55 lb. of coal per kw.h. (based upon the average consumption of coal and coal equivalent per kw.h. during 1930 by all plants in the United States producing electricity for public use) there is indicated an actual saving for the year 1932 of more than twelve million tons of coal.

FIG. 3. Sketch map of Beauharnois hydro-electric power development.

and should be increased by 30 per cent if they are to correspond with the values obtained from actual installations. Accordingly, the total potential water power of the country may be reckoned at about 43,700,000 horse power.

It is of interest to form some idea of the economic value of these installations in saving of fuel. The coal equivalent of water horse power is not altogether easy to determine for lack of definite information about operating conditions of individual plants, but basing a comparison on fuel power elsewhere, a conservative estimate, under current conditions, indicates that, if operated continuously throughout the year, each installed horse power would effect a saving of approximately $5\frac{1}{16}$ tons of coal, so that the present aggregate installation of more than 7 millions horse power

In view of the outstanding economic value of its water resources, it is not surprising that the capital invested in the various undertakings should exceed that invested in any other manufacturing industry of Canada. It is computed on a conservative basis that the aggregate amount of the capital involved is 1,620 million dollars or about £324,000,000 at par.

The scope for further development is, of course, considerable, and with so many examples of the remunerative value of this class of undertaking, progress bids fair to be continuous at a rapid rate for a number of years to come. Little more than 16 per cent of the total potential power is yet harnessed.

[1] "Water Power Resources of Canada." Bulletin No. 1623.
[2] "Hydro-Electric Progress in 1932."

Geophysical Prospecting

IN prospecting for minerals, oils, water, etc., use can be made of the physical characteristics of the materials near the earth's surface. The methods at present adopted can be divided into four groups. The first group utilises the magnetic susceptibility of the materials, the second their density, the third their elasticity and the fourth group comprises various electric methods. The second group comprises the 'gravimetric' methods and the third the 'seismic'. In some cases two or more methods can be applied to the same area and so unwanted factors can be eliminated. The gravimetric method was made possible in 1888 when Baron von Eötvös published his work on the torsion balance. In 1914 Mintrop demonstrated experimentally the possibilities of the seismic methods. Prof. A. O. Rankine discussed the development of geophysical prospecting in his presidential address last year to Section A of the British Association at York.

In a paper read to the Institution of Electrical Engineers on April 7, J. M. Bruckshaw gave a detailed account of the electrical methods of surveying. As a rule, the interpretations of the electrical surveys are of a qualitative nature and in this respect they are not so good as the gravitational and seismic methods, which give indications of the depth and size of the material for which search is made.

There is now a tendency to develop more precise electrical methods with the object of placing them on a quantitative basis. The importance of making a preliminary geological survey and determining the resistivity of samples of the rock in the neighbourhood is now recognised. The results found in this way impose limitations on the use of the various methods that can be applied. If a known mass of ore occurs in the region under test, the interpretation of the results is greatly simplified by conducting the electrical survey directly over the known body.

As an example of the utility of geo-electrical prospecting, the case of a survey made by Mr. Broughton Edge in Cyprus was described. Mineralisation was suspected from the indications of old Roman activities in the neighbourhood. This led to the ground being examined by means of four adits and three shafts, but without result. Within three days of starting the electrical surveys, the centre was plainly indicated by the equipotential lines. The interpretation was confirmed by driving two adits and these encountered a large pyritic mass, the upper end of which lay immediately below the centre. Although the surface of the ground was very rough the equipotential curves on the map were smooth.

In survey work, rocks and minerals are divided into two classes, metallic conductors and electrolytic conductors. Practically all minerals showing metallic lustre are in the first class. In nearly all methods of electrical prospecting, an equipotential line method is first employed as this takes very little time and locates the most promising areas. These areas do not necessarily represent mineral deposits, for bands of clay and graphite-impregnated schists, etc., yield the same type of anomaly as an ore body. In some cases, geophysics may differentiate between a mineral deposit and a band of clay, but it is generally the geologist who determines which of the indications are caused by ore.

The depth to which the ground can be examined depends on the kind of method used. In the resistivity methods, the ground examined penetrates to a depth approximately equal to the distance between the electrodes. With great depths the results obtained are difficult to interpret. As a rule, it is not convenient to use currents greater than five amperes. Good results are sometimes obtained by using high-frequency alternating currents.

Obituary

PROF. VICTOR GOLDSCHMIDT

SCIENCE has to deplore the loss of another of her 'grand old men', Germany one of her most distinguished sons, and the world of culture at large one of the most accomplished, versatile and beneficent of its exponents, in the passing on May 8 of Prof. (Herr Geheimrath) Victor Goldschmidt, honorary professor of mineralogy and crystallography at the University of Heidelberg, at the ripe age of eighty years. His name has long been a household word with the small, but now happily increasing, coterie of workers in crystallography, which he was fond of calling the "Queen of Sciences"; and he was never tired of expressing his intense delight in the wonderful beauty of crystals. Yet so wide were his interests that in many other subjects he was almost equally distinguished, particularly ethnography, astronomy, physiology, colour in art, and tone and harmony in music. Having inherited great wealth—sadly depleted afterwards by the War—he was able to advance the interests of his subjects to an exceptional degree, and became a 'pious founder' in the truest sense of the term.

Born in Mainz on February 10, 1853, of Jewish stock, in the year 1871 he became a student of the Gewerbakademie of Berlin. Then from 1872 until 1878 he attended the celebrated Bergakademie of Freiberg, and during his last three years there acted as an assistant. In order to acquire further experience, however, he migrated in 1878 to the School of Mineralogy and Crystal-

lography then growing up in Munich, which later became so famous under the guidance of Prof. von Groth; afterwards, in 1879, he went on to Heidelberg, where he took his degree of doctor of philosophy in 1880.

Prof. Goldschmidt had the inestimable advantage of the life-long help of a devoted and highly intellectual wife, a first cousin (formerly Fräulein von Portheim), who was both a remarkable linguist and keen appreciator of music and art in all its branches. Their home in Heidelberg, where they lived very simply and unostentatiously, but where they literally lavished hospitality and kindness on their many foreign visitors, was replete with valuable art treasures, such as Italian illuminated manuscripts, very early examples of printing, ancient French *objets d'art*, gems of every kind and a wonderful collection of crystals.

The laboratory of Prof. Goldschmidt at Heidelberg is a private one, which was provided and maintained at his own expense, but with the full concurrence of the University. He usually had working there, under his direction and that of his assistant Dr. Himmel, in mineralogy and crystallography, some ten to fifteen students, and also another half-dozen of more experience engaged in research, either for their doctorates or in a still more mature class of investigation. To this remarkable institution were attracted students possessing some previous experience from all over the world, including quite a number from England (especially Oxford and Cambridge) who were always warmly welcomed. Eventually in 1916 Prof. and Frau Goldschmidt definitely endowed the laboratory, together with an Institute for Folk-lore, and an ethnographical museum which they had also provided, as the "Josefine und Eduard von Portheim Stiftung für Wissenschaft und Kunst", in honour of their parents, Prof. Goldschmidt's mother and Frau Goldschmidt's father. Provision was also specially made for an English research bursary of about £150 per annum, to enable an English student of experience and promise but not too well provided with means to work with Prof. Goldschmidt, and incidentally to further friendship between Germany and England. On the eightieth birthday of Prof. Goldschmidt last February, the laboratory was formally named the Victor Goldschmidt Institut für Krystallforschung.

The published scientific papers of Prof. Goldschmidt form an immense list, numbering about 180, many of them masterpieces on specific minerals. Besides these papers he produced in the years 1914–26 the "Beiträge zur Krystallographie und Mineralogie", and since 1922 the "Heidelberger Akten der von Portheim Stiftung", and the "Materialen zur Naturphilosophie". Perhaps his most valuable contributions concerned blowpipe methods, which he carried to perfection, for the determination of minerals; crystal measurements by the theodolite method (azimuth and polar distance), using the two-circle goniometer which he perfected; and crystal drawing and calculation from the gnomonic projection, which he considerably elaborated. When we add to these his papers on etch- and solution-figures on crystal faces, his "Index der Krystallformen der Mineralien", his "Krystallographische Winkeltabelle", and last but not least his monumental "Atlas der Krystallformen" (1923) in nine volumes of figures and a like number of volumes of text, which took many years to complete, it will be obvious what a magnificent addition to our knowledge Prof. Goldschmidt has left behind him.

On the occasion of his seventy-fifth birthday Goldschmidt was presented with a "Festschrift", containing thirty-three original papers on mineralogy and crystallography, entirely contributed by his old students and a few personal friends; they included one from the late Dr. T. V. Barker of Oxford, and another by Dr. Mary Porter of the same University, who had received great kindness from Prof. Goldschmidt and his wife during the period of her work at his Heidelberg laboratory before the foundation of the bursary. It was published by the von Portheim Stiftung, under the editorship of Dr. Himmel, and with a foreword of appreciation of Prof. Goldschmidt's work by Prof. Milch. Prof. Goldschmidt was an honorary member of the Mineralogical Society in Great Britain, and of a dozen other scientific societies outside Germany.

Last December and January, Prof. and Frau Goldschmidt were in England, staying with the former's brother in London, and although when visiting the Master of Pembroke and Mrs. Hutchinson in Cambridge he appeared to be wonderfully vigorous, yet his relatives were then very anxious about his health. On leaving England they did not return home, but travelled to Salzburg in Austria, and before long it became necessary to remove from the hotel to a sanatorium, where Dr. Goldschmidt rapidly became worse, and where he died, as stated, on May 8. The recent happenings to his many Jewish friends in Germany cannot fail to have distressed him, and to have been a source of unhappiness during his last days. Yet he sought to find solace in planning further researches, and especially in compiling a review of the present position of crystallography, so as to discover the lines along which future research might most advantageously be prosecuted.

Unselfish to the end, Goldschmidt's thoughts were ever with the great institution which he had founded in Heidelberg, and now that he has been taken home and buried in that lovely spot by the banks of the Neckar, on the scene of his great life-work, we can only hope that the Stiftung and its traditions and especially the Victor Goldschmidt Institute for Crystal Research will be cherished as the worthiest memorial possible of this truly great man of science and perfect kindly gentleman. May his spirit inspire those who work there to emulate the master, and thus to produce further contributions of real value to our knowledge of the subject, the study of crystals, that was nearest his heart!

A. E. H. TUTTON.

News and Views

Prof. Robert Chodat

THE recipient of this year's Linnean Medal awarded by the Linnean Society of London is Prof. Robert Chodat of Geneva. Unfortunately, he was unable to be present at the anniversary meeting held on May 24 and the medal was received on his behalf by the Swiss Minister. In the present state of specialisation, it is difficult to cover much of the field of botany and Prof. Chodat is one of the very few who can be considered a master in most branches. His work on the systematics of Polygalaceæ and their geographical distribution, and his ecological accounts of the vegetation of Paraguay explored by him in 1914 and of Portugal, Spain and Majorca which he visited with his students, are of great merit. In his laboratory at Geneva he elaborated the methods of obtaining pure cultures of Algæ now in general use, and his papers on Algæ, culminating in his monograph on polymorphism, have made him a recognised authority on the subject. More recently he has turned his attention to Fungi, particularly the organisms of fermentation, where his knowledge of chemistry and physiology has enabled him to make important advances. It is not so much the minutiæ of a subject as the broad principles that have attracted him, as is seen in his critical study of the palæozoic Pteropsida and in his address on the conception of species in modern botany. In genetics his contributions, though not numerous, have been fundamental. It is natural that he should be a successful teacher and his admirable "Principes de Botanique" reveal his wide and philosophic outlook. Geneva has always been famous for its botanists and Robert Chodat is a worthy successor to de Saussure and the de Candolles.

Prof. William A. Bone, F.R.S.

Prof. William A. Bone, of the Imperial College of Science and Technology, South Kensington, has been awarded the medal of the Society of Chemical Industry in recognition of his researches into the mechanism of combustion. This medal, which was instituted in 1896, is awarded periodically for conspicuous service rendered to applied chemistry, by research, discovery, invention or improvements in processes. It was in 1898, when Prof. Bone was lecturer in chemistry and metallurgy at Owens College, Manchester, that he started systematic research on the combustion of hydrocarbons and the influence of hot surfaces in promoting gaseous combustion, for which research he was elected a fellow of the Royal Society in 1905. In 1911 he was awarded the Howard Potts gold medal of the Franklin Institute of Philadelphia. In 1912 he began to organise and direct the new Department of Chemical Technology at the Imperial College, South Kensington. Prof. Bone's researches have comprised the chemical constitution of coal, surface combustion, gaseous combustion and explosions under high pressure, the photographic investigation of flame propagation during gaseous explosions, the combustion of hydrocarbons and blast furnace reactions. A lecture on July 12 entitled "Forty Years of Combustion Research" by Prof. Bone is one of the features of the annual meeting of the Society of Chemical Industry to be held in Newcastle on July 10–14.

Academic Assistance Council

THE present state of affairs in universities in Germany has raised in acute form the position of many scientific workers who, by reason of race, religion or political views, are unable to carry on their investigations in their own country. While no doubt universities in other countries will offer facilities to such displaced workers, it must be remembered that their resources are limited and in most cases already allotted. An Academic Assistance Council has therefore been formed in Great Britain, to co-operate with similar bodies in other countries in collecting funds to provide maintenance for displaced university teachers and investigators and in placing them in universities and institutions where they will be able to pursue their work. An appeal for funds, addressed to "all who are concerned for academic freedom and the security of learning", and signed by distinguished men of science and letters, has been issued, in which it is emphasised that the formation of the Council implies no reflection on political issues in other countries but is solely an attempt to relieve suffering, prevent waste of valuable talent and defend learning. The Royal Society has placed office accommodation at the disposal of the Council, and Sir William Beveridge and Prof. C. S. Gibson are acting as honorary secretaries. Communications and contributions should be sent to them at the Royal Society, Burlington House, London, W.1.

The Old Ashmolean, Oxford

THE celebrations, arranged by Dr. R. T. Gunther, of the two hundred and fiftieth anniversary of the opening of the Old Ashmolean on May 21, 1683, brought together a large gathering, which included representatives from a number of universities and scientific institutions in Great Britain and the United States. The Royal Society and the Linnean Society sent messages of congratulation, the latter referring particularly to the original specimens of the Tradescants forming part of the Lewis Evans collection. On May 21, a private reception was held in the Old Ashmolean building by Dr. R. T. Gunther. The guests took tea afterwards in Exeter College Hall, following the route taken by the Duke of York and his retinue in 1683, after the original opening of the Museum. On May 22, a private luncheon-party assembled in Wadham College Hall, and a toast in memory of Elias Ashmole was submitted. Sir Frederick Gowland Hopkins, who was among the guests, referred to the desirability of a fuller realisation of the value of historic science as an intellectual equipment and implement in current methods of

education. In the course of the afternoon a lecture was delivered in the University Museum by Sir Arthur Smith Woodward on "Plot and Lhwyd and the Dawn of Geology". A survey was given of the position of natural science in Great Britain and in other European countries in the seventeenth century. The studies of Plot and Lhwyd were described. From the preface of the former to his work "The Natural History of Oxfordshire: an Essay towards the Natural History of England" (1677), it would appear that Plot was of vigorous temperament. He says: "But as for the hot-headed, half-witted Censurer, who, perhaps, only looks on the Title of a Chapter, or here and there a paragraph that makes for his turn, I must and do expect the lash of his tongue." The exhibition of objects of Ashmolean interest—especially those at the Bodleian Library in relation to Ashmole himself, and of great historic value—were a welcome form of dedication accompanying the celebrations.

The Neutron

THE Bakerian lecture of the Royal Society was delivered on May 25 by Dr. J. Chadwick, who took as his subject "The Neutron". Neutrons can be liberated by the bombardment of several light elements by α-particles, but, except from beryllium and boron, the yield of particles is very small. In some cases the experiments are consistent with the conservation of energy and momentum in the reactions. With beryllium, however, it is at first sight difficult to account for the whole of the energy available in the disintegration. From the data now available, the mass of the neutron is consistent with the view that the neutron is a complex particle formed by the union of a proton and an electron. Other arguments suggest that the neutron is an elementary particle. As an alternative, one might suppose the proton to be complex, consisting of a neutron and a positive electron, but this view also has certain difficulties. Dr. Chadwick dealt with experiments on the passage of neutrons through matter. Some interesting points appear in the collisions with the lighter nuclei, in particular with protons. In some cases inelastic collisions have been observed in which the atomic nucleus is disintegrated. When the radiation from beryllium, consisting of neutrons and γ-rays, passes through matter, positive electrons are occasionally produced. It is not yet known whether these are due to the action of the neutrons or to the γ-rays. The function of the neutron in the structure of atomic nuclei was also discussed.

Crested Rat at the London Zoo

THE authorities at the gardens of the Zoological Society have been fortunate in securing four specimens, from Kenya, of that most curious and rare rodent the 'crested rat' (*Lophiomys imhausi*); no specimen of this animal has ever before been exhibited in captivity, though it has long been known to science. having been described by Milne-Edwards so long ago as 1867. Though termed as 'rat', it has really no very close relationship to this animal. Indeed, owing to its many structural peculiarities it has been made to constitute a family by itself—the Lophiomidæ. Nor is it at all accurately described when it is said to be a "badger-like animal", for it bears no very close resemblance to any other known rodent. One of its most characteristic external features is the great crest of long coarse hair which surmounts the back, bordered on each side by two bands of white. The nature and function of a glandular tract running down from the nape tail-wards, along the back, has yet to be discovered. Until now, nothing was known of the young. But one of the new captives, since its arrival, has given birth, not to a litter, as one would have expected of a rodent, but to a single young one, and this has elicited a further fact new to science, since it was born with a coat of fur, and not naked as with other rodents. The fact that this animal is arboreal is not likely to have any connexion with this unusual condition of the new born young, and the fact that but one is produced at a birth.

Research in the Paint and Varnish Industries

ON May 25 the Research Association of British Paint, Colour and Varnish Manufacturers held an exhibition at its Research Station, Waldegrave Road, Teddington, Middlesex. The firms comprising the Association's members range from those concerned with the manufacture of linoleum to the manufacturers of printing inks and of polishes, the main body conforming in interests with the title of the Association. In the six years that the Association has been actively engaged in researches, this wide range of interests has necessarily given rise to a large number of apparently unrelated investigations. The industries concerned, however, all have to deal with the properties of fluids, of thin films, of pigments and with the inter-relations between the pigment and an embedding medium. The work on view on May 25 included new apparatus and technique for the measurement of the hiding power of pigments, of the gloss of surface films and of the tinting, fastness and bronzing characteristics of pigments, the rate of evaporation of volatile constituents from thin films, the reactions of detached films of paints, varnishes and lacquers to a steady load, a rapidly increasing load, and an alternating load. New methods of evaluating the technical utility of linseed, tung and other vegetable oils were on view, as well as small-scale manufacturing plant suited to the production of all types of varnishes, lacquers and paints. The very rapid recent advances in the field of synthetic resins were reflected in a series of chemical studies of the mechanism involved in the complex polymerisation processes on which the manufacture of these materials is based. In the field of pigment manufacture, several important advances in technique recently originated at the Research Station were on view. These concern improvements in dispersion of organic lakes, greatly increased resistance of lead chromes to photo-chemical and chemical influences and the treatment of prussian blues to overcome some of their usual defects from the point of view of dispersibility.

In the afternoon, Dr. W. Krumbhaar, director of the corresponding German organisation, Institut für Lackforschung, Berlin, gave two interesting addresses on the subjects "No Illusions about Chlorinated Rubber" and "Commercial and Scientific Activities of the Paint Industry in England and Germany", to a large audience in the library at the Research Station. Among the many points of technical interest dealt with by Dr. Krumbhaar was his reference to the fact that, in Germany, a scientific man is regarded as having at least as much business acumen and ability as has his non-scientific confrère. It was evident from Dr. Krumbhaar's description of the activities of his own Institute that, in addition to carrying out a wide range of scientific investigation, a considerable amount of effort is expended in educating the German paint and varnish industry as to the details of various government restrictive orders and in protecting them from the evil effects of misuse of the patent system by large suppliers of their raw materials.

Leverhulme Research Fellowships

By the will of the first Lord Leverhulme, who died in 1925, the income arising from a part of his estate is to be devoted to the provision of scholarships for "research and education". The trustees have now resolved to devote £12,000 a year to the establishment of a scheme of research fellowships. The fellowships are primarily intended to assist experienced research workers rather than workers in an early stage of their careers. The duration of the grant will normally not exceed two years. Fellows may work either at home or abroad and no subject of inquiry is excluded from the scope of the scheme. The advisory committee is constituted as follows : Dr. H. J. W. Hetherington (chairman), Prof. A. M. Carr-Saunders, Sir William Hardy, Dr. N. V. Sidgwick, and Mr. H. T. Tizard. Dr. L. Haden Guest has been appointed secretary. Applications (from British-born candidates normally resident in the United Kingdom) and all inquiries and communications in connexion with the scheme should be addressed to the Secretary, Leverhulme Fellowship Scheme, Union House, St. Martin's-le-Grand, London, E.C.1. It will be a convenience to the committee if as many applications as possible are in the hands of the secretary by June 19.

Recent Acquisitions of the British Museum (Natural History)

Acquisitions for the Department of Zoology include a series of elephant skulls from the Gola Forest, Sierra Leone, the gift of His Excellency the Governor of Sierra Leone. These skulls are of great scientific value as they demonstrate the existence of a small race of elephant in West Africa. Dr. G. H. Rodman has presented a series of stereoscopic radiographs of Mollusca shells for exhibition. Among the donations to the Department of Geology is a large collection from Miss M. S. Johnston, mainly of Silurian fossils from England and Norway. A portion of a meteoric stone which fell on July 8, 1932, at Kahrapar, Jaunpur, United Provinces, India, has been presented to the Department of Minerals by Mr. H. Minson. A collection of Coleoptera belonging to the family Curculionidæ and numbering approximately 40,000 specimens, has been deposited in the Department of Entomology as a "permanent loan" by the Hawaiian Sugar-planters' Association of Honolulu. The collection, which is representative of the weevils of every part of the world, was brought together by the late Dr. David Sharp, after his first and largest collection of beetles had been acquired by the Museum in 1905. His British collection was acquired in 1932.

The Department of Botany has had bequeathed to it the herbarium of Mr. James Groves, who was the recognised authority on Charophyta (stoneworts) and one of the best-known field botanists of Great Britain. He worked for many years in collaboration with his brother Henry, and together they edited the ninth edition of Babington's "Manual of British Botany". Henry died in 1912 and in 1918 a first consignment (6,000) of their British plants was presented to the Department. James later wrote the Ray Society's monograph on Charophyta with Canon Bullock Webster as joint author. The bequest includes more than 6,000 Charophyta and about 11,000 British flowering plants : the remainder are mosses and sea-weeds. All are well and carefully mounted ready to be incorporated in the herbarium. Dr. R. J. D. Graham, of the University of Edinburgh, has presented his collection of about 1,300 Mesopotamian plants made by himself and others. An account of the plants will appear shortly in "Notes from the Royal Botanic Garden, Edinburgh". The Sladen and Godman Trusts have presented about 900 plants recently collected on the Islands of the Gulf of Guinea by Mr. A. W. Exell, assistant keeper in the Department, in company with Mr. W. H. T. Tams, of the Department of Entomology. The islands visited were Fernando Po, Principe, São Thomé and Annobon, from which there was little material previously in the herbarium. The collections from Fernando Po were practically confined to the Inoka region in the south, a country with a most interesting vegetation unique in tropical Africa. There are many new records of plants and several new species. The collections will probably enable a general account of the geographical relationships of the four islands to be written.

Chemistry and the Art of Living

On March 24 Prof. H. E. Armstrong delivered the Sir Jesse Boot Foundation lecture in the lecture theatre of University College, Nottingham. Recalling the fact that one of the most pleasant memories of his life was the hours spent under the roof of Sir Jesse and Lady Boot, he paid tribute to the quality that belonged to his late host and claimed that, in founding the chair of chemistry, Sir Jesse Boot did a service to his fellow citizens which will ultimately save them from themselves : providing they be taught the proper art of living, which will soon be the duty of chemistry. When this is achieved, "cash chemists" may cease to exist, as drugs are only used to counteract inborn faults in the human machine and insufficient food, deficiencies in food, effects of over-feeding or improper feeding, zymotic disease

Hence the future lies with the farmer, who will have to produce not only the food that we desire but also that which we ought to have in a perfect condition. To do this, the farmer will have to feed his animals properly and this necessitates a great extension in the use of fertilisers on the land. Thus it appears that the "cash chemist" returns to action with a change of function—to supply the farmer with his chemical manures. Prof. Armstrong was despondent at the delay in reaching this condition of a brave new world and concluded with the following words: "at the moment our failure to use intelligence, the world over, is astounding—some fault there must be in developing it. A few months ago in a speech in this city I suggested clearing out the present race of students and their teachers and bringing in 500 chosen boys who could be trained as cooks. I would repeat my advice to-day but add that to cook should mean to understand what is cooked, what is fit and proper to be eaten, as well as the mere art of kitchenry. We cannot get away from the fact that we live always through our stomachs; from these it is, through the food we put into them, that we gain and have our being."

Electric Welding in Ship Construction

ELECTRIC welding, instead of rivetting, is being widely adopted in shipbuilding. In German naval dockyards it has practically superseded rivetting. Electrically welded ships have practically no leakage and there is little corrosion or wastage of plates around the welded joints. Economies are effected by welding in the weight and cost of a ship's hull. The welded ship therefore yields greater service for a smaller investment of capital. The University of Glasgow has introduced welding work into its laboratories and the design of welding joints has been introduced into all its engineering courses. The Glasgow Education Committee is also taking steps to form a new skilled class of workmen called ship welders. Before a change of this kind can be made it is necessary for the employers and the trade unions to meet. In the *Times* of May 26 an account is given of a conference held in Edinburgh between employers' federations and trade unions on this subject. Mr. J. B. Hutchison, the chairman of the employers, stated that it is of the greatest importance that the development of welding should proceed as rapidly and smoothly as possible in Great Britain on economical lines in order that competition with other shipbuilding nations may be successfully faced. It is understood that the employers made it clear that the selection of ship welders is likely to be made from the most suitable men, not confined to any one class and not necessarily from men directly displaced by the new process. Mr. Sherwood, on behalf of the unions, said that the proposals were of such a far-reaching character that full and careful consideration was necessary.

Electrical Equipment of the *Queen of Bermuda*

IN the G.E.C. (General Electric Co.) *Journal* for May there is a full and interesting description of the electrification of the Furness-Withy liner, *Queen of Bermuda*. It was launched at Barrow-in-Furness last February and has successfully completed its trials. Its tonnage is 22,500 and its shaft horse power is about 20,000. Electricity is used on the most extensive scale possible throughout the ship. It is used for the propulsion and steering of the ship. It is also used for lighting and ventilation, cooking, refrigeration, the handling of cargo, and there are eleven electric lifts, etc., the auxiliary machinery totalling about 3,000 horse power. For maintaining a supply of power adequate for essential services in cases of emergency, an oil-engine-driven dynamo of 50 kilowatts capacity is installed on one of the upper decks well above the water line. The change over of the panic-lighting circuits from the emergency busbars to a battery is entirely automatic and takes place on the failure of the supply voltage. The vessel is intended primarily for service between New York and Bermuda but she has been constructed for ocean-cruising as well. In view of the large amount of perishable foodstuffs which have to be carried, extensive refrigerating plant is provided. For this purpose, 23 motors are required, the largest being of 70 horse power for driving a carbon dioxide compressor. The lighting is done on a very lavish scale, requiring 450 kilowatts of electric energy. It is mainly effected by concealed lighting in opaque cornices, diffused lighting through continuous glazed cornices, or box lights glazed with tinted diffusing glasses in modern designs. For illuminating the dancing space three-colour lighting is used for the main ceiling. The lights are controlled by dimmers when dancing is in progress so as to produce a pleasing variation in the colour of the illumination. This is a great improvement on 'jazz' lighting.

Freshwater Biological Association

THE annual general meeting of the Freshwater Biological Association of the British Empire was held on May 11 in the rooms of the British Waterworks Association, Grand Buildings, Trafalgar Square, W.C.2. The following officers were elected for 1933–34:—*President*, Mr. Reginald Beddington; *Chairman of Council*, Prof. F. E. Fritsch; *Hon. Treasurer*, Mr. Nigel O. Walker; *Hon. Director of the Laboratory*, Dr. W. H. Pearsall; *Hon. Secretary*, Mr. J. T. Saunders. The report of the Council showed that considerable progress has been made in fitting out the Laboratory of the Association at Wray Castle at Windermere. Tables are now available for visiting research workers and accommodation for these workers is provided in the Castle. Subscriptions have been received from a wide circle interested in freshwater problems. Subscriptions, renting tables at the Laboratory, have also been received from universities, many of which have already nominated research workers to occupy their tables at the Laboratory. The Council is anxious to provide the fullest possible facilities at the Laboratory for those who wish to work on freshwater problems. The most pressing need at the moment is the provision of an electric supply for the Laboratory, but the Council has at present no funds to supply this need. The address of the honorary secretary of the Association is Mr. J. T. Saunders, Christ's College, Cambridge.

Australian Water Supply

THE water supplies of certain parts of Australia, and the occurrence of periodic drought, are the subject of comment by Dr. J. P. Thomson in an article in the *Sydney Morning Herald* of January 12. As a result of observations ranging over half a century, Dr. Thomson believes that there are unmistakable signs of desiccation and he advocates the immediate necessity of measures to preserve the water supplies and to resist the ill-effect of droughts. He points to observations on Lake George and various lagoons in the eastern part of New South Wales as well as Lake Eyre as showing rapid deterioration in humidity. The wells of the great artesian basin, according to him, are showing signs of decreased flow which he attributes to the plutonic and therefore limited supply of the water. He points also to the decreased flow in many water courses and the serious loss of water by excessive evaporation in the dry atmosphere. Dr. Thomson would like to see every effort to conserve water by preventing waste of flood water and checking the number of wells, and he favours also the preservation of fodder against times of stress. He points also to the urgent need of better weather forecasts, which he thinks must come from the antarctic, in order to give the farmer warning of any surplus or deficiency in rainfall. Measures such as these might go hand in hand with more land settlement and production for wider markets.

Russian Arctic Expeditions

IN recent years the Soviet Union has paid a great deal of attention to the exploration of its arctic territories and the investigation of commercial sea routes north of Siberia. The Society for Cultural Relations between the Peoples of the British Commonwealth and the U.S.S.R. has recently directed attention to the activities of Soviet arctic expeditions in 1932. Most important were the establishment of observatories at Cape Chelyuskin, at Rudolph Island in Franz Josef Land, in Novaya Zemlya and at the mouth of the Lena River. The Rudolph Island station is to be the base of a thorough exploration of Franz Josef Land and the little-known seas to the east. Several ice-breakers were engaged in hydrographical work in the Barents and Kara Seas while the *Sibiriak*, which made the north-east passage from Archangel to Bering Strait, reports that ice congestion in the western part of the passage can be avoided by passing north of Northern Land. It is by no means certain, however, that this route could be relied on every year in maintaining communication between White Sea ports and the Lena River, though the possibility is worth investigating.

Annales Guébhard-Séverine

WE have received No. 8 of these annals, which have been issued yearly since 1925 by the Institut Guébhard-Séverine, 4 Rue du Seyon, Neuchâtel, Switzerland, and are distributed free on application to the Institut, to investigators in all countries. The Institut is also willing to publish scientific works written in any of the languages French, English, German or Italian; its practice appears to be to translate into French for publication. Papers on subjects studied by the late Adrien Guébhard are particularly invited; these subjects include geophysics and geology, botany, electricity, hydrodynamics, osmosis, biological physics, meteorology, acoustics, photography and spectroscopy. The present number of the annals contains four papers, by R. Reinicke on the tetrahedral field of action of atoms, by F. Strunz on the natural sciences in the work of Albertus Magnus, by L. Courvoisier on researches to determine the 'absolute' motion of the earth, and by D. Chahnazaroff on petroliferous waters.

Institute of Physics

THE recently issued annual report for 1932 of the Board of the Institute of Physics shows a satisfactory record of work during the year. There has been a steady increase in membership of the Institute which now has about seven hundred names on its roll. The local sections, too, in Australia and India, report a successful year. During the year, a local section was formed at Manchester under the chairmanship of Prof. W. L. Bragg with Dr. H. Lowery of the Physics Department of the University as local secretary. The following officers among others have been elected for the session 1933–34: *President*, Sir Henry Lyons; *Treasurer*, Major C. E. S. Phillips; *Secretary*, Prof. J. A. Crowther.

Third International Congress of Experimental Cytology

THE third International Congress of Experimental Cytology will be held at Cambridge on August 21–26. The international president is Prof. Th. Huzella, professor of anatomy in the University of Debrecen, whose presidential address will be entitled "Culture des tissus en ses relations aux problèmes générales de la biologie et aux problèmes speciales de la médecine". The chief feature of the Congress will be discussions on the following topics: "Cell Respiration and Cell Metabolism"; "Cell Form and Function as demonstrated by Recent Advances in Tissue Culture"; "The Electro-Physiology of the Cell"; "Entwicklungsmechanik und Explantation"; "The Cultivation of Animal and Plant Viruses". Papers will be presented by authors from Great Britain, Germany, Austria, Hungary, U.S.S.R., United States, Poland, Italy, Holland, Czechoslovakia, France, Switzerland, Denmark, and Japan. Among the distinguished foreign visitors will be Prof. H. Wieland (Munich), Prof. A. Szent-Györgyi (Budapest), Prof. R. Chambers (New York), Prof. W. J. V. Osterhout (New York), Prof. J. Michaelis (New York), Prof. S. C. Brooks (Berkeley), and Dr. K. Landsteiner (New York). Further information concerning the Congress can be obtained from Dr. Honor B. Fell, Strangeways Research Laboratory, via Cherryhinton, Cambridge.

Twenty-fifth Anniversary of the French Society of Physical Chemistry

A PROGRAMME has now been arranged for the meetings which are to celebrate the twenty-fifth anniversary of the French Society of Physical

Chemistry, to which reference has already been made in these columns (Jan. 14, p. 53). Two general discussions will be held on Oct. 16–22, on "The Electron Theory of Metals" and on "Electrolytes and Boundary Layers (Electrode-Solution)". Among those who have already promised contributions to the discussions are Prof. Brillouin (Paris), F. Bloch (Leipzig), Prof. V. Henri (Liège), Prof. Joffé (Leningrad), Prof. E. K. Rideal (Cambridge), Prof. M. Volmer (Berlin), Prof. P. Debye (Leipzig), Prof. P. Dutoit (Lausanne), R. Audubert (Paris), Prof. F. Dubois (Clermont-Ferrand), A. H. Wilson (Cambridge), Prof. A. Gillet (Liège), Prof. O. Scarpa (Milan), Prof. Denina (Turin), Prof. J. Heyrovský (Prague). Notification of proposed attendance at the meeting should be sent as early as possible to the General Secretary of the Society, Dr. Ch. Marie, 9 rue de Bagneux, Paris (VI). The registration fee is 125 francs, including reception, banquet, excursions, etc., as well as advance copies of papers for discussion. Advance proofs will be forwarded immediately to those who pay their registration fee before June 30; others will receive them at the meeting in October.

Sixth Imperial Social Hygiene Congress

THE sixth Imperial Social Hygiene Congress will be held at the London School of Hygiene and Tropical Medicine, Keppel Street, London, W.C.1 on July 3–7 under the presidency of Sir Basil Blackett. On July 3, the presidential address will be delivered, and the rest of the Congress will be divided into a series of discussions including such topics as the effect on established social customs of modern knowledge and economic conditions; changes in the outlook on prostitution; biology and health—the teaching of biology in schools and colleges; conference of teachers of biology; methods of dealing with venereal disease in the defence forces of different nations; the training, etc., of health visitors, nurses and midwives; venereal disease administration and the supply of educational and cultural films. Progress reports from Great Britain and the Dominions concerning different branches of social hygiene will be presented at the Congress. Arrangements have been made for visits to various institutions of interest to the delegates, a special display of films, and an exhibition of simple equipment used in biological teaching. Further information concerning the Congress can be obtained from the Secretary, British Social Hygiene Council, Carteret House, Carteret Street, London, S.W.1.

Announcements

AT a meeting of the Royal Society held on May 25, the following were elected foreign members of the Society: Prof. Vilhelm Friman Koron Bjerknes, of the Physical Institute of the University of Oslo; Prof. Harvey Williams Cushing, of New York, distinguished for his work on the surgery of the brain; Prof. Peter Debye, professor of physics in the University of Leipzig; Prof. Friedrich August Ferdinand Christian Went, professor of general botany in the University of Utrecht.

THE annual visitation of the National Physical Laboratory will take place on June 27 from 3 to 6 p.m.

THE RIGHT HON. LORD MELCHETT has consented to accept the presidency of the British Science Guild in succession to the Right Hon. Sir Samuel Hoare, whose three-year term of office ends this month. Lord Melchett will be elected president of the Guild at the annual general meeting to be held in the Mansion House on June 19 at 4.30 p.m. when the Right Hon. The Lord Mayor of London (Sir Percy W. Greenaway) has kindly agreed to take the chair.

AT the anniversary meeting of the Linnean Society of London held on May 24 the following were elected officers of the Society:—*President*, Prof. F. E. Weiss; *Treasurer*, Mr. Francis Druce; *Botanical Secretary*, Mr. John Ramsbottom; *Zoological Secretary*, Dr. Stanley W. Kemp.

THE annual general meeting of the British Science Guild will be held in the Mansion House, London, E.C.4, on June 19, at 4.30 p.m., when the chair will be taken by the Right Hon. the Lord Mayor of London. The meeting will be followed by a popular lecture entitled, "Some Problems of British Forestry", by Prof. R. S. Troup, professor of forestry in the University of Oxford and director of the Imperial Forestry Institute.

APPLICATIONS are invited for the following appointments on or before the dates mentioned:—An assistant lecturer in mathematics at the University College of South Wales and Monmouthshire—The Registrar, University College, Cardiff (June 12). A director of research at the Forest Products Research Laboratory, Princes Risborough—The Secretary, Department of Scientific and Industrial Research, 16, Old Queen Street, Westminster, S.W.1 (June 22). A lecturer in pathology at the University of Liverpool—The Registrar (June 24). A head of the Manual Training and Engineering Department of Christ's Hospital, Horsham—The Headmaster. An assistant lecturer in agricultural botany at the University of Reading—The Registrar. A part-time teacher of bakery science (especially elementary physics and chemistry) at the Borough Polytechnic, London, S.E.1—The Principal. A head of the Mining Department at the County Technical College, Mansfield—The Principal. A lecturer in biology and some mathematics at the Stockwell Training College, London, S.W.9—The Principal. External examiners in scientific, medical and other subjects for various degree examinations in the University of London—The External Registrar, University of London, South Kensington, S.W.7 (July 3).

ERRATUM.—In NATURE of May 27, p. 764, twelve lines from foot of first column, for "*nn* higher unstable and lower grades" read "unstable *nn* higher and lower grades".

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.*]

Fibres from the Coat of a Blackface Lamb

IN the course of the study of the lamb's coat of various breeds of sheep, a range of fibre forms has been recognised by Duerden and Dry. In this method of classification, the apparent thickness of the fibres is of great significance; but analogous to results obtained from work on crimp, it is now suggested that it may not be entirely ascribed to increase of cross-sectional area, but may be due to a twist of the fibre. Thus a thick or thin filament would appear according as the major or minor axis of the cross-sectional ellipse was seen. Prof. Duerden kindly supplied typical prototrichs from the fleece of a Blackface lamb aged 1 month.

The specimens examined were taken as being characteristic of the extreme types of fibres of the Duerden range. The fibre was observed at magnification 500 at marked points along its length and oriented at each point through 180°. The fibre thickness, the ellipticity and the circumference so measured, together with axial orientation, were plotted against distance along the fibre for each case examined.

Type (*a*), *or sickle tipped fibre :* Visually the fibre may appear as being composed of three parts along its length : (*A*) the sickle-shaped tip, (*B*) a finer portion of the stem, and (*C*) a thick portion which is a definitive fibre or fibre proper.

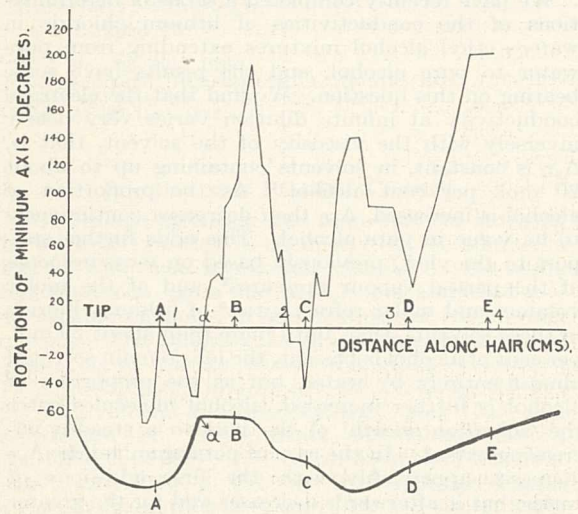

FIG. 1.

Measurement of cross-sectional area shows that the decrease in thickness from the tip to the next proximate portion of the fibre, if any, is of very small significance. Following this, the cross-sectional area of part (*C*), namely, the fibre proper, may be such that the final value is seven or eight times that at the sickle tip. Measurements of the angle or orientation of the minor axis of cross-section of a typical sickle tip fibre, kindly supplied by Duerden, are shown in Fig. 1, the diagram of the fibre below indicating the portion and visual appearance of the fibre examined. The angle of orientation follows the natural crimp of the fibre almost exactly.

Additional attention was paid to the point of inflection of this fibre, designated by α, namely, the point at which apparently the sharp transition takes place from the thick sickle tip to the thinner filament, and where a sharply defined bend occurs in the fibre

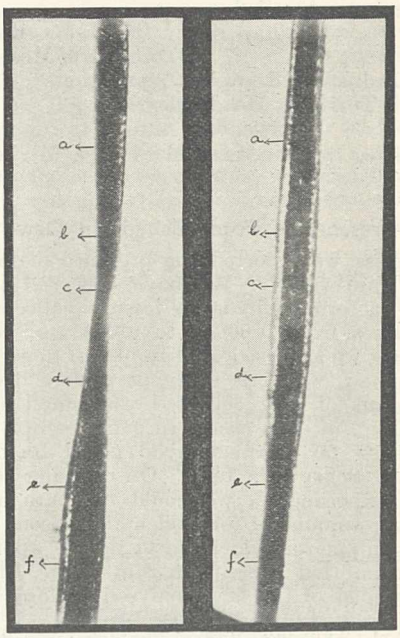

FIG. 2.

form. The two photomicrographs, Fig. 2, were taken at the point α in two directions at right angles to each other; coincident points, *a*, *b*, *c*, *d*, *e* and *f* are marked on each picture. A comparison of the two pictures shows clearly what has happened. A thick place when viewed in one plane becomes a thin place when viewed at right angles and vice versa. The value of the circumference along this portion shows an almost constant value.

The point α is therefore in reality a place of concentrated twist, that is, there is not a sudden decrease of thickness at this point, but a sharp rotation of the axes of the cross-sectional ellipse about the axis of the fibre length. The later increase in thickness at part (*C*) is real, and not due to rotation.

Type (*b*), *sickle tip not evident :* Samples provided by Prof. Duerden were longer in length than the sickle tip fibres, taken from the same animal; they were about 6·5 cm. long as against 4·5 cm. In these fibres the thickness shows no sudden changes, but a gradual increase along the whole length of the fibre. The ellipticity, in contrast to that of the sickle tip fibres, initially increases (not decreases) in value, and then settles down to oscillate about an average. In sickle tip fibres the ellipticity is high distally and decreases rapidly proximally. The orientation of the axes again closely follows the natural crimp. It would seem that in the sickle tip fibres, type (*a*), the end portion shows an apparent thickening, due to visual presentation of the major axis to the eye, whilst lower down the fibre the apparent attenuation is a consequence of viewing the minor axis. The same point on such a fibre viewed in a plane at right

angles to the first, shows a reversal of these dimensions.

In consequence of these observations, classification of fibres according to their apparent tip thickness becomes a matter for careful consideration as to whether such variations are real, or are associated with fibre twist of a concentrated character at a particular point, or due to both twist and variation of ellipticity of the cross-sectional contour.

Miss A. L. Walker carried out most efficiently the measurements recorded.

S. G. BARKER
(Director of Research).
Wool Industries Research Association,
Torridon, Headingley,
Leeds, 6.

NATURE, **130**, 736, Nov. 12, 1932.

Presence of Formaldehyde in Dew

LAST year we reported the presence of formaldehyde in rain-water[1]. We have observed that the amount of formaldehyde in freshly collected rain-water varies from 0·00015 to 0·001 gm. per litre.

Recently we analysed ten samples of dew collected at Allahabad, which is a comparatively dry place. The amount of dew collected was small and was about 10 c.c. in each case. In every sample of dew collected so far, formaldehyde could be detected at once by Schryver's test. On carrying out comparative experiments, we could estimate approximately the amount of formaldehyde present in dew. The amount of formaldehyde in dew is appreciably greater than that present in rain water. In most of the samples of the dew analysed the amount was approximately 0·0015 gm. per litre.

It appears that formaldehyde in dew comes from air in contact with grass, leaves, soil, etc. It is well known that almost all organic substances in the wet condition when exposed to light and air form formaldehyde. The origin of this formaldehyde has not yet been satisfactorily explained. We are of the opinion that organic substances, which are rich in energy, when exposed to light and air, are oxidised by atmospheric oxygen to carbon dioxide and water. The freshly-formed carbon dioxide appears also to be rich in energy, and with water can undergo photosynthesis to formaldehyde in presence of light more readily than ordinary carbon dioxide present in the atmosphere. That is why formaldehyde is more easily detected in the photo-oxidation of organic substances, which give out energy in their oxidation, than in the case where ordinary carbonic acid or bicarbonate solutions are exposed to light. In some cases, however, such as the photo-oxidation of glycine, formaldehyde, apart from photosynthesis, may also be obtained as a direct product of its photo-oxidation ; but in the majority of cases in the photo-oxidation of organic substances, formaldehyde is likely to be produced from the photosynthesis of the energy-rich carbon dioxide and water which are products of photo-oxidation in presence of sunlight. The formaldehyde produced in this way will be present in the air which comes in contact with organic matter present on the surface of the soil, wet leaves, grass, etc.

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ATMA RAM.
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NATURE, **130**, 313, Aug. 27, 1932.

Constitution of Dehydro-Ascorbic Acid

SOME time ago[1] we found that by the action of a copper acetate solution upon ascorbic acid, a dehydro-ascorbic acid is formed, which has the formula $C_6H_6O_6$, that is, it has two hydrogen atoms less than ascorbic acid. The determination of the free hydroxyl groups according to Zerewitinoff, shows for the dehydro-acid only two hydroxyls, in contrast to the original acid which gives four. One of the two hydroxyls removed by oxidation is the enolic hydroxyl, which is responsible for the reducing power of ascorbic acid.[1]

The dehydro-ascorbic acid is most likely an inner peroxide; which would account for its oxidative qualities.

According to Micheel and Kraft[2], oxidation of ascorbic acid to dehydro-ascorbic acid should lead to the formation of a new hydroxyl group. This is erroneous.

P. KARRER.
H. SALOMON.
K. SCHÖPP.
Chemical Institute,
University, Zurich.
April 26.

[1] P. Karrer, H. Salomon, K. Schöpp, R. Morf, *Acta Helv.*, **16**, 181 ; 1933. Vierteljahresschr. *Züricher Naturforsch. Ges.*, **78**, 9 ; 1933.
[2] Micheel and Kraft, *Z. physiol Chem.*, **215**, 215 ; 1933 ; and NATURE, **131**, 274, Feb. 25, 1933. Compare also P. Karrer, G. Schwarzenbach und Schöpp, *Acta Helv.*, **16**, 304 ; 1933.

Rôle of the Solvent in Electrolytic Dissociation

IN a letter to NATURE of April 22, Dr. A. R. Martin has discussed the interpretation to be placed on the experiments of Hughes and Hartley[1] on the effect of small additions of water on the electrical conductivities of salts in methyl alcohol and acetone.

We have recently completed a series of determinations of the conductivities of lithium chloride in water – ethyl alcohol mixtures extending from pure water to pure alcohol, and the results have some bearing on this question. We find that the electrical conductivity at infinite dilution varies very nearly inversely with the viscosity of the solvent, that is, $\Lambda_0\eta$ is constant, in solvents containing up to about 20 mol. per cent alcohol. As the proportion of alcohol is increased, $\Lambda_0\eta$ then decreases continuously to its value in pure alcohol. This adds further support to the view, previously based on measurements of the partial vapour pressures[2], and of the molar volumes and molar refractivities[3] of lithium chloride in these solvents, that, until more than about 20 mol. per cent of alcohol is present, the ions remain solvated almost entirely by water, but as the proportion of alcohol is further increased, alcohol molecules enter the 'solvation sheath' of the ions to a steadily increasing extent. In the case of potassium iodide, $\Lambda_0\eta$ increases appreciably with the first additions of water, but it afterwards decreases and for the greater part of the concentration range the curve follows the same course as that of lithium chloride.

In connexion with Dr. Martin's remark that the extent of dissociation is determined by the free energies of the ions and undissociated molecules in the solvent, and that the solvation of an undissociated molecule may be a factor comparable with the solvation of an ion in these quantities, an extreme case, recently investigated by Hamilton and Butler, is of some interest[4]. It was found that zinc chloride, although a typical strong electrolyte in water and

practically a non-electrolyte in alcohol, has nearly the same free energy in the two solvents. The consequences of this are interesting.

Let $(H_M)_W$, $(H_I)_W$ be the solvation energies of the undissociated molecules, and of the ions in water, and I the ionisation energy in the gaseous state. Then if F_W is the energy of ionisation in water, it is evident from the accompanying scheme that $F_W = (H_M)_W - (H_I)_W + I$. Similarly for another solvent A we have $F_A = (H_M)_A - (H_I)_A + I$.

$$\begin{array}{ccc} ZnCl_2 & \xrightarrow{\ I\ } & Zn^{++} + 2Cl^- \quad \text{In the gas.} \\ \uparrow{\scriptstyle (H_M)_W} & & \uparrow{\scriptstyle (H_I)_W} \\ ZnCl_2 & \xrightarrow{\ F_W\ } & Zn^{++} + 2Cl^- \quad \text{In water.} \end{array}$$

If the salt is largely dissociated in W and practically undissociated in A, F_W must be large and negative and F_A large and positive. Since the free energy of the ionised salt in W is about the same as that of the unionised salt in A, we also have $(H_M)_W = (H_I)_A - I$. These two requirements are only satisfied if

$$(H_I)_W > (H_I)_A, (H_M)_A > (H_M)_W,$$

that is, the solvation energy of the ions must be greater in W than in A, while the solvation energy of the undissociated molecules must be greater in A than in W.

Can such a state of affairs arise from the action of the dipole forces, or is it necessary to invoke some chemical interaction between the undissociated molecules and the solvent A ?

J. A. V. BUTLER.
L. C. CONNELL.

University, Edinburgh.
April 26.

[1] *Phil. Mag.*, **15**, 610 ; 1933.
[2] Shaw and Butler, *Proc. Roy. Soc.*, A, **129**, 519 ; 1930.
[3] Butler and Lees, *ibid.*, A, **131**, 382 ; 1931.
[4] *Ibid.*, A, **138**, 450 ; 1932.

Priestley as a Practical Chemist

NOT enough attention has been paid, in studying the work of Priestley in chemistry, to his admission that he was "not a practical chemist". He made that admission again and again—and amplified it—in scientific memoirs, in the memoirs of his life and in letters. The following list of references to the point should be of use to those who study Priestley : (1) "Philosophical Empiricism", etc., 1775, pp. 24, 26 ; (2) "Experiments and Observations", etc., 1775, p. 1 (reproduced in "Experiments and Observations", etc., 1790, 2, p. 295) ; (3) "Experiments and Observations", etc., 1779, p. 134 (*cf.* "The Collected Papers of Carl Wilhelm Scheele", trans. by Dobbin, p. 302) ; (4) Bolton, "Correspondence of Priestley", p. 124 (a letter, dated 12 . 1 . 1792, sent to Keir) ; (5) Thorpe, "Humphry Davy, Poet and Philosopher", p. 39 (a letter, dated 31 . 10 . 1801, sent to Davy) ; (6) "Memoirs of Dr. Joseph Priestley written by himself", Centenary edition, 1904, p. 40, par. 101. I suppose that other references to the same point are to be found.

What I call an admission, Prof. Patterson takes to mean that Priestley was not "a person who made his living by the preparation and selling of chemical compounds—a professional chemist" (NATURE, May 13).

Priestley said, writing to Davy : "As old as an experimenter as I am, I was near forty before I made any experiments on the subject of Air, and then without, in a manner, any previous knowledge of chemistry. This I picked up as I could, and as I found occasion for it from books." He said in his "Memoirs" : "if I had been previously accustomed to the usual chemical processes, I should not have so easily thought of any other ; and without new modes of operation I should hardly have discovered anything materially new". In the "Philosophical Empiricism" he reports that he made the acquaintance of Dr. Bryan Higgins : "I told him that, not being a practical chemist, having never had a proper laboratory, or seen much of the usual processes, I wished to have an opportunity of observing some of them : but that I more especially was in want of *chemical articles*, such as I could not easily procure at the shops."

There should be no difficulty in seeing what was meant. Priestley had a poor knowledge of chemistry —the orthodox thing—that was concerned with solids and liquids : the gases were beyond its pale. He could pursue the study of gases with the minimum of reference to the orthodox chemistry : what he needed of it he picked up as he went along. He made numerous acknowledgments of assistance that he got from friends, in learning the ordinary processes of a chemical laboratory. A certain instance is instructive. He commenced work in chemistry—upon gases, that is—in the year 1767. From nitric acid he obtained nitric oxide in the year 1772 and oxygen in March 1775. He learnt how to prepare nitric acid, with the guidance of Mr. Winch, jun., at the end of the year 1775 ("Experiments and Observations", etc., 1777, pp. 234–7).

A. N. MELDRUM.

92 Craiglea Drive, Edinburgh.
May 15.

Some Effects observed in Mice under Continued Treatment with Œstrin

DURING a recent inquiry at this Institute into the comparative effects of œstrogenic and carcinogenic substances on mice, some observations were made which suggest that œstrin brought about hernia in some of the animals.

The keto-hydroxy-œstrin employed in this experiment (for which we are indebted to the generosity of Dr. Girard) was made from the urine of pregnant mares and had a specific rotation $[\alpha]_D = +178°$. When injected into rats by the method described by Allan, Dickens and Dodds[1] it was found that 0·4 gamma gave a response in 50 per cent of ovariectomised rats. This corresponds to the figure usually given for the standardisation of crystalline keto-hydroxy-œstrin when employing the method described in that paper on a certain strain of rats.

Eight male mice were treated with subcutaneous dosage of œstrin in the right groin. During ten weeks five injections were given, each consisting of 0·5 c.c. of a 0·3 per cent solution of keto-hydroxy-œstrin in olive oil. At the end of this time, five of the eight mice were found to have bilateral scrotal hernias, their scrotal sacs being distended by viscera which normally are retained within the abdomen.

During the same period 28 male mice received applications twice weekly of a solution (0·3 per cent

in benzene) of the same œstrin to the non-epilated skin of the interscapular region by means of a small paint brush. After ten weeks of this treatment, three of these mice had scrotal hernias, bilateral in one and unilateral in the other two. Examination of 90 untreated stock mice and 276 mice under treatment of various kinds not entailing the use of œstrin did not reveal a single scrotal hernia.

The same solution of œstrin in benzene applied twice a week in a similar way and for the same period to the non-epilated skin of 10 female mice not only kept them in œstrus, as tested by the ordinary smear method, but also led in some instances to an accumulation in the vagina of a mass of keratinised epithelium sufficiently large to distend the canal and to block the outlet from the uterus, both horns of which were distended considerably with fluid. These results indicate that keto-hydroxy-œstrin in such a medium is readily taken up through the healthy skin, although it is impossible to ignore the possibility that some may have been taken up by the alimentary canal through the mice licking one another.

The hernias in the male mice treated with superficial applications of œstrin, and those in the mice treated by subcutaneous injection, may be reasonably attributed, it seems, to the action of œstrin. The phenomenon may have some connexion, perhaps, with the well-known fact that in certain species the pelvic ligaments are softened during pregnancy, when large quantities of œstrin are circulating in the body.

HAROLD BURROWS.
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N. M. KENNAWAY.

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London, S.W.3.
Courtauld Institute of Biochemistry,
Middlesex Hospital,
London, W.1.
May 23.

[1] *J. Physiol.*, **68**; 1930.

Occurrence of Ovulation without 'Heat' in the Ewe

A RECENT study of reproductive phenomena in the ewe has shown that, in this animal, ovulation occurs regularly during the month previous to the commencement of the breeding season, and occasionally during the breeding season, without the exhibition of mating. The premises for this conclusion may be stated briefly as follows :—

(1) Four out of five ewes killed before their breeding seasons had commenced showed healthy corpora lutea in their ovaries.

(2) In seventeen ewes kept constantly with a vasectomised ram, the vaginal secretions underwent one or more cycles of œstrous changes before the first 'heat' period had occurred. These cycles possessed the periodicity characteristic of the normal œstrous cycle.

(3) Five of these ewes killed during the breeding season showed, in their ovaries, either one or two more 'generations' of corpora lutea than could be accounted for by the number of full œstrous periods through which they had passed.

(4) The dicestrous interval is sometimes twice, and rarely three or four times its normal length. It is thought that multiplication of the cycle interval takes place as a result of the occurrence of ovulation and the development of corpora lutea although œstrus does not occur.

There is evidence to suggest that under highly favourable nutritive conditions, such as are constituted by the farming practice of 'flushing', these spurious ovulation periods may be converted into normal œstrous periods at which the mating instinct is exhibited.

Cole and Miller[1] have found that a single injection during anœstrus of serum from pregnant mares containing 50 'rat-units' or more of gonad-stimulating substance, causes ovulation although 'heat' does not ensue.

Observations made by Mr. Wm. C. Miller (unpublished) have shown that the ovaries of red deer hinds killed during early pregnancy commonly contain not only the corpora lutea of pregnancy but also one or more 'generations' of atrophic corpora. Since it is probable that in the wild state very few hinds fail to conceive at the first service, this fact suggests that the phenomenon of ovulation in the absence of mating may not be confined to the ewe.

Full details of the investigation will be published shortly.

R. GRANT.

Institute of Animal Genetics,
University of Edinburgh.
May 23.

[1] H. H. Cole and R. F. Miller, *Amer. J. Physiol.*, **104**, 165; 1933.

The Minor Details of the Planet Mars

IN the issue of NATURE for April 8, p. 518, a note appears on an article on Mars by Mr. H. B. Brydon, in which particular reference is made to my recent volume on the planet and my conclusions as to the illusory nature of the so-called canals. In order that readers of NATURE should not be misled by the article, I hasten to reply to Mr. Brydon's statements.

It is at Flagstaff that the planets Mercury, Venus, Jupiter and Saturn, as well as the Jovian satellites, have been seen covered with linear markings, which were afterwards pronounced unreal by their most prolific discoverer[1]. It is further imprudent for a believer in linear canals on the planet Mars to mention the name of Prof. G. W. Ritchey, since that great astronomer repeatedly asserted to me that, having carefully scrutinised Mars with the fine 60-inch reflector of Mount Wilson, constructed by himself, he never saw a single straight line, or canal, on the planet, though details were observed beyond the range of the most powerful refractors in existence.

My late-lamented mentor and friend, E. W. Maunder, remarked in 1894 that the so-called canals of Mars often disobey the laws of perspective; and I have demonstrated in my book the veracity of this statement, by showing that canals considered to run along arcs of great circles appear straight, not only at the centre of the disc, but also at 30° and more from the centre—a fact which, of course, establishes their illusive character.

I have also shown that the canals, after defying perspective, further defy diffraction, since they vanish in a large telescope, whereas a real, dark, planetary line, such as Cassini's division of Saturn's ring, becomes naturally darker and broader with an increase of aperture.

Lastly, I pointed out in 1909 that, in the 33-inch refractor I was using, no straight lines could be detected on Mars, while delicate detail, far beyond the reach of the small telescopes with which the

illusory canals had been discovered, was held quite steadily under fine seeing.

Such objections, whether considered severally or collectively, are, of course, fatal to the alleged reality of the linear markings. The planet is far too distant, from 35 to 250 millions of miles, to show canals. The truth is that a tired eye is liable to glimpse straight dark lines on the so-called continental regions of that neighbour world when viewed through an ordinary telescope; but these optical illusions vanish in a powerful instrument, which reveals broad, complex, dusky streaks, forming no network on the planet. The surface features of Mars are thus shown to be infinitely irregular and natural, like those of all the other bodies of the solar system.

Paris. E. M. ANTONIADI.
April 25.

[1] "Illusions of Vision and the Canals of Mars", in *Popular Science Monthly*, vol. 70, May, 1907.

Electron Diffraction by Vapours

DURING the last two years, a practical method has been evolved for obtaining good photographs of the diffraction of 30–55 kv. electrons by vapours. I now get satisfactory results with any substance the vapour pressure of which exceeds 10 cm. of mercury at 750° C. With the aid of the apparatus now set up, measurements of the electron diffraction of any known stable organic compounds can be made, and the investigation of many interesting structural problems arising in inorganic chemistry is also rendered feasible. A number of preliminary photographs have been taken of members of the following series and of certain other substances: Polyhalogen derivatives of methane and ethane; aromatic hydrocarbons and some of their isomeric dihalogen compounds; polymethylene dibromides from butane and decane; and volatile halides of the elements and of cyanogen.

It has recently been found that nearly double the number of diffraction rings that have been observed up to now can be registered by using a variety of photographic emulsions. Hence most of the work must be repeated before the full results can be published in detail.

HENRY DE LASZLO.
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May 23.

Viscous Damping of Vibrating Metal Bars

WITH the exception of those made by K. Honda and S. Konno[1] and also those by K. Iokibe and S. Sakai[2], few measurements of viscous damping in metals have been made. I have made some experiments concerning this problem with the assistance of Mr. K. Kubo[3]. The metals experimented with were aluminium, duralumin, copper and brass, each in the form of a bar clamped at one end and free at the other. To analyse the result the appropriate solutions of the following equation were used:

$$\rho \frac{\delta^2 y}{\delta t^2} + Ek^2 \frac{\delta^4 y}{\delta x^4} + \xi k^2 \frac{\delta^5 y}{\delta t \delta x^4} + \zeta \frac{\delta y}{\delta t} = 0,$$

where E is Young's modulus, ξ the coefficient of solid viscosity, ζ the coefficient of air damping, k the radius of gyration of a cross section of the bar, and y the deflection of the bar at x.

Vibration experiments were made in a vacuum chamber of inner diameter 40 cm., inner height 24 cm., and thickness 1 cm. A circular hole of 3 cm. diameter in the vertical wall of the chamber was plugged with a disc having parallel plane surfaces, through which the movement of the test piece in the chamber was observed. The air in the chamber was pumped out through a pipe system connected to a Cenco Megavac pump and a glass Langmuir diffusion pump, by which the pressure was lowered to 1/2,000 mm. of mercury. Special arrangements for the clamping and the motion of the bar as well as the photographic recording were devised.

The results, after analysis, showed that the coefficient of solid viscosity ξ in C.G.S. units is $7{\cdot}5 \times 10^6 \sim 8{\cdot}0 \times 10^6$ for duralumin, $5{\cdot}9 \times 10^6 \sim 6{\cdot}8 \times 10^6$ for aluminium, $9{\cdot}3 \times 10^6 \sim 11{\cdot}6 \times 10^6$ for copper, and $12{\cdot}7 \times 10^6 \sim 15{\cdot}0 \times 10^6$ for brass. It was also found that the coefficient of solid viscosity is different for different amplitudes of vibration. For large amplitudes the coefficient was also large.

From this work it will be seen that the values of the solid viscosities of metals are so small as to be of the order of $10^6 \sim 10^7$ in C.G.S. units. If the energy of vibration is dissipated outwards from the clamped end, the value will be apparently increased to a much greater degree. In an aeroplane flying in air or in analogous cases, little energy can be dissipated outwards, while the inner damping is too small, so that it is probable that the phenomena of perfect resonance will frequently take place. In the case of a building or of a machine on land, the dissipation of vibrational energy is not the effect of the viscous or other frictional damping but is chiefly due to the radiation of the energy from the boundary, so that the synchronous vibration in that case does not play an important part in the nature of the building or machine. The explanation of the increase of damping with the increase of the amplitudes of vibration is somewhat difficult in the present state of our knowledge on mechanics.

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Tokyo Imperial University.
April 24.

[1] *Phil Mag.*, **42**, 115–123; 1921.
[2] *Phil. Mag.*, **42**, 397–418; 1921.
[3] *Rep. Aeron. Res. Inst.*, Tokyo, No. 89; 1932.

Supersonic Vibrations set up in a Zinc Bar undergoing Transverse Vibrations

IN the course of experiments on the latent splitting of bars as reported by one of us[1], we noticed a very curious and interesting phenomenon in zinc.

When the zinc bar after observations of frequency

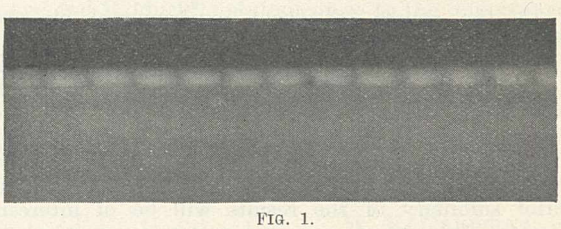

FIG. 1.

had been removed, we noticed on examining it that besides rupture lines, a large number of indentations and protuberances were clearly visible at very regular intervals along one of the vertical sides of the bar. It had the familiar appearance of the

Kundt's tube phenomenon, where nodes and anti-nodes are formed by the stationary longitudinal vibrations of the enclosed gas. The protuberances were shining spots formed by the bulging out of the zinc locally. The effect was photographed and is reproduced in Fig. 1 after enlargement. The distances between the successive nodes were measured directly on the zinc bar by means of a microscope.

As the reproduction shows, these nodes and anti-nodes are at extraordinarily regular intervals. The mean value of the distance between consecutive nodes came out to be 0·141 cm.

Now the velocity of longitudinal waves or the velocity of sound in a material is given by

$$V = \sqrt{E/\rho}$$

where E is Young's modulus and ρ the density of the material. But the velocity V of the longitudinal waves is also given by

$$V = n\lambda$$

$$\text{Therefore, } n^2\lambda^2 = E/\rho$$

Substituting the values of E and ρ for zinc and of λ as found from actual measurement, we get the value for frequency

$$n = \sqrt{\frac{8{\cdot}7 \times 10^{11}}{7{\cdot}1 \times (0{\cdot}282)^2}} = 1{\cdot}24 \times 10^6$$

This high frequency, of the order of a million, is probably due to the impact of zinc crystals in the bar during the course of alternate compression and extension in the act of vibration.

The frequency of transverse vibration of the zinc bar had been varied from nearly 78 to about 27 and the appearance reproduced in Fig. 1 was formed during the course of this variation. The thickness of the bar was 0·066 cm.

We made a few attempts to reproduce the phenomenon noted here, but have not been successful so far. It is possible that there is a critical frequency of the transverse vibration of a given bar for which the longitudinal vibration excited is the strongest, depending on the size of the metal crystals contained in the bar. It may be noted here that it is well known that metallic zinc contains ordinarily well-developed crystals.

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April 3.

[1] NATURE, 127, 90, Jan. 17, 1931.

Characteristics of the Ionosphere

IN the course of recent experiments[1] on the structure of the ionosphere, we have found that not two only but several[2] 'layers' exist in which there is either a maximum, or a tendency towards a maximum, of ionic density. Since any complete theory of the structure of the upper atmosphere or of the transmission of radio waves through it must take these facts into account, it is thought that a brief summary of the results will be of interest. Certain observations concerning abrupt variations of ionisation will also be described. In all these experiments transmission was at normal incidence to the layers.

(1) It has been found that in addition to the E region at a height of 100–120 km. and the F region from 190 to 300 km. there is an intermediate reflecting region, which we shall refer to as the M region. The data indicate that the average height of the M region is approximately 150 km. but that on some days it may be so high as 180 km. while on other days it may be so low as 130 km. The M region has been found on a number of occasions before noon during December of last year and January and February of this year. The data usually indicate that when this region is found there is a well-defined maximum of ionic density and that it is separated from the E and F regions by ionisation minima.

In order to observe the M region, it is necessary that the frequency used be great enough to permit penetration of the E region, but small enough to give reflection from the M region. The M region can, therefore, be observed only so long as its maximum of ionic density exceeds that of the E region below it.

As the maximum ionic densities of the E and M regions have been found to be of the same order of magnitude during the times when they are both observed, and as the maxima do not vary at the same rate with time, it is reasonable to assume that the M region maximum is normally present but that it is shielded by the E region except for a few hours in the middle of the day.

(2) The ionisation in the F region does not increase uniformly with height but has often been found to have a step-like structure[3]. This indicates that there is a tendency for the formation of several ionisation maxima in the F region. Occasionally two maxima have actually been found, but ordinarily these sub-regions overlap and the ionisation increases in a series of 'steps'. At times the 'treads' of this step-like structure are strikingly level, indicating remarkably abrupt ionic density gradients at heights near 200, 240 and 280 km. This type of phenomenon has been found only during daylight hours, and it may be said that if the steps are present at night they are very difficult to find. These facts suggest that the formation of these subregions depends upon the ionising activity of the sun.

(3) Throughout the daylight hours during the past winter the ionisation of the F region has often been found to vary in an erratic manner. The maximum ionic density exhibits abrupt changes which are often so great as 25–50 per cent within time intervals of 15–30 minutes. These changes suggest that there may be some variable source of ionisation, cosmic or solar in nature, the effect of which is superimposed upon a normally steady ionising effect due to the sun. The time of maximum ionisation seems to occur near noon, but the maximum is not at all well-defined, since the ionic density has about the same average value from 9.00 a.m. until 3.00 p.m. (winter and spring at Deal, N.J., latitude 40° N.).

(4) The ionisation of the E region increases with time in a uniform manner, attaining a maximum near noon. The abrupt changes found in the F region are not normally present in the E region.

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April 5.

[1] The method used was that previously described in the *Proc. Inst. Radio Eng.*, July, 1932.

[2] This had previously been suspected for days of magnetic storms (*loc. sit.*, p. 1145).

[3] T. L. Eckersley also has concluded that the F region may be stratified. See *J. Inst. Elec. Eng.*, vol. 71, September, 1932.

Output of Electrical Energy by Frog-Skin

IF a piece of frog-skin, mounted with glucose Ringer solution on both sides, is connected in series through two calomel electrodes with a micro-ammeter, a current may be observed to flow through the circuit for many hours. With a piece of skin 1·6 cm.² in area in a circuit of total resistance 1,500 ohms the current is 20–30 × 10^{-6} amperes during 12 hours after setting up.

Between 0° C. and 30° C. the resistance of the skin falls steadily, the potential rises to a maximum at about 20° C. and then falls off, and the current rises to a maximum at about 25° C. before decreasing. The output of electrical energy by the skin can be calculated as equivalent to the Joule heat developed in the circuit. This was found for four different skins to lie between 5 and 9 × 10^{-3} calories per minute per gram dry weight of ventral skin at 20° C. It has been shown[1,2,3] that when the ionic composition of the solution is constant the frog-skin potential is maintained by oxidation processes. It is of interest, therefore, to see what fraction of the energy released by oxidation may appear as electrical energy. The respiratory quotient of the skin of *Rana temporaria* is 0·97[4]. The average oxygen consumption of frog-skin[3] was found to be 20 × 10^{-3} c.c. oxygen per minute per gram dry weight at 20° C. (other values are summarised by Adolph[5]). Assuming that molecules of $(C_6H_{12}O_6)_n$ are burnt and taking the heat of combustion per gram as 680,000 calories, it will be found that the energy released by oxidation processes is on the average 100 × 10^{-3} calories per minute per gram dry weight at 20° C. The electrical energy output calculated above is 5–10 per cent of this value.

The temperature coefficient of the electrical energy output for a rise of 10° C. was determined for three skins and compared with the average Q_{10} for respiration for four skins.

	Q_{10} Electrical Energy			Q_{10} Energy from Combustion.
0° C.–10° C.	2·85	1·99	3·90	3·6
10° C.–20° C.	1·4	1·44	1·41	2·0
20° C.–30° C.	—	—	—	1·9

The power output is a maximum at 24° C. for the electrical process and at 38° C. for the respiratory processes of the skin. Lund and Moorman[6] have found that values of Q_{10} for potential and oxygen consumption of the skin of *R. pipiens* between 16·4° C. and 26·4° C. are 2·14 and 2·01 respectively. (In my work Q_{10} for the potential in this interval is near unity.) They adduce this approximate equality in support of a theory of the skin potential based on "the flux equilibrium of the oxidation-reduction systems" in the cells of the skin. Since, however, the frog-skin does not behave as a reversible galvanic cell, the potential cannot be related directly to the energy released by oxygen consumption except on the lines indicated above.

There are also objections to the interpretation of the skin potential, which is measured between reversible calomel electrodes, in terms of oxidation-reduction potentials which can only be measured with the aid of an inert metal electrode to act as an electron donor or acceptor[3]. The skin potential, like the injury potential of crab's nerve[7], depends on oxygen consumption and also on the nature and concentration of the electrolytes present[8]. With these two factors in mind, further work is in progress in conjunction with Dr. R. J. Pumphrey, on the nature of the frog-skin potential.

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April 14.

[1] Lund, *J. Exp. Zool.*, **51**, 265, 291, 327; 1928.
[2] Francis and Pumphrey, *J. Exp. Biol.* In press.
[3] Francis, *J. Exp. Biol.* In press.
[4] Bornstein and Klee, *Arch. exp. Zellforsch.*, **3**, 395; 1927.
[5] Adolph, *J. Exp. Zool.*, **53**, 313; 1929.
[6] Lund and Moorman, *J. Exp. Zool.*, **60**, 249; 1931.
[7] Hill, NATURE, **131**, 501; 1933.
[8] Uhlenbruck, *Z. Biol.*, **82**, 225; 1924.

The Astronomical Radiative Stability

ASTRONOMERS are doubtless not unaware of the enormous radiative uniformity that is demanded by the permanence of organic life on the earth. If the temperature at the earth's surface were altered even for a single season from its actual value about, say, 27° C. or 300° K., by 50° in excess or defect, all terrestrial organic life would be blotted out never to return. This would happen if even only once in the hundred million years demanded for terrestrial organic evolution the effective temperature of the solar radiating surface changed from the present mean value 6,000° K. by 1,000° in excess or defect, if it were a matter of steady state, while during the time of this change the stream of radiation incident on the earth would be altered in a proportion much greater. On current theories the difference between the top and bottom of the radiating solar atmosphere would be great in comparison with this figure, and lower down vast temperatures are soon reached. This shows how extremely steady the balance must be, and how slight the solar evolution must have been even in that vast time. As one result, the sunspot disturbances, even though they occupy only a very small part of the area of the solar disc, would have to be purely superficial phenomena. The output of radiation is very steady, as from a steady interior; yet the heavens are full of variable stars. Perhaps these considerations were remotely in view when long ago Whewell and Brewster were discussing the plurality of worlds, and Huxley championed the geologists against Kelvin.

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May 14.

The Combustion Problem of Internal Ballistics

IN a recent paper on the combustion problem of internal ballistics[1], we have attributed jointly to Love and Pidduck[2] a statement as to the importance of including both temperature and pressure in the rate of burning law for colloidal propellants. Their paper was published in two parts, and the statement in question was made in Part 2, which was entirely the work of Dr. Pidduck. Our reference, in consequence, was misleading, and we desire to correct the error.

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May 23.

[1] *Phil. Mag.*, 7, **15**, 529; 1933.
[2] *Phil. Trans.*, A, **222**, 599; 1922.

Research Items

Dragons. In *Man* for May, Mr. G. D. Hornblower discusses the origin and distribution of the art-forms of the dragon. The conception of a blend of various forms of fierce and dangerous animals such as lion, eagle and snake appears in the earliest pictorial records of the Near East. In Mesopotamia its association with deities may attribute to them the qualities associated with each animal. Dragons are both evil, as Tiâmat, or beneficent, as in the wings (a dragon survival) of the sun disc in Egypt. On all the earliest cylinders animal forms predominate, much subject to distortion. Animal art disappears in Mesopotamia under Semitic influence, but reappears in Assyrian art, while it holds its position in Egypt and North Syria. Beyond Assyria in Urartu (Armenia), dragons, lions and aurochs pointing to Assyrian influence appear on the objects looted by Sargon II from Musasir. It has been shown that Mitanni-Khattite art extended to this region, and thence to the Medes and through them to the Achaemenids, this zone including the hilly country around Elam, the modern Luristan, whence come objects of art attributed to the Kassites of the Iron Age and to be related, through Armenia, to a northern or 'Scythian' region of this art-province. Nomad peoples gave to this animal art a new life and vigour. The Scythians compounded an ancient animal art, possibly descended from an ancient stone age art extending from Finland to Siberia, with the influences from Mesopotamia and formed the animal art called 'Scythian', later adopted and further modified by the Sarmatians. In the southern province the animal art developed the peculiar characteristic of the elongation convention. Scythian elements were introduced into China in the Ts'in and Han dynasties, when the Chinese began to ride horses and changed their military equipment. In this new phase of Chinese art two provinces are to be discerned, one in which the chief characteristic is a plain animal form rendered naturalistically, and a second in which objects are decorated in foreign style, but with a well-developed Chinese manner.

Tell-Billa. An account of the joint excavations of the University Museum, Philadelphia, and the American Schools of Oriental Research at Tell-Billa, which is to appear in the *Museums Journal*, Philadelphia, opens with a report on the pottery by Dr. E. A. Speiser in vol. 23, No. 3. Tell-Billa is a mound fifteen miles north of Mosul, the excavation of which began in 1930 after a preliminary reconnaissance in 1927. This had indicated the importance of this mound and the adjacent Tepe Gawra, eight miles away, for knowledge of pre-Assyrian civilisation north of Nineveh. The two sites in conjunction have furnished stratified evidence for the study of more than four millennia of north Mesopotamian history, extending from neolithic down to the Hellenistic period. Gawra is by far the older site, the occupation of Billa beginning only when 14 metres of occupation deposits had covered the site of Gawra. From about 3000 B.C. to the middle of the second millennium, the two mounds show a parallel course of development. By this time Gawra had become unsuitable for further occupation and was abandoned for Billa. The occupation levels at Billa have been followed down to virgin soil. These show seven main strata, which afford a series of pottery sequences demonstrating ceramic changes and development at Billa and also contact with the outside world. From the survey of strata 7 and 6 (the lowest), it is apparent that the differences between the two strata are chronological rather than cultural. The chalice, first painted, then incised, is the most characteristic ware of strata 7 and 6 and is found in the seventh stratum of Gawra and at Nineveh. In south Mesopotamia a painted fragment occurs at Fara, of which the earliest level falls within the Jemdet Nasr period preceding the early dynasties of Ur. The Jemdet Nasr fabrics also include the squat pot with sharply marked shoulder which is well established at Billa. The distribution of the chalice corresponds roughly with the Highland Zone and has been traced from Anatolia to Persia. It is evident from the relation of Billa and Gawra that the chalice folk were intrusive. From this time onward Billa was subject to a succession of invasions from the north and north-east, with an influx of cultural influence from the south in stratum 5.

Norwegian Oyster Pools. Important hydrographical and biochemical work in connexion with oysters is described in Bergens Museums Årbok, 1932. 1. Hefte ("Naturvidenskabelig Untersuchungen in Norwegischen Austern-Pollen", von Torbjørn Gaarder und R. Spärck). Two oyster pools were investigated, the Espevik-Poll and the Saelø-Poll, both connected with the Hardanger Fjord. The chief conclusions are that the meteorological conditions, especially light, have a dominant influence on the physico-chemical relations and consequently on the life in these pools, since the light regulates the assimilation efficiency of the phyto-plankton which is the food of the oyster. The brackish water layer on the surface varies in thickness according to the rainfall, and the light must penetrate this layer effectually in order to reach the salt-water layer in which assimilation takes place. In a good year, the temperature below the brackish-water layer may reach a high figure and the smaller green organisms up to 3μ which are the chief food of the larvæ will abound in spring and summer. Unfortunately, the same food is taken by the small animals, especially gastropod larvæ (*Cerithium* particularly) and mussel larvæ which flourish under the same conditions. Efforts are made to get rid of these. In the bad years with little sunlight, bacteria increase greatly and it is interesting to find that this coincides with outbursts of the dinoflagellate *Ceratium*, the molluscs being little in evidence. The results of these researches indicate that much may be done with the pools in the way of oyster rearing provided that there is sufficient sunlight, the natural conditions being such that usually the chemical food required by the nannoplankton is adequately represented with the exception of nitrates and phosphates, which can be increased artificially.

Cattle Blood-Sucking habit of a Bug. On the occasion of describing a new genus and species of Anthocoridæ (Hemiptera) from New Zealand, W. E. China discusses the feeding habits of bugs belonging to this family (*Ann. and Mag. Nat. Hist.*, April, 1933). They appear to be probably all predaceous on eggs and larvæ of other insects, and even on the adults of smaller forms, such as Aphididæ and Coccidæ. Thus, *Triphleps insidiosus*, Say, and *T. australis*, China, feed on the eggs of the false cotton boll worm, *Heliothis obsoleta*; the many species of *Anthocoris*

found in flowers probably prey on the thrips which live there; *Piezostellus flavipes*, Reuter, occurring in granaries, probably feeds on eggs and larvæ of grain feeding Coleoptera and Lepidoptera, or perhaps on mites, etc. Many species live under bark, and such is the case of the new one described in the paper, *Maoricoris benefactor*, which preys on the bark-beetle *Acrantus opacus*, White. An extremely interesting member of the family is *Lyctocoris campestris*, which is commonly found in stables and cattle-sheds and is known to suck the blood of horses and cattle. This exceptional habit suggests a possibility that *Lyctocoris* may act as a transmitter of foot and mouth disease. While the evidence in favour of this novel hypothesis is purely circumstantial, experimental examination would be of considerable interest.

Karyology and Systematic Relationship. A series of eight papers mainly devoted to the chromosome morphology of various economic plants is found in the recently issued *Bulletin of Applied Botany, Genetics and Plant-Breeding*, Leningrad. Vakar has made a study of the chromosomes in various interspecific wheat hybrids, which throws further light on their relationships, *T. pyramidale* being near *T. turgidum* as *T. sphærococcum* is allied to *T. vulgare*. The paper by Senyaninova-Korchagina on the chromosomes of various *Ægilops* species has a bearing on the origin of the bread wheats. The tetraploid and hexaploid species of *Ægilops* possess only one pair of tri-articulate chromosomes and one pair with 'heads'. From evidence of this kind it is concluded that these species have arisen through interspecific crossing and subsequent doubling of the chromosomes in the hybrids. There is evidence also of a phylogenetic shortening of one chromosome arm into a head. The same author has studied the chromosomes of *Vicia faba* and the related *V. narbonensis* and *V. serratifolia*. She finds that while, for example, the races of *V. narbonensis* from Glasgow and Transjordania are morphologically alike, their chromosomes differ in the ratios of arm length. An extensive study of the Trifoleæ by Chekhov shows that nine species of *Ononis* out of ten are tetraploid, one being octoploid (64). In *Trigonella*, nine species have 16 chromosomes and one 28, probably due to an association of four chromosomes in a tetraploid. In this group most of the polyploid forms are perennial and have larger fruits. Emme has similarly investigated the species of the subgenus *Euavena* and the pentaploid hybrids of *Avena*.

Thickness of the Greenland Ice. The Wegener expedition to Greenland in 1930–31 was the first to use experimental seismic methods for measuring the thickness of the ice-sheet. Dr. E. Sorge has now given some account of these experiments and their results (*Geog. J.*, April). Measurements of the thickness were made in twelve places at 12, 42, 62, 82, 120 and 400 kilometres from the west coast respectively. The last of the series was at the station of Eismitte in the heart of Greenland at an elevation of 3,000 metres. Apparently the most accurate measurements were taken at 120 km., where observations were numerous. At Eismitte the seismograph was put up in only one place but several readings were taken. Dr. Sorge believes that at the central station the ice-sheet is about 2,000 metres thick but admits that, owing to possible error in the readings, it may be any depth between 1,800 and 2,700 metres. Even the smaller figure suggests thicker ice than was expected. At the 120 km. station the ice is 1,600–1,800 metres thick and the rock floor has slopes up to 30°. It is clear that the land surface of Greenland is not highland throughout and that much of the interior is not so high as the ranges near the coasts. In fact, the shape suggests a plate with a broader and higher eastern than western edge. Dr. Sorge discusses the methods employed and possible sources of error in the observations. One of the chief difficulties seems to be the weight of the explosives required, which is a serious problem in transport to the interior.

Earthquakes of Northern Africa. The African continent is usually regarded as one of general stability at the present time, and, if we confine ourselves to earthquakes of the first order, the impression is probably justified. There are, however, various regions in which shocks of moderate strength are common, one of the most important being that which consists of the three northern countries of Algeria, Tunis and Morocco. Mme. A. Hée has given an interesting account of the work recently done in those countries (*Matériaux pour l'Étude des Calamités*, No. 28, pp. 291–337; 1932). Regular observations in Algeria date from 1911, when two Mainka horizontal pendulums were erected in the Observatory of Alger-Bouzaréah. In Tunis, the meteorological service collected reports on earthquakes from 1922 and a Mainka pendulum was installed at Tunis in 1926. Since 1929, the Institut Scientifique Chérifien has undertaken the collection of macroseismic observations, but no recording instrument exists in Morocco. Thus, our knowledge of Algerian earthquakes is at present the most complete, and Mme. Hée gives lists of 586 earthquakes between the years 1911 and 1931, distributed in 22 different zones, four of these shocks reaching intensities 9 or 10. The more active zones, as usual, border the regions in which the sea bed slopes most steeply.

Cosmic Rays. Year Book No. 31 of the Carnegie Institution of Washington contains a summary by Prof. A. H. Compton of the results which have been obtained by the nine observers who, with the aid of a grant from the Carnegie Corporation of New York, have been sent with identical sets of apparatus to representative portions of the earth's surface. The rays are found to be influenced by the earth's magnetic field and are stronger at the magnetic poles than at the magnetic equator. The increase of intensity of the rays with altitude has been found to continue to very high elevations. The bursts of ionisation which have been investigated show that a single cosmic ray is capable of releasing at least 10^8 electron-volts of energy. The diurnal variation of the rays at mountain stations is found to be greater than those observed previously by observers at lower levels. Argon gas under pressure is found to be a much more sensitive detector of cosmic rays than other gases. On the whole, the observations are in favour of the view that cosmic rays are streams of electrified particles such as electrons or protons. See also NATURE of May 20, p. 713.

New Observations on the Heaviside Layer. Ratcliffe and White have recently described the results of a method for recording continuously the reflection of wireless signals from the upper atmosphere (*Proc. Phys. Soc.*, May). Short wave trains are radiated by a special transmitter and the pulses with their echoes are received at a station a few kilometres away and recorded by a cathode ray oscillograph. The time base of the oscillograph is synchronised

with the pulses by controlling both transmitter and oscillograph from the same A.C. mains. A record was taken from the oscillograph on continuously moving photographic paper. The records show very clearly the behaviour of the ionised layers, and from examination of a number of records, the 'normal' summer-time behaviour has been deduced. During the day, reflection takes place from the *E* layer at an equivalent height of about 120 km. In the evening, the reflection is gradually transferred to the *F* layer at about 260 km. The height of this region rises gradually and the echo splits into two components which rise and disappear successively. At sunrise this sequence is reversed. The *E* region reflection sometimes reappears during the hours of darkness, and this abnormal behaviour seems to be connected with an ionising agency quite different from that producing the daytime *E* region. It is possible that this agency may be the electric fields in the neighbourhood of charged rainclouds. Appleton and Naismith describe in the same journal measurements which they have been making for some time on the maximum ionic content of the Kennelly-Heaviside layer. The density of ionisation is connected with the critical wave-length below which the rays penetrate the lowest layer and are reflected at an upper layer. Observations were made once every week at about noon. The curve shows a summer maximum of ion density. The summer maximum ionisation was greater in 1931 than in 1932, and this may be correlated with greater sunspot activity in the former year. Occasions of abnormally high ionisation density are common during the summer months, and a fairly high correlation has been found between high ionisation and thunderstorm activity.

An Optically Active Inorganic Salt. Sulphamide, $SO_2(NH_2)_2$, behaves as a weak dibasic acid and if sodium rhodichloride, Na_3RhCl_6, is added to a solution of its sodium salt, the salt $Na[(H_2O)_2Rh(N_2H_2SO_2)_2]$ is formed. Since the residue $-NH.SO_2.NH-$ occupies two of the six octahedral co-ordination positions of the rhodium atom, the other two being occupied by water molecules, the acid radical in square brackets should give the usual *cis* and *trans* forms, in the latter of which the $-N_2H_2SO_2-$ groups occupy two positions in the plane, and one position in the plane and one axis, respectively. This configuration is dissymmetric and should exist in optical isomers. Mann (*J. Chem. Soc.*, April; see also NATURE, **130**, 368, Sept. 3, 1932), who has prepared this salt, has resolved it into optical isomers by crystallisation with dextro and lævo α-phenylethylamine and with d-nor-ψ-ephedrine. The occurrence of molecular dissymmetry among purely inorganic compounds is very rare, since it is almost invariably dependent on the presence of suitably co-ordinated ring systems and these are difficult to form with entirely inorganic elements, or are insoluble. The new compound, therefore, is of unusual interest.

Astronomical Topics

New Minor Planet. A very interesting new minor planet 1933 HH, of the tenth magnitude, has been discovered at Johannesburg. Berlin R.I. Circ. 779 gives the following orbit deduced by H. E. Wood and Mr. Jackson:

Epoch 1933 May 8·0 U.T.

M	193·5890°	
ω	157·0834	
Ω	335·9980	1925·0
i	7·6191	
φ	23·5206	
n	2863·962″	
a	1·15333	

Ephemeris for 0h U.T.

	R.A.			N. Decl.	
June 1	0h	18m	30s	1°	1′
,, 9	0	34	48	3	10
,, 17	0	51	18	5	22
,, 25	1	8	12	7	37

The object appears to resemble planet 1932 HA in that it comes inside the earth's orbit at perihelion, but it is now near aphelion.

Seasonal Changes on Jupiter. The axis of Jupiter is so nearly upright to its orbit plane that seasonal changes in the usual sense cannot be conspicuous. There are, nevertheless, certain changes traceable on its surface that approximate in period to its orbital revolution. Mr. A. Stanley Williams, who has been a regular observer of the planet for about half a century, has recently given (*Mon. Not. Roy. Astro. Soc.*, March) a study of the changes in rate of rotation of the north tropical current on Jupiter. He notes that this region is free from disturbing influences such as are present in the zone of the great red spot, so that there is more chance of detecting seasonal effects. The study covers half a century, 1881–30, and includes observations from all available sources. The graph shows evidence of a periodic change of rate, with maxima in 1888 ($9^h55^m40^s$), in 1904 ($9^h55^m32^s$), in 1919 ($9^h55^m30^s$), and in 1928 ($9^h55^m33^s$). There were well marked minima in 1911 ($9^h55^m17^s$) and 1922 ($9^h55^m21^s$). The author has used also a few observations made in 1835 and 1862, and deduces that the length of the cycle of change is 12·4 years, and that in the mean the epochs of minimum period, or maximum velocity, are given by the formula $1909\cdot9+12\cdot4E$. The period given is distinctly longer than the time of revolution, which is 11·862 years, but the interval covered by continuous and exact observations is scarcely long enough for the excess to be regarded as established. It is still more in excess of the average sunspot period; this has been suspected to be associated with some of the changes on Jupiter, but apparently the changes in rotation time are not correlated with it.

Illumination of Nebulosity surrounding a Nova. Mr. B. M. Peck contributes a paper on this subject to the February number of the *B.A.A. Journal*. Many attempts have been made to obtain the parallaxes of novæ by the rate of expansion of the surrounding nebula. There are, of course, two cases: that of an actual driving out of nebulous matter, and that of the rendering visible of previously existing clouds. The paper discusses the latter case and shows that the circle of visible nebulosity first expands to a maximum radius, and then contracts again to a point; the times of expansion and contraction are equal. During expansion the light is highly concentrated towards the centre, during contraction it tends to become uniform. The outburst is assumed to occur within the nebula. The results will be similar in kind if the nebula is behind the nova, but if it is in front of it there will be no contraction. The paper treats the subject analytically.

Central American Research by the Carnegie Institution

A FEATURE to be noted in the most recent developments of archæological research in the field is an increase in specialisation, and where financial considerations will permit, the supplementing of the purely archæological work by research in other branches of science which can be made to assist in the interpretation of archæological results in their bearing on the general problem of the history of man and the development of his culture, whether considered regionally or in its broader aspect. Thus Dr. A. V. Kidder, in his report as chairman of the Historical Section of the Carnegie Institution of Washington (Year Book No. 31), remarks: "It is difficult to escape the conviction that only by co-ordinated research involving the cooperation of all the disciplines devoted to the study of man and the collateral support of many biological and physical sciences can we attain understanding of any given episode in human history."

It is on these broad lines that the Carnegie Institution is now promoting the study of the archæology of Central America. Investigations which were undertaken originally as a study of the archæology only of the Mayas of Yucatan, have been expanded to embrace, in addition, on an ordered scheme, the geology, geography and climatology of the area, the physical characters of the inhabitants, their physiological characters and liability to disease, their ethnological affinities, their languages and their mode of life and culture.

At Chichen Itzá, the principal zone of interest of the Institution in Yucatan, Dr. S. P. Morley was engaged in the examination of a building known locally as the 'Mercado', although there is no reason to think that its original use was that of a market-place. It was probably a purely ceremonial building. It consists of a single vaulted chamber, no less than 250 ft. long, in which the architect had given full play to technically daring and bold ideas. Thus the vault is 15 ft. wide, the broadest span yet recorded for the Maya area. The building displayed the weakness of all other Maya buildings in placing too great reliance upon columnar beams of wood to carry the huge weight of the stone superstructure. The roof crashed even before the abandonment of the city; but its fall preserved intact a remarkable altar on which was sculptured in relief and brilliantly painted a procession of elaborately costumed captives, marching towards a centrally enthroned figure.

A second major undertaking at Chichen Itzá was the exploration of a building known as the 'Monjas' by Mr. John S. Bolles—a problem of considerable complexity, owing to the fact that a building, originally small, had been continually enlarged by alterations and additions until it became a veritable puzzle in massive masonry. Even on a superficial examination it showed five distinct periods of architectural modification.

From Chichen Itzá an expedition was sent to investigate the newly discovered site of Calakmul in the archæologically unknown region of south central Campeche. Two weeks were spent there. The site proved to be that of a very extensive Old Empire city, remarkable for the unprecedented number of its monuments. The dates of nearly fifty were deciphered, ranging from A.D. 364 until A.D. 550. It was evidently colonised from Peten. Its situation midway between Peten and northern Yucatan gives it great archæological importance.

Next to Chichen Itzá, the Institution's most important archæological centre in the Maya field is Uaxactun, an Old Empire city in Northern Peten, Guatemala, where work has been carried on since 1924. It was the oldest and longest-inhabited centre of Maya culture. Stratified deposits have been uncovered going back far beyond the first stone-carved records. Here, in what is known as the *A* group of buildings, a palace was excavated by Mr. Ledyard Smith. This is a type of building in the Old Empire of which very little is known. It was found to consist of four courts surrounded by cell-like structures. The greatest height of the building as it now stands is nearly 50 ft. The north court and main court were excavated and were found to be on different levels and connected by stairways. A number of pyramids were also examined, and were found to contain burial vaults which yielded much valuable pottery.

Advantage was taken of the temporary residence of Dr. S. K. Lothrop in Guatemala to engage him in carrying out a preliminary archæological investigation of the Highlands of that area.

In the collateral studies, to which reference is made in the beginning of the report, Guatemala was on this occasion made the principal centre of activity. Geographical reconnaissances were made by Dr. Wallace W. Atwood, president of Clark University, and Dr. Rollin S. Atwood of the University of Florida, the former undertaking the definition of the physiographic provinces of the Highlands, with special reference to Lake Atitlan and adjoining territory; while Dr. Rollin Atwood made a detailed geographical survey of the region of Chichicastenango.

A medical expedition worked in Yucatan under Dr. George M. Saunders, collecting information upon the various forms of malaria and amœbic dysentery. The prevalence of three types of malaria was demonstrated, as well as an infestation with the amœbæ causing dysentery. The medical expedition to Guatemala under Dr. George G. Shattuck had as its objective a general knowledge of the diseases prevalent in the Highland area and the collection of material for comparison with the low-lying Yucatan Peninsula, especially with reference to the Indian population. In Guatemala, as in Yucatan, the Indians showed an extraordinary resistance to the virus of syphilis.

At Chichen Itzá, Dr. Steggerda made a study of the amount and character of the food of the modern Maya and continued his study of their anthropometry, more especially with respect to growth and genetic study. Dr. Davenport also made an inspection with the view of gauging the possibilities of Yucatan as a field for genetic study.

In the ethnological field Dr. and Mrs. Asael Hansen made a study of the *barrio* of Santa Ana, a part of Merida which has recently undergone great changes towards urbanisation. In linguistics the work was confined to the study of material collected in previous seasons.

Notwithstanding these varied activities, Dr. Kidder notes a number of further problems in topography, geology and climatology which are especially urgent; while in biology, he says, the field "has hardly been scratched".

Alcohol Through the Ages

THE jubilee memorial lecture of the Society of Chemical Industry, which had this title, was given by Dr. E. F. Armstrong and has since been published (*J. Soc. Chem. Ind.*, March 24 and 31). Dr. Armstrong dealt in a very detailed and interesting manner with the production of alcohol and its industrial applications.

The process of distillation was known to the Ancients, though the earliest records of its application for obtaining concentrated alcohol for use by the Arabian doctors of medicine date from the tenth century. Concentrated spirit was prepared by Raymond Lully (born 1235) by dehydration with fused potashes, the name 'alcohol' being used for it by Libavius in 1597. The synthesis of alcohol from ethylene was effected by Henry Hennell in 1827–28. Methylated spirit for manufacturing purposes was legalised in 1855, and in 1902 the use of other suitably denatured alcohol for special purposes was permitted without duty.

In the manufacture of industrial alcohol, fermentation processes still hold the field, but are becoming menaced by the probability of the industrial production of ethanol (ethyl alcohol) from ethylene. The raw material for fermentation (cane sugar molasses, potatoes, sugar beets, maize, grain) varies in different countries. A pure culture of yeast is used and the fermentation is rigidly controlled, the carbon dioxide evolved being utilised in the United States by solidification to form 'dry ice' for refrigeration purposes. Attempts to use sawdust have been made, and in 1930 large quantities of alcohol (about half being used as motor fuel) were made in Sweden from the waste liquors of works producing paper from wood pulp.

Synthetic alcohol (ethanol) can be made from ethylene or from acetylene, but the latter process, once used in Germany, has been abandoned. Ethylene is present in the gas formed in the 'cracking' (thermal decomposition under pressure) of petroleum with the production of petrol. In one process used in the United States, the gas contains 28 per cent of ethylene, with other unsaturated hydrocarbons which can again be cracked to give ethylene with fair yields. Whereas abundant ethylene is available in the United States there is little or none produced at present in this way in Great Britain.

The conversion of ethylene from coke oven gas into alcohol has for some time been carried out in France, the reactions being those used by Hennell:

(1) $C_2H_4+H_2SO_4=C_2H_5.HSO_4$;
(2) $C_2H_5.HSO_4+H_2O=C_2H_5OH+H_2SO_4$,

the hydrolysis of the sulphovinic acid being carried out with steam and the diluted sulphuric acid used to make ammonium sulphate with synthetic ammonia. Large quantities of alcohol (4 million gallons up to the end of 1931) have been made from ethylene in the United States at a conversion cost, probably, of 1*s*. per gallon.

Another possible, but still uneconomic, process starts with water gas, containing carbon monoxide and hydrogen. In presence of a catalyst under high pressure, methyl alcohol (methanol) is the normal product:

$$CO+2H_2 = CH_3OH,$$

but by using a special catalyst, some ethanol is also produced.

In considering the industrial applications of ethanol, Dr. Armstrong referred to its use as a motor fuel in conjunction with petrol, and practically every country has provided by legislation for the production of this fuel. The manufacture of power alcohol is comparatively neglected only in the British Empire, except Southern Rhodesia, Natal and Queensland. The production of absolute alcohol by direct distillation was made possible by the researches of Sidney Young, but these were neglected for some years; the process is now largely used in France and the United States by concerns which have extensive patent rights. Many foreign governments are making the use of alcohol compulsory in order to save money from being spent abroad on petroleum products. The London General Omnibus Co., Ltd. has made extensive trials with mixtures of benzol and alcohol, and the use of alcohol fuels has long passed the experimental stage. The use of alcohol would provide a market for surplus agricultural products. Ether, aldehyde, acetone and acetic acid are all produced from alcohol on the technical scale.

International Commission for the Polar Year, 1932–33

THE International Commission for the Second Polar Year held its third meeting in Copenhagen on May 15–20, under the presidency of Dr. D. la Cour. Representatives from Denmark, Norway, Sweden, Finland, Germany, France, Italy, Holland, Great Britain (Dr. Simpson and Prof. S. Chapman), the Department for Terrestrial Magnetism of the Carnegie Institution of Washington and the U.S.A. Coast and Geodetic Survey attended. No representative from the U.S.S.R., which is taking a large part in the work of the Polar Year, was able to attend.

The report of the president showed that the great enterprise of the Polar Year is being very successful, and that the present unsettled conditions of the world are not having the adverse effects which one feared. At least forty stations north of latitude 55°, of which thirteen are north of latitude 70°, are recording the earth's magnetic field, most of which are using the remarkable quick run magnetographs designed by Dr. la Cour in addition to the more usual self-recording instruments. Three new magnetic stations have been established in the southern hemisphere, at Elisabethville by Belgium, at Cape Town by the University of Cape Town and at Magellanes by Chile, but the work in the southern hemisphere is somewhat disappointingly small.

All the magnetic stations are also taking meteorological observations and a large number of established meteorological stations have augmented their normal observations. The aurora is being studied in greater detail than it has ever been before. The auroral atlas prepared by Prof. C. Størmer has played a large part in the organisation of auroral work and with its help the observations are being made in a systematic manner which will greatly facilitate the discussion of the results. Simultaneous photographs of the aurora from observing points twenty or more miles apart, for the accurate deter-

mination of the position of the aurora in the atmosphere, are being made at several stations, amongst which the British station at Fort Rae is one of the most successful, more than 4,000 pairs of simultaneous exposures having already been obtained there.

The investigation of the temperature of the high atmosphere has been greatly facilitated by the use of *radio-sondes*, instruments which emit radio-signals while being carried on free balloons, from which the temperature at each height can be determined. More than two hundred such instruments have been supplied and brought into use at the different observing stations.

For the first time, explosions are being organised in high latitudes, in order to investigate the travel of sound waves through the upper atmosphere under polar conditions. These observations give information about the temperature conditions at much greater heights—40 km. or more—than can be reached by instruments carried on balloons. A grant of 40,000 dollars by the Rockefeller Trust for the purchase of magnetic instruments and *radio-sondes* and the training of observers in their use has been of the greatest value ; without this grant it would have been impossible to make observations in many parts of the world, and the investigations of the earth's magnetic field and of the temperature of the upper atmosphere would have been much less complete than they will be now.

The International Union of Scientific Radio-Telegraphy has organised an intense study of the ionosphere during the Polar Year, and the reports of the work of the British station at Tromsö is of outstanding interest and importance, a constant record being obtained of the height and intensity of the reflecting layers.

Without going into further detail, it will be clear that the scientific work during the Polar Year will be of immense value for the solution of many problems of geophysics.

The main work of the Commission was concerned with making plans for the early publication of the results obtained during the Polar Year and their ultimate discussion. The actual working up and publication of the observations must be undertaken by the various countries which have been responsible for making them ; but the Commission feels it essential that there should be some central body to direct and facilitate the discussion of the results. For example, it is highly desirable that copies of all the magnetic registrations, taken throughout the world during the Polar Year, should be available at some central place for the convenience of investigators ; that a list or index of all the observations made during the Polar Year should be prepared and published so that workers on any problem may know what data are available and where they can be found. The Commission considers that the best way to obtain this end would be to continue its functions after the end of the Polar Year and a resolution to this effect was passed.

The prosecution of the work of organising the discussion of the results will involve considerable expense. As no funds at present exist for such a purpose, the Commission could only express the hope that the necessary money will be made available.

In all, the Commission passed nineteen resolutions and there can be no doubt that very valuable organising work was accomplished.

The King of Denmark received the members of the Commission and expressed his great interest in the work of the Polar Year.

University and Educational Intelligence

CAMBRIDGE.—Dr. R. O. Redman, of St. John's College, has been appointed University lecturer in the Department of Astrophysics and Mr. J. A. Ratcliffe, of Sidney Sussex College, University lecturer in the Department of Physics. Dr. N. Feather, of Trinity College, and Mr. P. I. Dee, of Sidney Sussex College, have been appointed University demonstrators in the Department of Physics.

Candidates for the Michael Foster studentship in physiology are requested to send in their applications, with a statement of the course of research they propose to undertake, to Prof. J. Barcroft, Physiology School, before the end of June. The student receives the annual value of the fund (about £100) and may be re-elected for a second year.

Under the will of Mr. Arthur Marmaduke Shield, who died in 1922, a considerable sum of money was left to the Medical School for the foundation of a scholarship in human anatomy and for the general purposes of the School. A report of the Faculty Board of Medicine has recommended the foundation of the studentship and that the remainder of the bequest should be devoted to the foundation of a readership in pharmacology to be called the Shield readership in pharmacology. The Board wishes to offer the directorship of the sub-Department involved to Prof. E. Mellanby, professor of pharmacology in the University of Sheffield, and, in view of his distinction and present position, it seems appropriate that he should be given a personal professorship which will terminate with his tenure of the office.

DURHAM.—A new lectureship has been added to the Department of Geology, to which Miss Doris L. Reynolds has been appointed. Miss Reynolds was formerly on the staffs of the Queen's University, Belfast, of Bedford College, London, and of University College, London ; and her published studies of the sedimentary and igneous rocks of the north of Ireland are well known to petrologists.

LONDON.—The title of professor of philosophy in the University has been conferred on Dr. L. S. Stebbing, in respect of the post held by her at Bedford College.

THE British Government has decided to participate in the management of the International Bureau of Technical Education, and Mr. A. Abbott, formerly chief inspector of technical education, has been nominated as its representative on the Administrative Council and Mr. E. G. Savage, chief inspector of technical education, as correspondent with the Bureau. The address of the Bureau is : 2, Place de la Bourse, Paris, 2e.

THE eighth Summer School organised by the British Social Hygiene Council will be held at St. Hugh's College, Oxford, on July 27–August 3. The study programme includes four lectures in biology by Mr. D. Ward Cutler and Dr. N. J. T. M. Needham, five in psychology by Prof. A. E. Heath and Dr. William Brown, five in anthropology by Prof. R. Firth and Miss Monica Hunter and three in physiology by Dr. Agnes Scott. Other lectures and discussions will deal with prostitution, the unemployed adolescent, problems arising in residential institutions for

young people and developments in colonial education. The courses of lectures should prove of special interest to teachers. Further information can be obtained from the Secretary, British Social Hygiene Council, Carteret House, Carteret Street, S.W.1.

APPLICATIONS are invited for the following scholarships administered by the Council of the Institution of Electrical Engineers, of which awards will be made this year: Duddell Scholarship, value £150 per annum, tenable for three years, open to British subjects less than nineteen years of age on July 1, 1933, who wish to take up a whole-time day course in electrical engineering; Ferranti Scholarship, value £250 per annum, tenable for two years, open to British subjects less than twenty-six years of age on July 1, 1933, who are students or graduates of the Institution and desire to carry out whole-time research or post-graduate work; Swan Memorial Scholarship, value £120, for one year, open to British subjects less than twenty-seven years of age on July 1, 1933, who desire to carry out whole-time research or post-graduate work; Silvanus Thompson Scholarship, value £100 per annum and tuition fees, tenable for two years, for works employees; open to British subjects less than twenty-two years of age on July 1, 1933. The successful candidate will be required to take up a whole-time day course in electrical engineering at an approved university or technical college. Inquiries for full particulars and nomination forms (specifically mentioning the name of the scholarship) should be addressed to the Secretary of the Institution, Savoy Place, London, W.C.2.

A CASE for a "Colonial Educational Conference" was made out by Sir George Maxwell, formerly Chief Secretary, Federated Malay States, in a speech made on April 11 at a meeting of the Educational Circle, Royal Empire Society. The importance in colonial administration of paying due regard to indigenous languages, customs and traditions and the view that the language is "the most adequate exponent of the soul of a people" have been often stressed in recent years, notably by the Phelps-Stokes African Commission of 1924 and in memoranda issued in 1927 and 1930 by the Colonial Office Educational Advisory Committee but, said Sir George Maxwell, "Memoranda are not enough". The primary concern of the suggested conference, as of the educational conference of the French Colonial Exhibition of 1931, would be the adaptation of education to the needs of the colonies and it would deal with such matters as: a linguistic educational survey, textbooks, vernacular training schools for teachers, vernacular trade and artisan schools, extent of demand for higher schools and a university; and the power of the colony to assimilate the product. On some of these, light will perhaps be thrown by the series of special lectures to be given at the summer school organised by the British Social Hygiene Council to be held at Oxford on July 2–August 3, on the work of colonial administrators with special reference to the educational aspect. This same problem of the adaptation of education to the needs of a community with a cultural heritage radically different from western civilisation is dealt with at some length in "The House of the People", an account of Mexico's new "schools of action" published by the United States Government Printing Office, Washington (pp. 73, price 10 cents).

Calendar of Nature Topics

South-West Monsoon in India

From November to April the prevailing winds over India blow from the north-east, but during April the direction is reversed and from May to October the winds blow mainly from west in the Arabian Sea and from south in the Bay of Bengal. Among sailors these alternating winds are known as the north-east and south-west monsoons, from an Arabic word meaning seasons. In India, however, the 'monsoon' means rather the annual rains which fall during the period of the south-westerly winds. The latter begin in May, but in this month the amount of moisture in the air is only sufficient to cause scattered thunderstorms. The real monsoon rains begin in June, when powerful streams of air sweep across India from the west on the west coast of the Deccan and from the south in Bengal. Each of these currents has a well marked 'front', which brings the first heavy rains, usually with thunder. The arrival of this front is the 'burst' of the monsoon, which is often heralded by a weak cyclonic depression in the Arabian Sea or Bay of Bengal. The burst of the monsoon occurs early in June on the west coast and on about June 15 in Bengal; normally by the end of June the monsoon is established over the whole of India.

Spring in Northern Europe

In temperate countries the change from winter to summer takes place gradually and often fitfully through a much-varying spring. In higher European latitudes, within the line of the Arctic Circle, the transition is more abrupt and produces startling changes in the countryside. There is a sudden upheaval in early June and, within a few days, the hillsides, previously snow-clad, stream with rushing torrents. Wide patches of earth appear and grow rapidly green. Alpine and other flowering plants follow quickly in profusion, and the sunlit landscape glows with colour. Millais (1919) has recorded that on the north coast of Norway no birds were seen before May 25 except resident ravens and magpies together with various gulls. During the next ten days the first spring arrivals appeared—flocks of snow buntings, redwings, fieldfares, shore larks, and the Greenland wheatear. Soon after the beginning of the ice break in the first week of June, several pairs of long-tailed duck and a pair of red-throated divers were noted. The advent of migrants continued throughout June, until the dotterels, buntings and other late-comers reached summer quarters. On June 6, 1916, Millais witnessed, near Hammerfest, the courtship of the bluethroat. A female was joined by two brilliant males, whose gorgeous throats shone like jewels in the sun. They went through a leaping courtship somewhat similar to the courting behaviour of the common redbreast.

Spawning-Time of the Sturgeon, and the Need for Protection

Formerly the rivers of Poland were famous for the abundance of their sturgeon (*Accipenser sturio*), and of these perhaps the most famous was the Vistula, where a quarter of a century ago large catches were made. Now the numbers have fallen seriously: on the lower Vistula, in Pomerania, the years 1929–32 yielded 65 individuals, the middle regions during

1925–32, 36. The weight percentages caught in different months were :—April 14 per cent, May 37, June 18, August 2, September 2 ; which means that already in April sturgeon are present abundantly in the Vistula and that in August the migration is over. The heaviest individuals appear in April and May, and after June and July the weight suddenly falls, an indication that the latter are the spawning months, since the weight of roe makes up about 20 per cent of the total body weight. The actual spawning grounds in the Vistula have never been discovered.

Now the only area in which a close season is enforced is Pomerania, and there the close season runs from July 15 until August 31 ; so that during the very time when the river ought to be left undisturbed for spawning, fish are liable to be caught. The close season should be extended in area, and also in time to cover the spawning period, say from June 1 to the present closing date. Although destruction of sturgeon for food has had something to do with the growing scarcity of the species, it must not be forgotten that still more is its disappearance due to the pollution of the rivers by the refuse of industrial and human centres. (Wlodzimerz Kulmatycki, in *Ochrona Przyrody*, Warsaw, 12, 8 ; 1932.)

The Spring Flush

Pastures are now approaching the peak of their productivity in England and the skill of the grazier is shown in the most economical conversion of the plentiful growth of grass into a saleable form. The problem has always been recognised as a difficult one, namely, the adjustment of the balance between the interests of the pasture and the grazing stock. Writing of the utilisation of grazing land, Arthur Young says : "There are two opinions directly contrary to each other : first it is asserted by one set of graziers, that, let the grass to be fed consist of ever so many acres, that the cattle should have it all at once. Secondly the other set advance that large fields of fifty, eighty or an hundred acres should be divided, that the farmers may change his stock from one to another and give the grass fresh and fresh".

The difficulty of putting these rival theories to the test seemed insuperable to Arthur Young, on the ground of soil variation and individuality in the grazing stock. Only recently, more than a century after the above was written, are scientific methods of the evaluation of herbage by their botanical composition and the performance of grazing stock being worked out. The difficulties are still there, but modern technique in the field, and the treatment of the data by statistical methods, enables valid conclusions to be drawn from data which present the high degree of variability associated with living material. New aspects of the utilisation of grass land are continually coming to light, and no crop is at present so much in favour for scientific research.

The outstanding feeding value of young grass, the superior qualities of selected strains of the native grasses and clovers, and the extraordinary influence which the grazing animal can exert on the direction of development of a pasture, are all recently established points of first rate importance in grass land management. Pasture management can never be a rule of thumb operation but the time is rapidly approaching when graziers will have a body of well-established principles at their command, in place of the rival opinions no less tenaciously held now than in the time of early writers.

Societies and Academies

LONDON

Physical Society, April 7. A. H. BLATCHFORD : The diffraction of X-rays by liquid sulphur. The X-ray diffraction effects given by liquid sulphur at various temperatures between 130° C. and 260° C. indicate an unstable grouping of atoms of sulphur which becomes less pronounced with increased temperature, and changes in form gradually up to 220° C., when there is a sudden alteration corresponding to the change from the form S_λ to S_μ. Raman and Ramanathan's theory of X-ray scattering by liquids is applicable to some extent at temperatures near the melting-point. E. GWYNNE JONES : The hyperfine structure of perturbed series. Rules governing such effects are derived. It is found that these rules are not analogous to those obtained from the analysis of multiplet structures. A. J. BRADLEY and A. H. JAY : Quartz as a standard for accurate lattice-spacing measurements. A test has been made of the use of quartz as a standardising substance for very accurate lattice-spacing determinations. With copper-K_α radiation it gives a very good photograph with many sharp K_α doublets, which may be measured with accuracy. A redetermination of the axial ratio from an X-ray powder photograph gave $c/a = 1{\cdot}10002 \pm 0{\cdot}00004$, and this value was confirmed by X-ray measurements on several other crystals. Assuming Bergqvist's value for d_{100} (4246·02 X units) it was found that $a = 4902{\cdot}9$ x., $c = 5393{\cdot}3$ x. The values of d_{100} at 18° C. for different specimens all lay between $4245{\cdot}9_5$ and $4246{\cdot}3_0$. L. H. MARTIN and K. C. LANG : The thermal conductivity of water. The parallel-plate method was used over the range 7°–60° C., the apparatus being especially designed to cope with the difficulties which arise in the measurement of the conductivity of a volatile liquid. Two series of measurements were made, the plates in one apparatus having approximately three times the area of those in the other.

Society of Public Analysts, May 3. S. G. WILLIMOTT : An investigation of solanine poisoning. In two districts of Cyprus there is a practice of eating potato shoots and leaves as vegetables, and last year an epidemic of poisoning was traced to this cause. The amount of solanine found in the green shoots of the Irish potato plants consumed in these cases was more than five times the quantity present in the tubers of the same plants. It was found that the solanine content of potato shoots diminishes as the altitude at which the plant is grown increases. Habitual consumers of potato shoots probably acquire immunity to the alkaloid. F. E. HUMPHREYS and H. PHILLIPS : Examination of leather for the presence of extractable chromium compounds. In view of the fact that cases of dermatitis have been attributed to the wearing of chrome-tanned leather, experiments have been made to ascertain the amounts of chromium compounds which can be extracted from various types of chrome leather, under conditions similar to those which the leather encounters during wear. Chrome leathers suspected of causing dermatitis did not contain a greater quantity of water-extractable chromium than did normal leather, but many chrome leathers might irritate the skin of a person particularly sensitive to chromium compounds. Solutions resembling sweat in composition do not remove much more chromium, either as chromate or

trivalent chromium compounds, than does water, although slightly acid solutions tend to extract slightly larger amounts than neutral solutions. W. M. SEABER: Barium as a normal constituent of Brazil nuts. Barium occurs as a normal constituent of Brazil nuts, the amounts found in 14 samples of the shelled nut of different seasons ranging from 0·02 to 0·31 per cent. As a rule, Para nuts contain less than Manaos nuts. Nearly the whole of the barium is in an insoluble form, but a considerable proportion of it can be extracted by 0·15 per cent hydrochloric acid, and with higher concentrations of acid it is practically all dissolved. HERBERT HAWLEY: The phytosteryl acetate test as a routine method for examining butter fats. A method is described in which the sterols are directly extracted from a small amount of butter fat by shaking with chloroform and an alcoholic solution of digitonin, and then converted into acetates the melting point of which is determined. The method will detect 5 per cent of vegetable fat in butter or ghee.

Royal Meteorological Society, May 17. D. BRUNT: The adiabatic lapse-rate for dry and saturated air. The equation giving the saturated adiabatic lapse-rate is derived as an energy equation, and a slight approximation makes it possible to reduce this to a form suitable for direct computation. The results obtained are represented graphically. An alternative derivation of the fundamental equation for rising saturated air is given, which, by assuming the principle of entropy from the beginning, reduces the derivation to very brief compass. C. S. DURST: Notes on the variations in the structure of wind over different surfaces. Over the sea, the short-period fluctuations in wind are greater in tropical air than in polar air, although when inversions of any magnitude occur over the sea, smooth-flowing air can persist with higher velocities than over agricultural land. An example is shown of the structure of wind over desert, and the frictional churning of the air due to a town is examined; the effects on temperature are found to be appreciable. C. E. P. BROOKS and THERESA M. HUNT: Variations of wind direction in the British Isles since 1341. Regular observations of wind direction began near London in 1667, at Edinburgh in 1731 and at Dublin in 1725, and extend, with gaps in the earlier periods, to the present day. Over nearly the whole series the prevailing wind has blown from about west-south-west, but abnormally frequent easterly winds were recorded during the period 1740–48 in London and Dublin and during the period 1794–1810 in London. The present century has been remarkable for the persistence of south-westerly winds. Before 1667, observations are scanty but Merle's diary shows a dominant wind from west-south-west in the years 1341–43, while there is good evidence that easterly winds were abnormally frequent during the latter half of the sixteenth century.

LEEDS

Philosophical and Literary Society, March 3. R. WHIDDINGTON and J. E. TAYLOR: Inelastic scattering of electrons in helium at zero angle. Experiments on electron impacts, energies between 40 and 400 volts, with helium atoms have been carried out, the inelastically scattered electrons at zero angle receiving special attention. It is shown that for the $2'P$ excitation: the probability is very approximately a linear function of the energy of the incident electrons between about 40 and 400 volts energy; the probability of excitation falls to zero at an energy somewhat greater than that corresponding to the critical excitation energy; and the excitation probability is definitely lower than that predicted by recent theories. R. WHIDDINGTON and T. EMMERSON: Scattering of electrons in helium. The experimental and theoretical results so far published indicate that both the inelastic and elastic scattering of slow electrons in helium rise to a maximum for zero scattering angle. Using fine electron beams and narrow slits together with magnetic spectrum analysis and photographic recording, results have been obtained at smaller angles than those hitherto investigated, which show a maximum probability at a small angle with a low probability at zero angle. R. WHIDDINGTON and F. C. POULTNEY: Energy of the beams in electron diffraction. The experiment of G. P. Thomson on the velocities of electrons diffracted by passage through a thin film has been repeated. Greater resolving power is obtained by using 90° deviation, when the circular rings become elliptical but are found to remain symmetrical about the central spot. Consequently it is deduced that the velocities are the same to within 0·30 per cent. No trace of diffracted electrons of energy less than that of the main beam is found. EDMUND C. STONER: Interatomic distances and ferromagnetism. Slater's suggestion as to the variation with interatomic distance of the sign and magnitude of the interaction integral is discussed with reference to the relative values of the interaction in the ferromagnetic elements, the change in volume on magnetisation, the variation of atomic moment in alloys of ferromagnetic elements, and the effect of manganese on the atomic moment in nickel manganese alloys. E. C. POLLARD: Law of force between neutron and proton. The increase of the heights of nuclear potential barriers with the increase in atomic number is discussed from the point of view of the content of the nucleus; if a polarisation field is assumed between neutron and proton, the experimental figures permit the calculation of the 'polarisibility' of the neutron. This is done. A. W. FOSTER: Some measurements of the thermoelectric powers of nickel and nickel-chromium alloys in the neighbourhood of their Curie points. The thermoelectric powers of some nickel-chromium alloys have been accurately measured between 100° C. and 450° C. and the destructive effect of small amounts of chromium on the change at the Curie point in nickel confirmed. J. GRAINGER and RACHEL M. HEAFFORD: Some effects of the ordinary tobacco mosaic upon the developmental anatomy of the host plant. Many virus diseases cause a mottling of yellow and dark green areas to appear upon a leaf. The anatomy of these several areas has been studied by many workers who have examined cross sections of the leaf. A recent paper by the authors (*Proc. Leeds Phil. Soc.*, 2, No. 9, 1933), describes the anatomy as revealed by examination in planes parallel to the surface, and also shows the various stages of development of mosaic diseased and healthy leaves. The presence of the virus has the general effect of slowing down the rate of vacuolation of leaf tissues, but it also causes irregularities to appear. The hypothesis is advanced that the anatomical features associated with light green and dark green areas of a diseased leaf can be explained by different relative rates of vacuolation in the upper epidermis, the palisade, the spongy parenchyma and the lower epidermis.

PARIS

Academy of Sciences, April 18 (*C.R.*, 196, 1153–1176). M. GIGNOUX and L. MORET: The prolongation in Haute-Savoie and in Switzerland of the structural units of the Dauphiny Alps. D. VAN DANTZIG: The fundamental group of compact abstract groups. SAINTILLAN: Forces of inertia of a system and a carrying along movement. R. TREMBLOT: A variable star with eclipses of short period. The star *BD.* 10·838 (Henry Draper Catalogue, *H.D.* 26909) has been recently shown by C. Hoffmeister to be a variable with very short period. The author's observations from January until March, 1933, confirm this and suggest that the variability is due to two stars and not to one star rotating on itself. MME. RÉCHID: Study of the thermal decomposition of ammonium phosphate. MLLES. M. MONTAGNE and G. ROUSSEAU: The preparation of the anils of fatty ketones. HENRI LAGATU and LOUIS MAUME: The comparative composition, in the vine, of homologous leaves taken respectively from stems carrying fruit and stems deprived of their grapes. The leaves from stems carrying grapes are poorer in lime, nitrogen and potash but richer in phosphoric acid than the homologous leaves from sterile branches. A. MAGNAN and A. SAINTE-LAGUË: Analysis of the 'hovering' of the *Volucella*. E. FOURNEAU, M. and MME. J. TREFOUËL, D. BOVET and PIERRE KŒTSCHET: Chemicotherapy of infections with *Trypanosoma congolense*. The selective action of polyarsenical organic compounds.

CRACOW

Polish Academy of Science and Letters, Jan. 9. L. CHWISTEK, W. HETPER and J. HERZBERG: (1) The fundamentals of rational metamathematics. (2) Remarks on the fundamentals of rational metamathematics. M. JEZEWSKI and J. KAMECKI: The dielectric constants of aqueous electrolytes. The dielectric constants of solutions of various electrolytes have been measured at concentrations varying from zero to 0·01 *N*. K. DZIEWOŃSKI and L. STERNBACH: The reactions of α-naphthylamine with benzoyl chloride. MLLE. J. ACKERMANN: The innervation of the skin of *Amblystoma mexicanum*. Z. KOLODZIEJSKI: The transplantation of young larvæ of axolotl on adult animals. L. W. WISNIEWSKI: Remarks on the systematics of the family of Coitocæcidæ. T. VETULANI: Researches on the types of Arab horses raised in Turkey.

GENEVA

Society of Physics and Natural History, Feb. 16. F. CHODAT and M. JUNQUERA: The reduction of methylene blue by an *Endomyces* at the expense of its endocellular hydrogen donators. The authors study the variations of the reducing activity of *Endomyces Chodati* in the system: methylene blue (acceptor), living yeast (ferment), in the absence of an extra-cellular hydrogen donator (Thunberg's technique, MacIlvaine's buffer mixture, temperature, 40° C.). The optimum conditions of *p*H, and of the age of the organisms are described. α-Monobromacetic acid, even when added in high concentrations, is without effect on the enzymatic process. M. GYSIN: Petrographic researches in the Haut-Katanga. (2) The formations of the Kundelungu. In the south-east part of the Haut-Katanga, the Kundelungu is represented from bottom to top by a schisto-grit dolomitic and clay conglomerate (tillite), by limestones and dolomite massifs, dolomitic grits with a little felspar and clay, by lustrous schists sometimes containing grit and by felspathic and dolomitic grits passing to quartzites. The author gives the correlations between these formations and those recognised in northern Rhodesia and in the cupriferous district of the Katanga. He then describes the petrographic constitution of these different rocks. A. LOMBARD: The Virgulian and the stratigraphy of the Portlandian of the Col du Marchairuz region. The Virgulian in the neighbourhood of the Col du Marchairuz and the Monts de Bière (Vaudois Jura) has been described by various geologists. Completing these data, the author demonstrates that this sub-stage is reduced to zero to the south-west of the Marchairuz. It is then impossible to distinguish the lower Portlandian from the upper Kimmeridgian. The upper Portlandian is characterised by marly limestones, important dolomitic levels and cargneules. The latter increase in thickness from north-east to south-west. The dolomitic layers diminish. H. PAILLARD and R. DUCKERT: Researches on the catalytic oxidation of acenaphthene. The authors have studied the oxidation of acenaphthene in solution in various solvents by the action of compressed oxygen and in the presence of catalysts capable of giving oxides of nitrogen. Under these conditions the only important oxidation product is naphthalic acid. H. PAILLARD and P. FAVARGER. Researches on the chlorination of acenaphthene. The authors have studied the action of chlorine on acenaphthene and the conditions necessary for obtaining a good yield of 5-chloroacenaphthene. A. PERIER: The influence, in a homogeneous ethnic group, of the variation of the cephalic index on that of the alveolo-palatinal and superior facial indices. The superior facial and alveolo-palatal indices show no correlation with variation of the cephalic index. Hence their relative stability, a disharmony inasmuch as the most brachycephalic skulls, are, proportionally, the most leptene and the most leptostaphyline. G. TIERCY: The respective phases of minimum ionisation and light minimum in the Cepheids. The author attempts to show how the combined effect of the curve of radial velocities, of that of light and of the theory of radiating equilibrium affords an explanation of the fact that the minimum ionisation phase precedes the light minimum.

Forthcoming Events

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

Wednesday, June 7

FOLK-LORE SOCIETY, at 8—(at University College, Gower Street, W.C.1).—Mrs. E. S. Drower: "Mandean Magic, White and Black". (Discussion).

Thursday, June 8

LONDON SCHOOL OF HYGIENE AND TROPICAL MEDICINE, at 2.—Sir George Buchanan: "International Hygiene" (succeeding lecture on June 9).*

UNIVERSITY COLLEGE, LONDON, at 2.30.—Sir Flinders Petrie: "Egyptian Links with the Past" (to be repeated on June 10 at 3, and June 13 at 5.30).*

ROYAL COLLEGE OF PHYSICIANS OF LONDON—(Croonian Lectures).—Prof. E. Mellanby: "Nutrition and Disease—the Interaction of Clinical and Experimental Investigations" (succeeding lectures on June 13 and 15).

Friday, June 9

LONDON SCHOOL OF HYGIENE AND TROPICAL MEDICINE, at 2.—F. Radcliffe: "Factory Medical Work".*

LONDON SCHOOL OF HYGIENE AND TROPICAL MEDICINE, at 5.—N. H. Mummery: "The Practice of Industrial Medicine".*

ANNUAL CONGRESS OF THE SOUTH-EASTERN UNION OF SCIENTIFIC SOCIETIES, June 7–10. Prof. E. J. Salisbury —president.

Official Publications Received

GREAT BRITAIN AND IRELAND

Proceedings of the Royal Society of Edinburgh, Session 1932–1933. Vol. 53, Part 2, No. 10: Spermatogenesis in *Drosophila obscura* Fallen, 1: The Cytological Basis of Suppression of Crossing-over. By Dr. P. Ch. Koller and Thelma Townson. Pp. 130–143+3 plates. (Edinburgh: Robert Grant and Son; London: Williams and Norgate, Ltd.) 2*s*.

The University of Sheffield: Research Department for the Cold Working of Steel and other Ferrous Metals. Reports to December 1932. Pp. 72. (Sheffield.)

The Empire Journal of Experimental Agriculture. Vol. 1, No. 1, April. Pp. 96. (Oxford: Clarendon Press; London: Oxford University Press.) 7*s*. 6*d*. net.

Royal Astronomical Society. List of Fellows and Associates, 1933 March. Pp. 45. (London: Royal Astronomical Society.)

Proceedings of the Royal Society. Series A, Vol. 140, No. A841, May 3. Pp. 241–483. (London: Harrison and Sons, Ltd.) 12*s*.

The Transactions of the Worcestershire Naturalists' Club. Vol. 8, Part 5, 1928–1931. Edited by Carleton Rea. Pp. v–x+295–392+123–139. (Worcester.) 10*s*.

Joseph Priestley, 1733–1804. By Dr. Robert Martin Caven. Pp. 25+6 plates. Chemistry and Life. (The Fourth Gluckstein Memorial Lecture, 1932.) By Sir Frederick Gowland Hopkins. Pp. 21. The Chemist in the Far East. By Alexander Marcan. Pp. 18. (London: Institute of Chemistry.)

Royal Botanic Gardens, Kew. Bulletin of Miscellaneous Information, 1932. Pp. iv+512+54+57+12 plates. (London: H.M. Stationery Office.) 15*s*. net.

Agricultural Progress: the Journal of the Agricultural Education Association. Vol. 10, 1933. Pp. 252. (Cambridge: W. Heffer and Sons, Ltd.) 5*s*. net.

Proceedings of the Royal Irish Academy. Vol. 41, Section A, Nos. 5–6: The Frequency Distribution of Resonance Radiation, by Dr. R. W. Ditchburn; The Transmission of Resonance Radiation through a Gas (Steady State), by Dr. R. W. Ditchburn. Pp. 41–60. 1*s*. 6*d*. Vol. 41, Section B, Nos. 10–11: The Synthesis of Diflavones, by Dr. Joseph Algar, Isabella B. McCarthy and Eveline M. Dick; The Action of Ammonia on Ethyl Malonate and Ethyl Malonamate, by Dr. Kenneth C. Bailey. Pp. 155–167. 1*s*. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.)

Air Ministry: Aeronautical Research Committee: Reports and Memoranda. No. 1498 (T.3218): Spinning Calculations on some Typical Cases. By H. B. Irving and A. S. Batson. Pp. 26+10 plates. 1*s*. 6*d*. net. No. 1501 (Spin. 70, 70a, T.3243): Tests of Floating Ailerons on a Bristol Fighter Aeroplane. Part 1: Rolling Balance Tests, by F. B. Bradfield and G. F. Midwood; Part 2: Full Scale Tests, by A. V. Stephens. Pp. 26+20 plates. 1*s*. 9*d*. net. (London: H.M. Stationery Office.)

Report of the National Baby Week Council, 1932: presented and adopted at the Sixteenth Annual Meeting of the National Baby Week Council held in London on the 22nd March, 1933. Pp. 26. (London.)

The Ninety-ninth Annual Report of the Royal Cornwall Polytechnic Society. New Series, Vol. 7, Part 2, 1932. Pp. xiii–xxvi+107–202+xvi. (Camborne.) 5*s*.

Proceedings of the Cambridge Philosophical Society. Vol. 29, Part 2. Pp. 165–318. (Cambridge: At the University Press.) 7*s*. 6*d*. net.

Armstrong College, Newcastle upon Tyne: Standing Committee for Research. Report, Session 1931–1932. Pp. 42. (Newcastle upon Tyne.)

North-Eastern Rhodesia: Geodetic Survey of South Africa. Vol. 6: Report on the Measurement of the Arc of the Thirtieth Meridian in North-Eastern Rhodesia. Executed by Dr. T. Rubin under the direction of Sir David Gill. Pp. 123. (London: H.M. Stationery Office.) 10*s*. net.

The Kent Incorporated Society for Promoting Experiments in Horticulture. Annual Report, 1932, East Malling Research Station, Kent, 1st January 1932 to 31st December 1932. Pp. 163+11 plates. (East Malling.) Free to Associate Members; to Non-Members, 3*s*. 6*d*.

The Journal of the Institution of Electrical Engineers. Edited by P. F. Rowell. Vol. 72, No. 437, May. Pp. 365–460+xviii. (London: E. and F. N. Spon, Ltd.) 10*s*. 6*d*.

Memoirs of the Cotton Research Station, Trinidad. Series A (Genetics), No. 5: Cytological Studies in Cotton, 1: The Mitosis and Meiosis in Diploid and Triploid Asiatic Cotton. By A. Skovsted. Pp. 227–251+plates 8–11. (London: Empire Cotton Growing Corporation.) 2*s*. 6*d*.

Board of Education. Educational Pamphlets, No. 93: An Experiment in Rural Organisation. Pp. 35+4 plates. (London: H.M. Stationery Office.) 9*d*. net.

Journal of the Royal Statistical Society. Vol. 96, Part 2, 1933. Pp. viii+183–380. (London: Royal Statistical Society.) 7*s*. 6*d*.

Proceedings of the Linnean Society of London, Session 1932–33. Part 2. Pp. 49–104. (London: Linnean Society.) 2*s*.

OTHER COUNTRIES

Spisy vydávané Přírodovědeckou Fakultou Masarykovy University (Publications de la Faculté des Sciences de l'Université Masaryk). Čis. 169: On the Bodily Differences between Sprinters and Non-Sportsmen (A Study of 100 Students from different Grammar Schools in Brno). By Dr. R. Malafa. Pp. 11. (Brno: A. Píša.)

Práce Moravské Přírodovědecké Společnosti. Svazek 8, Spis 4, Sign.F68: On the Question of Human Races on the Basis of the Precipitin Test and Isoagglutinations (Eskimos, Kalmuks, Gipsies, Europeans including Jews). By Prof. V. Suk. Pp. 42. (Brno: A. Píša.)

Transactions of the Mining and Geological Institute of India. Vol. 28, Part 1, April. Pp. 65. (Calcutta.) 4 rupees.

Scientific Papers of the Institute of Physical and Chemical Research. No. 414: On the Constitution of Phosphorescence Centres in Fluorite. By Satoyasu Iimori. Pp. 189–200. 25 sen. Nos. 415–421: On the Constitution of Stachyose, a Tetrasaccharide obtained from *Stachys tuberifera* Np, by Motoi Onuki; Nutritive Value of Sperm Whale Oil and Finback Whale Oil, by Yoshikazu Sahashi; On the Ergosterin Content of various Edible Mushrooms in Japan, by Midzuho Sumi; Narkotin und Vitamin C, von Suttekiti Maruyama; The Thermoluminescence Spectrum of Calcite, by Satoyasu Iimori; Note on the Spectra of PbII, HgI, SbI, ClII and JII, by Kiyoshi Murakawa; Dependence of *K* Lines of Elements from Cu to Ti on Chemical Combination, by Sanae Yoshida. Pp. 210–310. 95 sen. (Tokyo: Iwanami Shoten.)

Travaux de la section de Géodésie du l'Union Géodésique et Géophysique Internationale. Tome 8: Rapports généraux établis à l'occasion de la quatrième assemblée générale, Stockholm, 11–23 août 1930. Pp. vi+136+16+79+24+85+14+32+28+5+24+ii. (Paris.) 120 francs.

Journal de la Société des Américanistes. Nouvelle Série, Tome 24, Fasc. 2. Pp. xxix+221–446. (Paris.)

Proceedings of the Imperial Academy. Vol. 9, No. 3, March. Pp. v–vi+83–142. (Tokyo.)

The Geology and Underground Water of Rangoon (with Special Reference to Tube-Wells). By P. Leicester. Pp. iv+78+10 plates. (Rangoon: Government Printing and Stationery Office.) 15 rupees: 22*s*. 6*d*.

Mineral Resources: British Guiana. Particulars *re* Geological Formation and Surveys, Previous Workings, Communications, Transport, etc., in the North West District, Mazaruni and Puruni District, Potaro—Essequibo District. Pp. 64. (British Guiana: Department of Lands and Mines; London: The Crown Agents for the Colonies.) Free.

National Research Council of Japan. Report No. 10, April 1930—March 1931. Pp. ii+351–391+6. (Tokyo.)

Koninklijke Vereeniging "Koloniaal Instituut" Amsterdam. Twee en twintigste Jaarverslag 1932. Pp. 116. (Amsterdam.)

Sveriges Geologiska Undersökning. Ser. C, No. 376: Den järnmalmsförande lagerserien i sydnöstra Skåne. Av Assar Hadding. Pp. 39. 1.00 kr. Ser. C, No. 377: Vemdalskvartsitens ålder. Av Bror Asklund. Pp. 56. 1.00 kr. Ser. C, No. 378: Bidrag till kännedomen om kambrium och ceratopygeregionen inom Storsjöområdet i Jämtland. Av. Per Thorslund. Pp. 11. 0.50 kr. (Stockholm: P. A. Norstedt and Söner.)

Annual Report of the Harbour Commissioners of Montreal for the Year 1932. Pp. 121. (Montreal: Harbour Commissioners of Montreal.)

Publications of the Dominion Astrophysical Observatory, Victoria, B.C. Vol. 5, No. 3: The Problems of the Diffuse Matter in the Galaxy. By J. S. Plaskett and J. A. Pearce. Pp. 167–237. 50 cents. Vol. 6, No. 6: The Minimum Masses of Three Spectroscopic Binary Stars. By J. A. Pearce. Pp. 49–58. Vol. 6, No. 7: The Spectroscopic Orbits of the Four Helium Stars H.D. 29376, H.D. 39698, H.D. 44701 and H.D. 208095; The Radial Velocity of Boss 5628. By J. A. Pearce. Pp. 59–77. Vol. 6, No. 8: The Orbits of Four Spectroscopic Binaries. By W. E. Harper. Pp. 79–91. (Ottawa: F. A. Acland.)

Publications de l'Observatoire de Genève. Rapport sur les concours de réglage de chronomètres de l'année 1932. Par Prof. Georges Tiercy. Pp. 25. (Genève.)

Department of Agriculture: New South Wales. Veterinary Research Report. No. 6, Part 3 (December 1931). Pp. 93–136+4 plates. (Sydney: Alfred James Kent.)

CATALOGUES

Catalog and Price List of Eastman Organic Chemicals. (List No. 24.) Twenty-fourth edition. Pp. 108. (Rochester, N.Y.: Eastman Kodak Co.)

Monel Metal and Nickel in the Chemical and Allied Industries. (MH3.) Pp. 16. (London: Henry Wiggin and Co., Ltd.)

Heffer's Book Adviser, or What shall I Read? No. 2, April. Pp. 24. (Cambridge: W. Heffer and Sons, Ltd.)

Gardens and Gardening, Botany (General and Cryptogamic), Local Floras, Forestry, Timber, etc. (Catalogue No. 208.) Pp. 44. (London: Dulau and Co., Ltd.)

Watson's Microscope Record. No. 29, May. Pp. 24. (London: W. Watson and Sons, Ltd.)

Some Examples of "Vidi" Illustrations. Pp. 12. (London: The Kathleen Boland Studio.)

The Nickel Bulletin. Vol. 6, No. 5, May. Pp. 63–82. (London: The Mond Nickel Co., Ltd.)

Liver Extract B.D.H. (for Injection) in the Treatment of Pernicious Anæmia by Intramuscular Injection. Pp. 4. (London: The British Drug Houses, Ltd.)

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