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Sterilisation and Mental Deficiency.

THE conditions which exist in a modern organised community are so exceedingly complicated that ability above the ordinary is demanded of those who would cope with them. The environment which man has created is not the optimal for many biological types, and this is certainly true of the certifiable mental defectives, whose numbers have doubled during the last twenty years, and of whom it is estimated there are now no less than 300,000 in England and Wales alone (Report of the Mental Deficiency Committee of the Boards of Education and Control, 1929). It has long been recognised that these require a special environment of their own in which they are not forced to compete with their normal fellow-men, and where they are out of harm's way; and so, for them, appropriate institutional accommodation has been devised. But the country is not prepared to find the money wherewith to provide such segregation for 300,000. In fact, only about 25,000 are thus sheltered. A further 50,000 are under guardianship, whilst the rest are scattered amongst the general population, relatively uncontrolled and unprotected, to constitute a most serious social problem.

The survey of the Royal Commission on the Care and Control of the Feebleminded (1908) was necessarily imperfect and incomplete, but this cannot explain away the startling fact that in twenty years the incidence of this incurable condition has increased from 4·6 to 8·56 per thousand. It is certain that there has been an actual increase of appalling magnitude. Since there is evidence to show that in a great many instances mental deficiency is genetic in origin, it is reasonable to assume that the increase is due, partly or largely, to the production of mentally defective offspring by mentally defective parents and by others who, though they themselves are not mentally defective, nevertheless transmit the corresponding hereditary factors. If this is so, then it must be expected that the incidence of mental defect in the population will continue to increase, unless the production of mentally defective children is checked; and the only sure method of reducing it is that of denying parentage to all who are likely to produce offspring exhibiting the condition.

Until we know exactly the genetic basis of hereditary mental defect, we cannot possibly deny parentage to the normal who carry the genetic factors corresponding to it in their hereditary constitutions. We can only teach and plead that any normal couple who have produced a mentally

defective child should have no more children. But if the condition is genetic in many or all cases, no matter what the exact genetic basis of it may be, we cannot be mistaken in attempting to deny parentage to the certifiable mental defectives. To the eugenist, who holds the view that the condition is most commonly the expression of a biologically and socially undesirable hereditary constitution, the Report of the Mental Deficiency Committee of the Boards of Education and Control is as writing on the wall, foreshadowing the decay and doom of our human stock: for, since there must be harmony between the size of a population and the resources of its country, if the mental defectives increase, normals must decrease proportionately. No wonder there is a widespread interest in this matter, and that statesman, economist, sociologist, and biologist are in favour of legalising the voluntary sterilisation of mental defectives as provided for in a Bill brought before the House of Commons by Major A. G. Church on July 21; though unfortunately leave was not given for the Bill to be printed, so that it will not have a second reading.

Mental deficiency cannot be cured. The only possible treatment is the segregation of the mental defectives in appropriate institutions. If some or much mental deficiency is genetic in origin, as much care must be given to the children of the next generation as to the mentally defective individuals of this. So long as institutional treatment implies non-propagation, all is well; but if such segregation is insufficient or incomplete, then that portion of society which cares for the future as well as for the present must claim the right to prevent propagation on the part of the certifiable mentally defective. So long as medicine cannot cure the condition, society must claim the right to prevent the repetition of an hereditary blunder which yields individuals who cannot, in virtue of their organic inheritance, adapt themselves to prevailing social conditions, and who, because of their helplessness and lack of restraint and responsibility, hinder the further evolution of man and of society. The majority of rationally-minded people are agreed that every individual, including mental defectives, shall enjoy as much personal liberty as is consonant with the well-being of society, but insist that society can claim the right to protect itself, by all means at its disposal, from all those forces which threaten its existence.

The object of this Bill is to make the sterilisation of mental defectives, by such operative interference as vasectomy or salpingectomy, a lawful act, upon their own application or that of their parents or guardians. Its purpose is the sterilisation of mental defectives prior to their discharge from institutions; it also makes it possible for a defective to be sterilised voluntarily, with the sanction of the Board of Control, without being sent to an institution. The voluntary nature of the Bill is illustrated by the following safeguards: before an operation for sterilisation may be performed, the patient's consent must be given, if he or she be capable of expressing willingness or otherwise; secondly, the spouse or parents or guardians have to agree; the consent of the Board of Control must be obtained; and, finally, the operation must be approved by some judicial authority, such as a bench of magistrates. Only when these conditions have been observed can the judicial authority authorise the performance of the operation.

Undoubtedly, it is very necessary in this community to assume that any Bill dealing with such a matter as this will meet with considerable opposition, for personal opinions based on emotional bias are commonly more welcome than rational argument in accord with established fact. We may thus assume that the promoters of the Bill are presenting their minimum demands, fashioned in such a way as not to offend those whose opinions on this matter are really of no account but whose votes are important. The Bill is a soft-metalled pocket-knife which is to be used to hack away the steel ropes of mental deficiency which now entangle society. It cannot reduce the incidence of mental deficiency in Great Britain with any reasonable speed. Relatively few of the 300,000 mental defectives will be sterilised until spouses, parents, guardians, judicial authorities, as well as mental defectives themselves, have been persuaded that sterilisation by vasectomy and salpingectomy is to be desired, not only from the point of view of the patient, but also, and especially, from the point of view of society.

It is to be noted that the promoters of the Bill do not suggest that sterilisation should replace institutional segregation. They rightly hold the view that since institutional treatment is not available for all, and is commonly incomplete, sterilisation should be an auxiliary method of preventing propagation by mental defectives. Too much stress must not be laid on the suggestion that sterilisation will greatly diminish, if not entirely eliminate, mental defect. Until we know that mental defectives of one generation are responsible for more mental defectives in the next than are normal individuals carrying the genetic ingredients of this condition, it is impossible to form an accurate

estimate of the reduction in the incidence of mental deficiency which would follow upon sterilisation of all mental defectives in a single generation. Nevertheless, whatever be the size of the contribution of mental defectives of one generation to mental deficiency in the next, so long as there is a contribution, then we are justified in advocating sterilisation of the certifiable mental defective if non-propagation can thus best be ensured.

It is not claimed in this Bill that the wholesale practice of sterilisation would remove the necessity for institutional treatment. Sterilisation would not make a defective more efficient, or lessen in any way his or her social incapacity. It is impossible to contemplate the release of the bulk of mental defectives from a sheltered environment into an unsympathetic world, there to become the prey of the unscrupulous. Sterilised or not, they must drift into crime and destitution. Institutional treatment must be maintained and extended: there can be no return to the evil days when the mentally deficient pursued a wretched existence on the streets or in the workhouse and prison. Sterilisation is to be regarded as a means whereby the accommodation in institutions and the number of mental defectives may be brought into harmony. From the point of view of economy, it is probable that institutional treatment is in the end the cheapest method of dealing with a type that must always be economically a burden. A point of some importance is that it is generally taught that the mentally deficient lead a somewhat uncontrolled sexual life. If mental defectives known to be sterilised were widespread in the community, it is not improbable that promiscuous sexual intercourse would be increased and the spread of venereal disease thereby extended. Is it not possible that vasectomy increases sexual libido? Certainly it does not diminish it.

For these reasons, it is doubtful whether sterilisation as a general policy and as a wholesale measure to be applied to all defectives can command universal approval. Undoubtedly, on economic, humanitarian, and preventive grounds, segregation as a general policy is preferable, and, if complete and continuous, it prevents propagation. No one seems to urge that such institutional inmates should be castrated, yet this is the only method of removing the sexual urge which, according to many authorities, is exaggerated in this condition and must lead to personal distress. But there is no doubt whatsoever that in special cases sterilisation is the ideal treatment. There are many defectives, for example, who are relatively stable, and for whom, after training in an institution, a suitable place can be found in the general population. In the case of such, there is only one problem—the problem of destroying their reproductive ability.

To the layman the safeguards which surround the Bill would seem entirely sufficient, but it has to be remembered that, if and when sterilisation is legalised, there will be a very considerable increase in the number of applications, from parents and others responsible for maintenance, for the discharge of patients in institutions; and, unless the very greatest care is exhibited, there will be a very real danger of the operation being extended to defectives who are quite unsuited to outside conditions, for the sole reason that someone wishes to save money. Though sterilisation will not reduce the need for further institutional accommodation, when it has been legalised, it will be used as an argument by local authorities for the non-provision of such accommodation.

From many points of view it is to be regretted that this Bill was presented before the conclusions of the presently functioning Mental Deficiency Committee of the British Medical Association have been made known. The medical profession is heavily involved in this projected scheme, and Major Church would be in a much stronger position if, in addition to the support of the Eugenics Society, he knew that he had behind him the official endorsement of medicine.

Unofficial Moments of a Great Archæologist.

A Season's Work at Ur: al-'Ubaid, Abu Shahrain (Eridu), and Elsewhere; being an Unofficial Account of the British Museum Archæological Mission to Babylonia, 1919. By Dr. H. R. Hall. Pp. xxii + 300. (London: Methuen and Co., Ltd., 1930.) 25*s.* net.

DR. HALL'S last book was published ten days after his sudden and premature death. His friends may derive some consolation, and his readers at large satisfaction, from the fact that here for the first time in his writings he has given the world a narrative which is largely of personal experience. The tragic circumstance may also excuse a reviewer who pays more attention to this aspect of the book than to the scientific.

Practically all the scientific results had indeed been more fully published elsewhere—by Hall himself in archæological journals and the British Museum official publication "Al-'Ubaid" (written in collaboration with Woolley and Gadd), passages

of which are quoted at some length. Here and there he revises an opinion on a small point of detail; and in the chapters on Abu Shahrain and al-'Ubaid contributes, with some interesting plates of his own finds, a summary of the much-discussed painted pottery of the Near—and Far—East. But though almost half his space is devoted to a description of his own excavations, his main intention even here is to enable the reader to visualise the conditions and interest of his work in the field, rather than to offer him an archæological text-book.

As the full title indicates, however, there was a great deal more to this one Mesopotamian venture of Hall's than excavating alone. He was sent to report on, and take steps to safeguard, such antiquities in Iraq as he could reach; and he made the most of his mandate. He was a born traveller; scarcely a place he visited which failed to awaken some memory of stored-up knowledge; to many, unvisited before, he brought a more real acquaintance from his reading than others had got from the place itself. Allusion is the essence of his mental background—allusion which is safe from the charge of superficiality because of the amazing catholicity of his learning and the accuracy of his memory. The broken and, to-day, uninspiring arches of Koldewey's Hanging Gardens at Babylon suddenly take on the wooded appearance of the Zagros, as we follow Hall's apt comparison with the Mappin Terraces. Reaching Naṣirīyyah, which the British troops occupied after hard fighting in a July heat (1915), he recalls that though this was a "perfectly incredible time of the year for military operations . . . yet their grandfathers fought harder at Chillianwalla and Sobraon, wearing the same uniforms they would wear in London, with cross-braces constricting the chest". A holiday spent on the Albanian coast and "a thorough acquaintance with Miss Durham's books" enabled him to talk (in Arabic) of people and places they both knew, to a Serb, who was one of the Turkish prisoners working for him at Ur. These are random examples, but typical of his attitude throughout his mission.

Hall has a very strong sense of fun, which is never suppressed for long at a time. A favourite theme is his efforts to obtain for himself, by cajoling, impudent bullying, or 'scrounging', facilities and comforts which were not due to his rank as captain. But though he laughs at military methods, his gratitude to the several senior officers who helped him in various ways is generously expressed. He pokes fun at the large text printed in Gothic letters, the celluloid cuffs, and other relics of the German excavators, which he discovered in Koldewey's deserted headquarters at Kwairēsh. But his sallies are robbed of malice by the memory of happy times in Germany before the War—memories which he had revived during several visits in recent years.

Hall's constant reference to the kindness of officials who helped him in Iraq is matched by his frequent tributes to other workers in his own field: to Taylor and Thompson and others who had dug before him; to Woolley and Mallowan, his successors at Ur and al-'Ubaid; and to the cuneiform scholars, especially Sidney Smith and Gadd, without whom the work could not have been carried on, nor much of his book written.

Finally, the book is profusely illustrated with photographs, largely of his own taking, which in Hall's case invariably meant snap-shots. Some of his pictures are not perfect technically, but they never fail to have point or to help the text. Frequently they express his impish humour, for example, Fig. 9, called "'Mespot' from the Tigris"; or his informal observation of things entirely outside his work, such as the photograph of the "German and L.S.W.R. locomotives" (Fig. 24); besides his delight (common to most excavators) in recording for his personal amusement every stage in his official work, even down to the transport of his boxes of antiquities (Fig. 256).

These are the qualities which will place "A Season's Work at Ur" on the shelves of specialists, to whom the bulk of the archæological material contained in it is already familiar. For the general reader the book supplies as well not only a very handy account of the history of excavation at Ur and al-'Ubaid down to 1929 and of the results thereby obtained, but also an admirable introduction to the most important ancient monuments of southern Mesopotamia.

S. R. K. GLANVILLE.

Historical Aspects of Biology.

A Short History of Biology: a General Introduction to the Study of Living Things. By Charles Singer. Pp. xxxv + 572. (Oxford: Clarendon Press; London: Oxford University Press, 1931.) 18*s.* net.

WRITERS on the history of science are too often addicted to anecdote, ancestor worship, and undue preoccupation with the blind alleys of scientific inquiry and speculation. Dr. Singer's new book has none of these defects.

He has traced the elucidation of the problems of contemporary biology to their earliest beginnings, keeping the problems rather than individuals to the forefront. Consequently, his book will provide, for many readers with no previous biological knowledge and a predilection for historical studies, an attractive introduction to the science of living matter. In adopting this course, he necessarily discloses his own views on many controversial topics. His perspective is inevitably influenced by what he regards as the most significant contemporary issues. It would therefore be easy for a reviewer to single out many passages for adverse criticism. It would also be an ungrateful act to do so. Few readers will always share all Dr. Singer's opinions. There can be no two opinions concerning Dr. Singer's erudition, the usefulness of this book, and the desirability of making its contents accessible to a wide circle of readers.

Teachers of elementary biology will welcome, in Dr. Singer's "Short History of Biology", an indispensable volume, packed with information and admirably illustrated. The style is engaging. The exposition is clear. It is divided into three parts, of which the last is the longest. The first is occupied with the history of early descriptive anatomy and natural history. It covers the period when biological knowledge embraced most of what was known of familiar terrestrial objects, before physics and chemistry had as yet emerged as experimental sciences. It includes three chapters, one devoted to Greek natural science, one dealing with the Alexandrian school and the scholastics, and one laying the foundations of the modern period in the work of the German herbalists, the "De Fabrica" of Vesalius, and the researches of Harvey. This section, in which the author pertinently discusses the relations of natural science and decorative art in the Renaissance, might have been more entertaining had Dr. Singer written with less consideration for the feelings of our eminent contemporaries who are anxious to reinstate the natural sciences in their former tutelage to ecclesiasticism. Dr. Singer dismisses the contention that the progress of natural inquiry was impeded by the growth of Christianity, though he does not overstate the favourable contrast between the world of Moslem and Christian Europe in the twelfth and thirteenth centuries. It is, of course, true that the decline of interest in natural science began long before Hypatia was butchered by the monks of St. Cyril. It is not less difficult to credit Dr. Singer's paradoxical belief that the growth of natural science was eclipsed because "the Romans were an essentially practical people". The temper and method of science are essentially practical. The seedling planted by the Greek materialists was already languishing on Greek soil before the Greek States lost their independence. Greek curiosity had been diverted into other channels, before the Roman conqueror incorporated the personnel of Greek superstition in its pantheon. Secular in its earliest beginnings, it became more and more engrossed in Persian mysticism and the mystery religions of the East. If Christianity was not chronologically the death-knell of Greek natural science, Platonism, from which Christianity borrowed the arithmetical refinements of its theology, was the signal and symbol of its decline.

In the second part, Dr. Singer deals with the historical foundations of modern biology. This section includes a discussion of the influence of Cartesian philosophy on the growth of experimental physiology, the progress of classificatory systems, the rise of comparative anatomy, the foundations of modern knowledge of the distribution of animal and plant species in space and time, and the revival of evolutionary speculation at the end of the eighteenth century. Among the more interesting features of this section are the discussions of the part played by the discovery of the microscope and the inauguration of the learned societies as factors in the separation of biological studies as a group of independent sciences outside the Aristotelian framework of the scholastic system. Chap. vii., which deals with "Distribution in Space and Time", is specially readable.

In the third part, Dr. Singer abandons the chronological method completely to trace from their beginnings in the seventeenth and eighteenth centuries the emergence of the main themes of inquiry which have occupied biological inquiry during the last seventy-five years. Separate chapters are devoted to the cell doctrine, biogenesis, the chemistry of the body, the process of development, sex, heredity; and the history of the nervous reflex is dealt with in the chapter entitled "The Relativity of Functions". Here Dr. Singer writes with a very evident bias towards the introspectionist point of view. Whether he has maintained his determination to avoid undue attention to unprofitable lines of inquiry is a matter for doubt. Time alone will show whether the writings of Lloyd Morgan deserve prominence in a history of science, except as evidence of the survival of Aristotelianism in the machine age.

In its plan and method Part 3 is the best

section in the book. The separate paths which have been followed in the attempt to elucidate the main contemporary themes of biology do not as yet coalesce. To treat biology in the latter half of the nineteenth century as a single unit of human inquiry would have been disastrous. Dr. Singer has felt compelled to introduce much that is topical in this section, to clear the ground for the reader who is not a highly trained biologist. Had he done otherwise he would certainly have been less intelligible to many who, it is to be hoped, will read his book. On the other hand, those who are trained biologists will be disappointed to find that the historical aspect of this section is rather overshadowed by the exposition of elementary principles and all too familiar facts. Dr. Singer can atone for this shortcoming by writing another book more especially for the specialist. The book he has written contains much matter which will be suggestive and instructive to many who are biologists, and it should kindle the interest of still more who are not biologists.

It may be hoped that this book will add to the growing dissatisfaction which is felt towards present methods of teaching elementary biology in Great Britain, where the 'type system' still discourages many students from pursuing the study of animal life. Dr. Singer perhaps goes rather too far in subscribing to the doctrine that "l'histoire de la science c'est la science même". It is quite possible to understand the principle of segregation, to use it as an instrument to interpret and predict the results of breeding experiments, and to extend its scope without knowing anything about the studies which an Austrian abbé conducted in a quiet monastery garden seventy years ago. It is unlikely that the progress of modern genetics would have been impeded if de Vries, Correns, and Tschermak had remained ignorant of the fact that their discoveries had been forestalled forty years earlier. It is also true that no one can contribute to an intelligible exposition of the present status of the evolutionary hypothesis if he is unfamiliar with the metamorphosis which the word 'selection' has undergone, as it has passed in turn through the hands of Darwin and Wallace, Weismann and Galton, Morgan and J. B. S. Haldane. Without attention to its history the teaching of science provides a poor equipment for the understanding of a civilisation which owes its special peculiarities to the utilisation of scientific knowledge. The history of science is the major part of a philosophy attuned to the civilisation to which we ourselves belong.

Dr. Singer himself believes that there is a legitimate field for philosophy transcending the synthesis of all scientific knowledge. Those who question the usefulness of applying the term 'knowledge' to anything which lies outside the scope of mathematics and experimental science may look forward to a time when the subject he has done much to advance will enjoy a greater share of public esteem than he would claim for it. In the newer secular universities, departments of the history and method of science staffed by workers trained in the historical and natural sciences might well displace the teaching of a subject whose only *raison d'être* is its historical rôle as the rationale of a discredited supernaturalism.

LANCELOT HOGBEN.

Physics for Students.

(1) *Physical Principles of Electricity and Magnetism.* By Prof. R. W. Pohl. Authorised translation by Winifred M. Deans. Pp. xi + 356. (London, Glasgow and Bombay: Blackie and Son, Ltd., 1930.) 17*s.* 6*d.* net.

(2) *A Survey of Physics for College Students.* By Prof. Frederick A. Saunders. Pp. x + 635. (New York: Henry Holt and Co., 1930.) 3.75 dollars.

(3) *General Physics.* By Prof. Wm. S. Franklin and Prof. G. E. Grantham. Pp. xvi + 705. (Lancaster, Penn.: Franklin and Charles, 1930.) 4 dollars.

(4) *Intermediate Physics.* By Dr. R. A. Houstoun. Pp. xviii + 638. (London, New York and Toronto: Longmans and Co., Ltd., 1930.) 10*s.* 6*d.*

(1) AN unqualified welcome can be given to this excellent translation of the second edition of Prof. Pohl's book, of which the original edition has already received appreciative notice in NATURE. Here is given, with a completeness and mastery unapproached in any English work of the kind known to the reviewer, a lucid and systematic account of the physical principles of electricity and magnetism. While the treatment is everywhere didactic, it is shown how the ideas involved and their development are always based on experiment, Prof. Pohl's ingenuity and resource in this direction being most notable. There is very little reference to persons or history, the closely knit argument being almost completely untrammelled by tradition and unhampered by customary modes of presentation; and while the mathematics used is almost negligible, the strict logic and quantitative treatment make the presentation very thorough, and

the wealth of illustration and clarity of statement result in a wholly delightful book.

(2) Prof. Saunders' survey also produces a very favourable impression. Without being superficial, or straining for effect, the author has succeeded in giving an account of the subject matter of physics covering a surprisingly wide field, the writing being accurate and restrained, but never lacking in interest. The scope of the book may be realised when it is mentioned that, to take only a few haphazard examples, the mass spectrograph and isotopes, quanta, the Raman and Compton effects, spectrum series, atmospheric electricity and cosmic rays, acoustics of buildings, solar radiation, and Bernouilli's principle are among the many matters dealt with.

The author does not lose sight of the essence of physics as a coherent and systematic body of thought; indeed, the distinction of his work lies in the way this is apparent, while at the same time up-to-date practical applications, theory, and research all find their place. The clear diagrams and well-chosen illustrations merit a word of commendation. It is a pleasure to find a book of this kind which, instead of being a heterogeneous compilation, either childish or incomprehensible, is such an admirable example of what this sort of thing should be.

(3) Profs. Franklin and Grantham have prepared an elementary treatise, most of the 694 pages of which are taken up with work of a standard nature, although more advanced and comparatively recent ideas are incorporated—unfortunately, not always too clearly. The volume is interspersed with short essays or paragraphs of a general character with titles such as "The Wisdom of Ignorance", "The Illusion of Activity", "Wave Mechanics", and "The Modern Idolatry", which do not appear to add materially to the value of the book.

Features worthy of mention are the liberal sprinkling of problems in connexion with the text, and the analogy of electrostatic with electromagnetic quantities and that existing between the latter and mechanical units. The book is primarily intended for American students; whether it has any particular value in Great Britain is doubtful.

(4) With the completion of the section on sound, Dr. Houstoun has been able to collect the various parts of his "Intermediate Physics" into one volume. The subject matter is presented in the direct, clear manner which one has learned to associate with the author, and a reliable, convenient textbook is thus made available.

Short Reviews.

A Brief History of Medicine in Massachusetts. By Dr. Henry R. Viets. Pp. xii + 194 + 8 plates. (Boston and New York: Houghton Mifflin Co., 1930.) 4 dollars.

THIS work, which is issued on the occasion of the tercentenary celebration of the settling of the Massachusetts Bay Colony and the one hundred and fiftieth anniversary of the founding of the Massachusetts Medical Society, is divided into seven chapters. The first is an introduction, in which a sketch is given of contemporary medicine in Europe in the sixteenth and seventeenth centuries. The second chapter deals with the colonial period dating from the landing of the pilgrims from England on Dec. 21, 1620, to the end of the seventeenth century, during which the bond between the clergy and the medical profession gradually became severed. In the third chapter, which is concerned with the eighteenth century to the American Revolution in 1775, the author shows that medicine in Massachusetts during that period was characterised by severe epidemics of small-pox, partially controlled by the introduction of inoculation in 1721, strict enforcement of quarantine in the fort of Boston, improvement in the tone of medical practice, the establishment of a medical society, the appearance of sporadic medical literature, and the divorce of medicine from the influence of the ministers.

In the fourth chapter, the effects of the American Revolution and the formation of the Massachusetts Medical Society and the Harvard Medical School are described. The fifth chapter is concerned with the early nineteenth century, during which Benjamin Waterhouse introduced vaccination into the United States, the Massachusetts General Hospital and *Boston Medical and Surgical Journal* were founded, Jacob Bigelow published his work on self-limited diseases, and Oliver Wendell Holmes his classical paper on puerperal fever. The sixth chapter is devoted to an account of the discovery in 1846 of ether anæsthesia by the dentist, W. T. G. Morton, described by Dr. Viets as the most important advance in medicine made in the United States. The last chapter contains a sketch of the contributions by Boston men to medicine and surgery from 1847 to the present day.

The work is illustrated by several portraits and a list of references is appended.

Environment and Plant Development. Being "Klima und Boden in ihrer Wirkung auf das Pflanzenleben". By Prof. Dr. Henrik Lundegårdh. Translated and edited from the second German edition by Eric Ashby. Pp. xii + 330 + 8 plates. (London: Edward Arnold and Co., 1931.) 24*s.* net.

THE keynote of this book is the author's invitation to the student to go out into the field and to study the living plant in its natural surroundings as well as the natural environment of the plant. He pays full tribute to investigations which have been conducted in the laboratory, but

he carries laboratory research in plant physiology, with its many limitations, into the field, where the life processes of plants, though more difficult to study, can be investigated under entirely natural conditions. He emphasises that records obtained of a plant's behaviour at any given time or at stated intervals do not reveal the many fluctuations which the plant undergoes during the whole period of the day, for plant environments experience more widely different ranges and variations of climate than those recorded by the usual meteorological instruments.

Suggestive ideas, often based on isolated investigations and experiments, indicate to the field ecologist the many avenues of research still awaiting him. The interpretations suggested for many well-known phenomena will prove of considerable interest and value to the botanist, horticulturist, agriculturist, and forester, and illustrate the part that botany plays as a basic science for all these forms of study of plant life.

The last chapter, devoted to principles of experimental ecology, contains an interesting and suggestive "Survey of Adaptation Forms": a contribution to the classification of plants on ecological principles. The field botanist is left to develop this scheme and complete the 'key' to plant life in relation to ecological characters. The author closes with the remark, which by now will have been impressed upon his reader, that "the detailed ecological analysis of an association is, however, an extremely troublesome and tedious undertaking".

The translation has been rendered into simple language which enables the arguments to be followed readily by any student of botany.

Cancer and Scientific Research. By Dr. Barbara Holmes. (Sheldon Books of Popular Science.) Pp. 160. (London: The Sheldon Press; New York and Toronto: The Macmillan Co., 1931.) 3*s.* 6*d.* net.

ACTIVE research into the cause of cancer is now running mainly along two lines. Laboratory workers are particularly concerned with the experimental production of cancer by tar and other similar irritating agents, and with the fowl tumours which may be transmitted from bird to bird by an ultramicroscopic agent. Statisticians and hygienists, on the other hand, are attentively and fruitfully examining the relation between modes and habits of life and the occurrence of malignant tumours. Particularly encouraging is the fact that these two methods of approach have in recent years converged to the common conclusion that much cancer is due to external influences rather than to any inherent vice in the body, and should therefore be preventable.

We do not know of any short semi-popular publication in which the important facts—and some of the theories—are set out so plainly as they are here, and with as good an instinct for grain rather than chaff. The common significance of the human and animal experience is well brought out. Dr. Holmes wisely confines herself to the causes of cancer, and scarcely mentions treatment. We can commend her book to biologists in general even more heartily than her father does in the preface.

A Brief Introduction to the Use of Beilstein's Handbuch der organischen Chemie. By Prof. Ernest Hamlin Huntress. Pp. viii + 35. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1930.) 5*s.* net.

THIS is an interesting booklet designed to help the young student in mastering the intricate system of classification used in the last edition of Beilstein's "Handbuch". A very comprehensive account of this is given at the beginning of vol. 1 of the "Handbuch"; but the system is naturally so complicated and difficult to understand that properly to assimilate it requires a better knowledge of German than most young students possess. Notwithstanding the excellent compendia that exist, Beilstein is still the best and most used source of information on organic compounds, and it is essential that anyone intending to specialise in organic chemistry should be able to find his way in it easily and rapidly.

The booklet under review gives a very concise, clear, and intelligible account of the system of classification of the alicyclic and homocyclic divisions, and concludes with a number of examples to illustrate the fundamental points involved.

The printing is good and is singularly free from typographical errors. Its sole disadvantage is the price, which is high for a 35-page booklet.

The Monadology of Leibniz: with an Introduction, Commentary and Supplementary Essays. By Dr. Herbert Wildon Carr. Pp. ix + 213. (London: The Favil Press, 1930.) 10*s.* net.

THE popularity of Leibniz in recent years gives an added interest to this new critical edition of the masterly epitome of the great philosopher's views. A running commentary accompanies each paragraph of Prof. Carr's translation, and illuminates the condensed thought of the "Monadology". The elucidations of Leibniz himself on the origin and meaning of the theory of monads, on the reform of the ontological argument, on the definition of matter, on the nature of free-will and the theory of pre-established harmony, together with Prof. Carr's supplementary essays on the monadology, are a useful help to the understanding of this work, which is but a small part of Leibniz's philosophy. T. G.

How You Work: an Introduction to the Human Body. By Dr. Isabel Wilson. Pp. xi + 178. (London: Gerald Howe, Ltd., 1930.) 3*s.* 6*d.* net.

THIS delightful little book is so attractively written and couched in such simple language that no child ought to be denied the opportunity of hearing, from teacher or parent, about the working of its little body. There can be no better exercise for the attainment of human understanding and happiness than that of starting to think biologically at an early age.

Helium and its Properties.*

By the Right Hon. LORD RUTHERFORD, O.M., F.R.S.

THE history of the discovery of helium presents some features of unusual dramatic interest. During an eclipse in 1868, Jansen and Lockyer noticed that the visual spectrum of the sun's chromosphere showed a bright yellow line of unknown origin. Later it was found that this line and others that accompanied it appeared not only in the sun, but also in many of the stars. Lockyer suggested that these lines were due to an undiscovered element, to which he gave the name helium.

Shortly after the discovery of argon, Sir Henry Miers sent a letter (Feb. 1, 1895) to Ramsay pointing out that the American analyst Hillebrande had observed that a considerable quantity of gas, supposed to be nitrogen, was liberated by solution of certain minerals containing uranium. Miers suggested that the gas might prove to be argon and not nitrogen. Following his suggestion, Ramsay purchased about a gram of the mineral cleveite from a dealer for three shillings and sixpence and proceeded to purify the gases evolved and to examine their spectra. A number of new lines were observed and a spectrum tube containing the new gas temporarily called crypton by Ramsay was sent to Sir William Crookes for a detailed study of its spectrum. Crookes reported tersely, "Crypton is Helium; come and see it". Less than two months had elapsed from the receipt of Miers's letter to the announcement in the Paris Academy of Sciences, on March 26, 1895, of the discovery of helium on the earth—a discovery of profound significance to the development of physics. It was soon shown that helium is a monatomic gas of density about twice that of hydrogen and of atomic weight 4. We now know that it is the first of that remarkable group of inert monatomic gases, namely, helium, neon, argon, krypton, xenon, and the radioactive emanations, which have played such an important part in helping to fix the arrangements of the electrons in the outer atom.

In 1903, Ramsay and Soddy found that helium was produced by the transformation of radium, and, as a result of a series of researches, Rutherford showed that the α-particles which are ejected with great velocity from radioactive atoms are identical with helium nuclei. It is probable that the greater part, if not all, of the helium found in the earth and in the natural gases escaping from the earth owes its origin to the α-particles expelled from the radioactive elements during their transformation in the earth's crust.

It now seems clear that the helium nucleus of resultant charge 2 is remarkably stable and is in some way built up by the combination of four protons and two electrons. The loss of mass in this combination shows that a very large amount of energy, probably in the form of penetrating γ-rays, is emitted during the process. It can be calculated that the energy released in the formation of one pound of helium from hydrogen corresponds to the energy liberated in the complete combustion of 10,000 tons of coal. There can be no doubt that helium is formed from hydrogen under some, as yet unknown, conditions in the stellar system. However, it has not yet been found possible to produce helium from hydrogen under laboratory conditions. Millikan claims that the absorbable part of the cosmic rays must be attributed to the radiation emitted in the formation of helium in the depths of space.

The α-particle or helium nucleus has proved of great importance in extending our knowledge of the structure of nuclei, and it is now believed that the nuclei of the heavier elements are composed mainly of α-particles and electrons, although a few free protons may also be present. The bombardment of light elements by swift α-particles has given us the first definite proof of the transformation of some of the ordinary elements by artifical methods.

Helium is the most difficult of all gases to produce in liquid form. This was first accomplished by the late Prof. Kamerlingh Onnes in his laboratory at Leyden in 1908 by using liquid hydrogen as a cooling agent. Helium liquefies at a temperature of about 4° absolute, and is a clear colourless liquid of density about 0·15. In recent years, by using helium under pressure, Prof. Keesom, of Leyden, has succeeded in solidifying helium. By the evaporation of liquid helium at low pressure, temperatures so low as 1° absolute have been obtained.

Liquid helium thus provides a suitable method for the study of the effect of low temperatures on the properties of matter. One of the most striking observations is that certain metals become superconductors at such low temperatures and show little if any resistance to the passage of an electrical current. Several cryogenic laboratories have been instituted for the study of the effects of low temperatures on matter. Apart from the well-known and well-equipped laboratory at Leyden, Prof. J. C. McLennan liquefied helium in the University of Toronto in 1923, while in 1925 a similar department was instituted in the Reichsanstalt, Berlin. Researches in the properties of matter at the lowest possible temperatures have already added widely to our knowledge in a number of important directions.

Helium is present in our atmosphere in small quantity, about one part in 185,000 by volume. In the early days, most of the helium used for experimental purposes was obtained by heating radioactive minerals and particularly the mineral thorianite from Ceylon. It was also found that helium is often present in considerable quantity in the gases escaping from hot springs and the natural gases from the earth's crust.

In 1914, Sir Richard Threlfall suggested to the

* Abstract of the Friday evening discourse delivered at the Royal Institution on March 27.

Board of Inventions of the Admiralty that, on account of its lightness and non-inflammability, helium might prove of great service for balloons and airships. Prof. J. C. McLennan was asked to initiate experiments to see whether helium could be separated in quantity from the natural gases escaping from the earth in certain districts of Canada which were known to contain about 1 per cent of helium by volume. Arrangements were made on a semi-commercial scale to purify the helium by liquefying the methane and other gases present. The impure helium was concentrated in the non-liquefying portion. In this way, many thousands of cubic feet of helium were prepared and transported in cylinders at high pressure. About the same time, the Bureau of Mines of the U.S.A. began similar experiments on a large scale, using the natural gases of Texas, which are rich in helium. Large quantities of helium were separated by liquefaction methods, and the cost of the helium was found to be sufficiently low to use it in airships in the place of hydrogen. Apart from the cost of transport, the expense of separation of helium decreases with the concentration of the helium in the natural gases. The commercial prospects of the use of helium in airships and other purposes have led to a search for rich concentrations of helium.

While most natural gases contain less than 1 per cent of helium, much richer mixtures have been recently found by boring. One source in Grand County, Utah, has a helium content of 7 per cent. Another was found in Colorado yielding as high as 8 per cent. The gas appears at a depth of about 950 feet in what is known as the Wingate sand. The Helium Company has erected a plant at Thatcher, Colorado, for purification of the helium obtained from this source. Analysis shows that the gas contains 15 per cent carbon dioxide, 8 per cent helium, 1·75 per cent methane, and the rest nitrogen. The plant installed has a capacity of about 600,000 cubic feet of the gas per day, corresponding to a possible annual production of 12 million cubic feet of helium. With such a rich helium mixture, the cost of separation should be much less than in the plants treating the natural gases of much lower helium content.

It is possible that similar rich concentrations may be found on the eastern slopes of the Rocky Mountains in Canada. A small gas field was found a few years ago not far from Toronto which had a content of 0·8 per cent helium. The rights of those wells have been secured for the University of Toronto in order to have an ample supply of helium for cryogenic experiments in the laboratories.

At the time of its discovery, helium was considered to be a rare gas and a litre of helium was a precious possession. The helium originally employed by Kamerlingh Onnes for the liquefaction of helium was painfully obtained by heating radioactive minerals. This is in striking contrast to the position to-day, when the annual production of helium is measured by millions of cubic feet, and where sufficient quantity will be available at a comparatively low cost for filling several large airships now in course of construction.

A. M. Liapounov, 1857–1918.

By A. J. PRESSLAND.

FROM time to time, French versions of the writings of A. M. Liapounov have become available to the scientific public; but the obituary notice in the *Proceedings* of the Academy of Sciences in Leningrad (1919, p. 367, by Stekloff), and other papers, are in Russian. Quite recently the Academy has published two brochures, one a biography and the other a general survey of Liapounov's work on Chebichev's problem, and the following is a digest of this material.

A. M. Liapounov, the eldest son of M. V. Liapounov and a grandson of V. A. Liapounov, registrar of the University of Kazan, was born on May 25, 1857. Six of his immediate kinsmen attained to academic eminence. His father, an astronomer of repute, died in 1868, leaving a young family. So the boy was brought up for a time by a married aunt, in whose house he increased his acquaintance with people of intellectual distinction. In 1870 he entered the third class of the gymnasium of Nishni-Novgorod, where he was taught Latin, Greek, and elementary science. He read widely, Buckle, Draper, Humboldt, Réclus, and Karl Ritter being his favourite authors, and he developed a love for exact science. The national idealism that was then popular did not appeal to him, but he was attracted by the study of economics and the theory of the struggle for existence.

In 1876 Liapounov passed out of the gymnasium with the highest distinction and matriculated at St. Petersburg, where at first he attended the lectures of Mendeléeff, which he soon forsook for those of Chebichev. To the latter is due the inspiration of Liapounov's researches. Chebichev laid stress on *Anschauung* and *Realien*, holding that research work was valuable only when it lent itself to application, and theory useful only when it emerged from a consideration of particular cases.

Chebichev directed Liapounov to the problem of determining the free surface of a liquid gravitational mass that was rotating about an axis. He had already proposed the problem to prominent students such as Zolotarev and Sophia Kovalevskaya, but no one of them seems to have made noteworthy progress. The problem has a long history. Newton noted that an ellipsoid of revolution can be a surface of equilibrium, but Maclaurin was the first to give it serious consideration; on this account an ellipsoid of revolution which is a form of equilibrium is called an ellipsoid of Maclaurin. D'Alembert showed that for every angular velocity less than a given limit there were

two Maclaurin ellipsoids, each compressed in the direction of the axis of rotation. Laplace showed that, as the moment of angular momentum increased, the smallest axis of the ellipsoid decreased until the angular velocity reached its maximum, after which the angular velocity decreased to zero and the ellipsoid flattened out, becoming ultimately a thin disc of infinitely large radius. Hence for each value of the angular velocity there will be two Maclaurin ellipsoids, and Lagrange was of the opinion that these were the only two possible ellipsoids of equilibrium. But Jacobi proved that the ellipsoid with three unequal axes was also a possible form.

Jacobi's solution was examined by Meyer and Liouville. The latter showed that in certain cases a long thin ellipsoidal spindle might be obtained, the largest axis of which increased without limit and the other two approached zero in magnitude and unity in ratio. So it can be proved that, within certain limits of the value of the angular velocity, there may be three ellipsoids of equilibrium—two of Maclaurin and one of Jacobi; within other limits, two only each of Maclaurin, and the latter may coincide giving one only, of Maclaurin.

Chebichev told Liapounov that easy but novel problems which could be solved by well-known methods were of no value in testing the powers of a young research student. Such a student required something that presented obvious difficulties. So the problem was enunciated thus: "It is known that for certain values of the angular velocity the ellipsoidal form no longer serves as a surface of equilibrium for rotating homogeneous liquids. Does it change into some new form of equilibrium which, for small increments of angular velocity, differs but little from an ellipsoid?"

Domestic misfortune interrupted Liapounov's university career; but he won a university prize, and after graduation chose as the subject of his M.A. dissertation "Some Particular Aspects of Chebichev's Problem", which he defended before a board of which Bobilev and Korken were members. In 1885 he was recognised as a *privat-dozent* and was preparing to lecture on the theory of potential when he received a call to the chair of mathematics at Kharkov. His new duties, which were increased by work at the local technical institute, were so strenuous that he had to defer the presentation of his dissertation for the doctorate, for five years. The subject was "Some General Aspects of Chebichev's Problem". These two dissertations were translated into French and published by Davaux in 1904, 1908.[1]

In 1901 Liapounov was elected a member of the Academy of Sciences at St. Petersburg and thus secured the leisure and the freedom from financial cares that enabled him to resume his work on the problem. He soon discovered that to the first approximation there were no new forms and that a second approximation was hard to obtain. In his M.A. dissertation he had discussed the stability of the ellipsoids of Maclaurin and Jacobi and had found that when Maclaurin's became unstable they changed into those of Jacobi, and that the latter when they became unstable appeared to change into a new figure having algebraic surfaces of the third degree (Poincaré's pear-shaped figure).

Within a year of the publication of the M.A. thesis Poincaré mentioned in *Comptes rendus* that he had been in correspondence with Lord Kelvin on the subject. Lord Kelvin had arrived at results but had given no proofs. Poincaré reached the same results as Liapounov but by less stringent methods, and Poincaré assumed that the figures sought really existed. In answer to Liapounov's inquiry, Poincaré replied that he had not proceeded beyond the first approximation and that the methods of successive approximations did not provide a proof of the existence of the figures, since the difficulty of finding a second approximation was insurmountable. His assertion, that the figures sought existed, seemed to Liapounov to be based on intuition, and when Poincaré's memoir appeared in *Acta Mathematica*, Liapounov was dissatisfied with it.

When Liapounov, twenty years later, resumed consideration of the problem, he soon found where the difficulty of the second approximation lay. Poincaré and Liapounov, when seeking the new figure that differed but little from the given ellipsoid, had compared it with the given ellipsoid. Liapounov now overcame the difficulty by introducing an ellipsoid confocal with the given one and passing through that point of the surface sought at which the potential of the attracting liquid is under consideration. By this means Liapounov easily obtained approximations to any given order and was able to prove the series convergent. Thus Liapounov was able to give a rigorous proof of the existence of those forms of equilibrium already known and to show that there were no intermediate forms.

There are other special solutions of the general problem. Poincaré and Sophia Kovalevskaya have treated an annular form such that the section of it made by a plane through the axis of rotation is approximately an ellipse. There are also cylindrical forms of equilibrium which provide material for mathematical problems. Liapounov directed attention to the case of two liquid masses separated from one another and each rotating round an axis, which passes through the common centre of gravity and is perpendicular to the line joining the centres of gravity of the two separate masses, and found that when they were sufficiently far apart their surfaces of equilibrium differed but little from ellipsoids; and he proved that for homogeneous liquid the pear-shaped figure is unstable.

This result is at variance with the results obtained by Poincaré and Darwin, each of whom found difficulty in obtaining a second approximation. Poincaré found one by a special process which yielded no further approximations. Darwin adopted the result, which supported his theory of cosmogony. Liapounov, however, declared that Poincaré's methods were not rigorous, since they were based on approximate formulæ, whereas his own were obtained by exact formulæ.

The stumbling-block had been an expansion of the potential due to Lagrange and Laplace. No proof had been given that this expansion was admissible. Liapounov replaced it by a new expansion having a smaller parameter, established the admissibility of the new expansion, applied the methods of successive approximations, showed how to find these approximations to any required order, proved that his approximations were convergent, and generalised his investigations.

Liapounov's papers on Chebichev's problem are contained in four volumes published between 1906 and 1914, written in French and extending to 768 folio pages. It is understood that Liapounov left a large amount of manuscript which will be published when circumstances permit. This remark applies also to the papers of Leonard Euler. In 1902, the Academy of Sciences proposed to mark the bicentenary of the birth of Euler (1907) by the issue of a complete edition of his works. A committee consisting of A. A. Markov, B. B. Galitzin, and A. M. Liapounov was appointed to deal with the matter. It is possible that the latter has left papers dealing with the subject.

It is painful to describe the last days of Liapounov. Russia was involved in political and social turmoil, and it was at one time feared that Liapounov might suffer like Lavoisier. This fear happily was unfounded. His wife was attacked by tuberculosis and he was threatened with cataract. They went to Odessa in search of health, and there his wife died. A few days later, on Nov. 3, 1918, he died in Leningrad as the result of a voluntary act.

[1] Ann. T(oulouse), 2 ser. t. 6; 1904. Ann. T., 2 ser. t. 9; 1908.

Two Historic Electric Power Stations.

AT an ordinary general meeting of the Newcomen Society held in London on April 15, and at the seventh annual meeting of the American members held in New York on April 16, two papers were presented dealing with two historic electric power houses. One of the papers was by Mr. G. A. Orrok and dealt with the Pearl Street station in New York, the first central station in the world; the other was by Col. R. E. B. Crompton and gave a history of the first installation of house-to-house electric supply in England, the power house of which was described as "the parent generating station of Great Britain". It was the invention of the incandescent light, the perfecting of the dynamo, and the invention of the multiple arc system, with its corollary in the feeder system and three-wire system, which brought the central station into being as a means of furnishing a means of transmitting light, heat, and power in any amount and to such distances as might be required. In the early 'eighties, many private installations of electric lighting plant were laid down, and generating plant was supplied to individual buildings and ships, but the two stations referred to at the meeting of the Newcomen Society were the first stations in the United States and England respectively to supply electric current to customers in the same way that gas and water had been supplied.

The Pearl Street station was due to the genius of Edison, from whose note-books of 1878 and 1879 can be gathered some of his earliest ideas on electric power generation and distribution. The Edison Electric Light Co., the parent company of all the Edison companies, was incorporated early in 1880, and the Edison Electric Illuminating Co. of New York, the local company, held its first meeting on Dec. 20, 1880.

To the latter belongs the credit of erecting the Pearl Street station, which began operations on Sept. 4, 1882, and by the end of 1883 had 455 customers and more than 11,000 lamps installed. The original plant consisted of four Babcock and Wilcox boilers of 200 h.p. each, supplying steam at 120 lb. pressure to Porter-Allen high-speed engines of 125 h.p. each, directly coupled to the famous 'Jumbo' dynamos. As the station was half a mile from the river, it was a non-condensing station and the coal consumption at first was about 10 lb. per kw. hour. A serious fire on Jan. 7, 1890, interfered with its operation for a time, and five years later this pioneer station was closed down and the property disposed of.

Many interesting particulars of the electrical equipment of the station were given by Mr. Orrok. From the dynamo brushes the current was led by round copper bars to spring-controlled switches, the design of which was taken from the short-circuiting switch under the telegraph key. The station bus bars were fixed to wooden insulators bolted to the walls. There were neither voltmeters nor ammeters, as such things had not been invented.

Crude as many of the devices were, they met the situation and enabled central station companies to do business. Referring especially to Edison's chemical meter, in which each unit of current invariably removed a definite amount of zinc from one metal plate to another, Dr. Orrok said: "Was there ever a more beautiful combination of parts—each dependent on a simple physical or chemical law—than was presented in this ingenious commercial device for translating first the lamp-hour, then the ampere-hour, and finally the kilowatt-hour values into dollars and cents? . . . It is no exaggeration to say that no single device in the whole system did more to lay the solid foundation for the commercial and financial success of the Edison stations from the first than the chemical meter."

The first central station in Great Britain, dealt with in Col. R. E. B. Crompton's paper, was situated in Kensington and was erected by the Kensington Court Company, afterwards the Kensington and Knightsbridge Company, started by Col. Crompton to supply electricity to the houses they erected on a site which had been cleared by the company promoter, Baron Grant, but which had passed into the hands of the Land Securities Company.

In the generating station were installed two

Babcock and Wilcox boilers, supplying steam to seven generating sets. The dynamos were coupled directly to Willans central-valve high-speed engines. Three sets were designed to give 500 amp. at 100 volts and four sets 500 amp. at 200 volts. Vibration troubles were avoided by fixing the sets to massive concrete foundations kept clear of the buildings.

Meters were rented to customers and the current was distributed by bare copper strip conductors fixed to porcelain insulators in subways in the streets. To ensure continuity of supply, a large battery of accumulators was installed. Current was supplied to a certain number of houses in 1886, by 1887 the company was making a profit, and later on another station was erected at Chapel Place, Knightsbridge. As the demand increased, a still larger plant was built at Wood Lane, Shepherd's Bush. This was put into operation in 1901, and soon afterwards the original steam plants in Kensington and Knightsbridge were shut down.

Obituary.

MAJOR T. F. CHIPP.

IN writing an account of the life and labours of those who truly may be said "to have finished their course", after having enjoyed the allotted span and seen the fruit of their work, there is, despite the sadness, an element of satisfaction and the fitness of things. But in the case of one of much promise, suddenly removed in the prime of life and with every prospect of a distinguished and useful career in the future, feelings of grief and sadness predominate and render the task of writing any adequate tribute both painful and difficult.

The tragically sudden death of Major Thomas Ford Chipp, assistant director, Royal Botanic Gardens, Kew, is such a case. Born on Jan. 1, 1886, he died on Sunday evening, June 28, at 9 P.M., shortly after returning to his house. Chipp was thus in the prime of life, tall, strong, vigorous, always happy and cheerful, filled with enthusiasm for his work, and deeply interested in the many duties which fall to the lot of Kew's assistant director. Through his varied colonial and War experiences he had gained a wide knowledge of men and affairs, and in addition he was a man of sound judgment and commendable tact; he was endowed with a very pleasant personality, which, during his nearly nine years' service at Kew as assistant director, had endeared him not only to his scientific colleagues but also to all the student gardeners and the whole of the Kew staff. In the larger botanical world both at home and abroad he was highly esteemed, and this was clear at the International Botanical Congress held last year at Cambridge, and is also borne out by the many letters which have reached Kew. The untimely death of a man of his calibre and powers, when men of this type are all too rare, is a greater loss than Kew has ever before been called upon to bear. His death will be equally a very severe loss to the botanical work of the Empire centred at Kew.

Chipp was the son of Edward Thomas Chipp, chief constable of Gloucester. He received his early education at the Royal Masonic School, Bushey, and there he quickly developed his taste for natural history and served as secretary to the school natural history society. This inclination towards science led him to look to horticulture for a career, and, after a period of service in the gardens of Syon House, he entered Kew in 1906 as a student gardener. After a few months in this capacity, he was selected, owing to his marked ability, for one of the temporary technical assistant posts in the herbarium, where he remained until 1908. During this period he prepared himself, in his spare time and with very limited means, for the B.Sc. examination, University of London, which he passed in 1909 with honours in botany. He then received an appointment as demonstrator in botany at Birkbeck College, and in 1910 was appointed an assistant conservator of forests in the Gold Coast. Before proceeding to West Africa, he spent a year studying forestry in Germany and the Federated Malay States.

In 1914, Chipp was appointed assistant director of the Botanic Gardens at Singapore, but the War starting while he was in England *en route* for the Straits Settlements, he at once sought permission to rejoin his territorial regiment, the 8th Middlesex, in which he had held the rank of captain. With his regiment he proceeded to Gibraltar and afterwards to France, where he served continuously until 1919, being ultimately attached to the staff with the rank of major, and was awarded the Military Cross. In 1919 he went to Singapore to take up the post of assistant director to which he had been appointed five years earlier.

Chipp's good work while assistant conservator of forests in the Gold Coast had been duly noted, and in 1921 he accepted the invitation from the Gold Coast to be deputy conservator of forests in the colony. His career both at home and in the colonial service had naturally also been closely followed at Kew with interest and appreciation, and on the retirement of Sir David Prain in 1922 and the promotion of the present director, Major Chipp was invited to occupy the vacant post of assistant director of the Royal Botanic Gardens, Kew, and assumed office on Aug. 1, 1922.

Chipp was never idle, and his first scientific contribution of importance, "A Revision of the Genus *Codonopsis*", was made to the Linnean Society of London in March 1908. His university studies and forestry training during the next few years prevented him from carrying out any original work of importance, but on reaching the Gold Coast he soon produced the very useful "List of Trees, Shrubs and Climbers of the Gold Coast, Ashanti and the Northern Territories", in 1913, and a similar "List of the Herbaceous Plants and Under Shrubs" in the following year. Shortly after his return to the Gold Coast, in 1921, he published a "Forest Officers' Handbook of the Gold Coast,

etc." (1922), which won him the London degree of Ph.D. The War period naturally precluded any possibility of scientific activities, but it is characteristic of Chipp's unbounded energy that, directly he took up his duties at Singapore, he set to work and contributed many articles to the *Gardens Bulletin* of the Straits Settlements; among the more important of these are his papers on "The Fungi of the Malay Peninsula".

When he became assistant director at Kew, in 1922, Chipp used any spare moments for carrying on the researches he had initiated during his second period of service in West Africa, and published some useful papers in the *Kew Bulletin*. He became a recognised authority on vegetation studies, and was honorary secretary of the British Empire Vegetation Committee. In this connexion he edited, with Prof. A. G. Tansley, the very valuable book, "Aims and Methods in the Study of Vegetation" (1926), which is recognised as the leading book on the subject. To this book he contributed the chapter relating to the tropical countries. As honorary secretary of this Committee, he devoted much labour to reading, digesting, and reviewing numerous publications relating to the vegetation and ecology of the Empire. His more recent book, "The Gold Coast Forest: a Study in Synecology", published in 1927, is a valuable contribution on original lines. This work formed his thesis for the degree of D.Sc.

At the beginning of 1919, Chipp was sent to Cyprus and the Sudan by the director of Kew, on the invitation of the respective Governments, and the reports on his visits were of great value and highly appreciated. While in the Sudan, he was able to ascend the scarcely known Imatong Mountains, on the Uganda border, making a careful study of the flora and bringing home large collections. An account of the botany of the region was published in the *Kew Bulletin* in 1929, and a more general account of his tour, entitled "Forests and Plants of the Anglo-Egyptian Sudan", appeared in the *Geographical Journal* for February 1930.

Chipp was co-secretary, with Mr. F. T. Brooks, of the Fifth International Botanical Congress, held at Cambridge last year. The organisation of this large Congress and the subsequent editing of the various reports entailed a vast amount of labour for the secretaries, and the perfection of the arrangements, and the smoothness with which the heavy programme was carried through, showed again the care and thoroughness which appeared in all Chipp's work. The preparation and publication of a new International Address-book of Botanists, decided upon by the Congress, was entrusted to an international committee consisting of Major Chipp, Prof. Diels of Berlin, and Dr. Merrill of New York. A great deal of the work of collecting information, and all the labour of final collation and the arrangements for publication, had been almost completed by Chipp with his usual ability just before his death, and the work is now in the printer's hands.

Early last year, after attending the French Government celebrations in Algeria, Chipp was invited to accompany Mrs. MacIver's expedition into the Central Sahara, and made a careful study of the vegetation; his account of the scientific work of the expedition will be found in the August number of the *Geographical Journal*.

Chipp by his extensive travels in northern and western Africa had thus become one of the recognised authorities on the botany of this extensive region. His last paper, "The Vegetation of Northern Tropical Africa", which is about to be published in the *Scottish Geographical Magazine*, was delivered in the form of lectures given in March last at Edinburgh, Dundee, Aberdeen, and Glasgow. His untimely death is thus not only a great loss to Kew but also to botany. He was indeed a man whose like it will not be easy to find.

A. W. H.

BARON KITASATO, FOR.MEM.R.S.

BY the death of Prof. Kitasato on June 14, Japan has lost its foremost bacteriologist and the medical world one of its most successful workers.

Kitasato made several discoveries of first-rate importance. In 1889 he cultivated, for the first time in a pure state, the bacillus of tetanus, and clearly demonstrated the pathology of the disease, lockjaw, to which it gives rise. In 1890, Kitasato, conjointly with Emil Behring, made the great discovery of antitoxin in the blood of animals immunised against tetanus toxin, and thus laid the basis of serumtherapy. In 1894, Kitasato discovered, isolated, and cultured, for the first time, the bacillus of plague, and in a very exact manner and in an incredibly short time worked out the chief features of this organism so completely as to leave little for his successors to do on the pure bacteriology of plague. Kitasato published many other researches in German and Japanese. In all of his works available to readers of European languages he had always something fresh, and his results, obtained by exact methods, well recorded, have stood the test of time.

Shibasaburo Kitasato was born in December 1852 in the Kumamoto præfecture on the island of Kiushiu. He died in his seventy-ninth year. He studied medicine at Tokyo and graduated there in 1883. He was early a man of promise and (1885) was sent by the Japanese Government to Europe to study bacteriology and epidemiology. He settled at Berlin in the Hygienisches Institut under Robert Koch, then in the zenith of his powers. Kitasato remained six years with Koch. He was a man of exceeding diligence and worked in a room by himself all day and every day. He soon made himself master of the very exact bacteriological technique elaborated by Koch, and he owed a good deal of his subsequent bacteriological successes to his training in Berlin. During the German period of his life, Kitasato published a long series of bacteriological researches. They were almost uniformly good and some were brilliant. Kitasato set himself problems, performed the necessary, often laborious, experiments for their solution, made the correct inferences, and set out his results in model form for others to study and repeat. There was nothing 'woolly' about his work.

On his return to Japan in 1891, he founded a private bacteriological institute in 1892, and a year later it was subsidised by the Government of Japan. From 1899 until 1914 this great bacteriological institute—the Imperial Japanese Institute for Infectious Diseases—was directed by Kitasato with skill and success. Many of his pupils have attained a wide reputation in Europe.

For his valuable services to his country, Prof. Kitasato was chosen a member of the Japanese House of Peers in 1916, and was raised to the peerage with the title of Baron in 1923.

The impression he made was one of great dignity and seriousness, but he talked freely in German on bacteriological subjects. His knowledge of English was negligible.

Kitasato has created for himself by his high-class scientific work an enduring name not only in Japanese medicine but also over the whole world. He was admitted a foreign member of the Royal Society in 1908. W. B.

WE regret to announce the following deaths :

Lieut.-Col. Sir Charles Bedford, formerly director of the Central Excise Laboratory for India, known for his work on the manufacture and excise control of alcohol in India, on July 8, aged sixty-five years.

Dr. E. G. Echeson, known for his work in electrometallurgy and chemistry, formerly assistant to Edison, on July 6, aged seventy-five years.

Prof. C. H. Kauffman, emeritus professor of botany and emeritus director of the herbarium of the University of Michigan, on June 14, aged sixty-two years.

News and Views.

ON July 25 occurs the centenary of the death of the astronomer, Fearon Fallows, the first director of the observatory founded at the Cape of Good Hope through the action of the Commissioners of Longitude. Born in July 1789, at Cockermouth, Cumberland, the birthplace of Dalton, Fallows was brought up to his father's trade of weaving, but by study and the assistance of a clergyman was able to become a school teacher and then to proceed to Cambridge. Entering St. John's College, he graduated as third Wrangler in 1813, Sir John Herschel being Senior Wrangler, and became mathematical lecturer at Corpus Christi College. On Oct. 20, 1820, he was chosen director of the proposed observatory at the Cape, and to him fell the lot of choosing the site and of installing the first instruments. Immediately on arrival in 1821, with small instruments made by Dollond and Ramsden, he began observations of the principal southern stars, the results of which are contained in his catalogue of 273 stars contributed to the Royal Society in 1824. Later on, he published an account of a series of pendulum experiments. His work was done with but little assistance and in discouraging circumstances. He himself suffered from the effects of sunstroke, and his death at the early age of forty-two years was brought about through scarlatina and dropsy. He died at the naval base, Simons Town, but his grave, marked by a slab of black Robben Island stone, is near the observatory. He left some four thousand observations, which were afterwards reduced by Airy. His successors at the Cape have included Henderson, Maclear, Stone, and Sir David Gill.

ON July 17, in the Public Library of Kingston-on-Thames, a portrait memorial tablet was unveiled to commemorate the work of Eadweard Muybridge, one of the pioneers of modern cinematography. Born at Kingston-on-Thames in 1830, Muybridge emigrated to America, and, joining the staff of the United States Coast and Geodetic Survey, he rose to be director of the photographic surveys. About 1872, a discussion arose among some horse-lovers at the Sacramento race-course, California, as to whether a horse ever had all four feet off the ground at once. A wager having been made, Muybridge was asked to settle the point with the aid of the camera. Placing on one side of the track a long white screen and on the other twenty-four cameras, he stretched threads across the track which were broken by the horse and released the camera shutters. The results were conclusive and showed that a galloping horse did, at times, have all four feet off the ground. Muybridge's interest was stimulated by this work and he carried on his investigations, publishing a book, "The Horse in Motion", and inventing apparatus for projecting pictures at rates between 12 and 32 pictures a second. In 1880 he invented his zoopraxiscope; in 1881, in Paris, where he met Marey, he also produced moving pictures, and the following year he lectured on the subject at the Royal Institution. He died twenty-seven years ago, bequeathing his zoopraxiscope and lantern slides to Kingston Museum.

AT the ninety-ninth annual meeting of the British Medical Association held at Eastbourne on July 17–25, the president, Dr. W. G. Willoughby, Medical Officer of Health of the town, took as the subject of his address, "Public Health—To-day and To-morrow". Respecting to-day, the situation is not altogether satisfactory, for the Registrar-General's returns for England and Wales demonstrate that there are still far too many deaths at early ages; and that, though the vitality of the nation has steadily improved, the expectation of life is still only fifty-five years for males and fifty-nine years for females. Coincidently with the 40,000 annual deaths of children who escape the risks of infancy, there must be a large amount of sickness among the survivors, causing much indifferent health and permanent physical defects. That this is so is confirmed by the reports of national health insurance and by the wholesale rejections of would-be recruits for the fighting services. In the outlook for the future, owing to the reduction in the birth and death rates, we now have to deal with a population increasingly older than in the past; and as the population becomes older the prospect of a further reduction

in the death rate become less, so that if the present course of birth reduction continues, the excess of births over deaths will disappear.

UNFORTUNATELY, as Dr. Willoughby pointed out, there is a greater proportionate reduction in the number of births among the better types of the race than among the less satisfactory, resulting in a mental and physical disadvantage to the race as a whole. The proportion of mental defectives in the population has increased from about four to eight per 1000 in twenty-five years. Birth control is at its minimum among these people, who seem especially fertile. In a minor way, accidents and perilous occupations exact an increasing toll from the nation. There never was a time when so much was expected from the State without individual effort, and lack of such effort and want of employment tend to the acquiring of habits that are not conducive to health. Fortunately, some of the changes that are occurring are favourable to the health of the population, such as improved education. In the later portion of his address, Dr. Willoughby dealt with the relation of the medical profession to the public health, to post-graduate medical study and research, and to the auxiliary medical services.

A COMMUNICATION from Sir Aurel Stein in the *Times* of July 16 gives the first detailed account of the events which led up to the abandonment of his expedition of archæological and geographical exploration in Chinese Turkestan. Every effort had been made to conciliate the Chinese authorities. A memorandum describing the object and scope of the expedition was submitted and fully explained to the Ministry of Foreign Affairs when application was made for a permit; the wish was expressed that a Chinese scholar and topographer should accompany the party, and an undertaking was given that no object of archæological interest would be removed from the country without the previous consent of the Chinese Government. It is obvious that from the very outset a determined effort was made at every possible point to delay the expedition, in order that no work could be undertaken during the coming winter, the only season when archæological exploration is possible in the desert. The party was halted on the frontier of Hsin Chiang while permission to enter the province was obtained, although this had already been granted. This was only the first of a series of difficulties and delays, and in the end it was not until mid-November, some weeks late, that the expedition was allowed to leave Kashgar for Khotan. Even so, Sir Aurel was met at Keriya with the announcement that no digging was permitted, though this had been specifically sanctioned before he left Kashgar. Notwithstanding these obstructions, by the end of April the Tarim basin had been completely circumambulated and much valuable information acquired. At this point the request for a detailed memorandum of the objects of the expedition proved the last straw. As there seemed no prospect of any cessation of vexatious obstruction, Sir Aurel Stein returned to Kashmir.

AN extraordinary meeting of the Institut International d'Anthropologie will be held in Paris on Sept. 20–27 in connexion with the Colonial Exhibition under the honorary presidency of M. Paul Doumer, President of the Republic, and Marshall Lyautey. This special meeting is to be regarded as the fifth Assemblée Générale of the Institut and the fifteenth Congrès International d'Anthropologie et Archéologie prehistorique. The Congress, in accordance with previous practice, will meet in five sections, under presidents as follows: morphological anthropology and study of races (Drs. Vallois and MacAuliffe); human palæontology and archæology (M. le Comte Begouen); eugenics and heredity (Dr. Vignes); psychosociology and criminology (Drs. Papillaut and Paul Boncour); ethnography, folklore, and human geography (M. Louis Marin). Special attention will be directed to topics relating to the French colonies, and in particular to extra-European archæology, a subject which the promoters of the Congress point out is becoming of increasing importance in the archæological field. Reports on problems in this province will be presented from MM. Reygasse, Joleaud, Patte, Laforgue, Benoit, Begouen, Père Koehler and others. Visits to museums, collections, and other places of interest to members of the congress are being arranged. Applications for membership should be addressed to the Secretariat of the Institut International d'Anthropologie, 15 rue de l'Ecole de Médecine, Paris, from which further details may be obtained.

A RECENT communication to the Société Préhistorique Française by Mr. Ludovic MacLellan Mann, in the fourth part of the Society's *Bulletin* for the current year, deals with his discovery of an apparently unique site and a new culture of pre-Chellean age in the gravels of Stanstead, Upper Caterham, Surrey. Systematic excavation in the summer of 1930 brought to light what is claimed to be evidence of human occupation and a flint factory at a depth of 7 metres beneath strata of alluvium, sand, and gravels which are absolutely sterile. Mr. Mann has found material which he regards as a series of implements, finished and unfinished, two hearths, and animal bones. The pressure of the immense mass of superincumbent material and moisture have rendered the flint extremely fragile, and some implements, in addition to artificial fracture, show subsequent natural fracture due to pressure. The number of unfinished implements far exceeds that of the finished, and the small implements are more numerous than the large. The unfinished large implements, which show every stage of manufacture and exhibit what is apparently a new technique, have certain characteristic forms, of which that with a horseshoe cutting-edge is the most typical. The small implements have a wide variation in form, some of them resembling those of the last phase of the stone age. Mr. Mann admits that the implements are difficult to find and identify; nevertheless, he claims that here is unquestionably a workshop site of a new pre-Chellean culture (for which he suggests the name "Stansteadian") of late Pliocene or early Pleistocene date.

THE B.C.G. ('Bacille Calmette-Guèrin') vaccine is a culture of a bovine strain of the tubercle bacillus which by cultivation for a number of generations upon a glycerine-bile medium has become non-virulent and is tolerated by bovines. Animals treated with this vaccine become relatively insusceptible to tuberculosis, and vaccination of human beings is now being attempted. Numbers of children have been vaccinated in France, and according to Calmette the incidence of tuberculosis among them is much less than among non-vaccinated children in similar environments. Experiments by Calmette and Wilbert at the Pasteur Institute, French Guinea, upon chimpanzees and monkeys, showed that of vaccinated and control animals kept with infected monkeys, none of the vaccinated and all of the controls became tuberculous. A. Stanley Griffith has carried out a further series of experiments on the protective power of B.C.G. vaccine against tuberculosis in monkeys (Med. Research Council: *Spec. Rep. Series*, No. 152. H.M. Stationery Office, 9*d*. net). His conclusions are that the strain of B.C.G. vaccine used in these experiments can produce local tuberculous lesions in the rhesus monkey, but these are always benign and do not lead to generalisation. Vaccination with it, however, whether by feeding or by injection, has failed to afford the complete protection to monkeys claimed by Wilbert, but may in some instances have produced a low grade of relative immunity. Full details are given of the experiments performed and of the results obtained.

THE ninth International Dairy Congress was held in Copenhagen on July 13–17. The Congress was attended by more than 1600 delegates, of whom 800 came from Denmark, 200 from the other Scandinavian countries, and the remainder from other parts of Europe, the United States, and other parts of the world. About 200 representatives of various agricultural, dairying, manufacturing, and scientific interests attended from Great Britain and Ireland and the Dominions. More than thirty governments sent official representatives. The Congress was officially opened on the afternoon of July 13 by the president, Mr. S. Overgaard, in the presence of His Majesty King Christian X. In the evening the Congress was entertained by the Mayor of Copenhagen in the world-famous Town Hall. The four mornings of the Congress were devoted to sectional discussions of papers covering an extremely wide range of dairying interests: public health legislation and administration, bacteriology, animal husbandry, genetics, biochemistry, dairy machinery, and other interests were all thoroughly represented. The afternoons were devoted to a series of tours to points of interest within a radius of about fifty miles from Copenhagen. These included experimental farms and dairies, bacon factories, typical Danish agricultural units, milk distributing centres, as well as a number of places of less technical interest. A National Dairy Exhibition was also held at the Forum during the Congress week.

HISTORICALLY, perhaps the most important happening at this particular Congress was the formation of a special branch of tropical dairying within the dairy federation. The slow but steady increase of tropical dairying has brought with it its own problems, and congresses like the one just held, even were they to serve no other purpose, would be invaluable in affording opportunities for the discussion of such special problems and for the creation of the machinery necessary to secure the permanent interchange of experience and views about them. The next International Dairy Congress is to be held in 1934 in Berlin, and an invitation was extended by His Excellency Baron G. Acerbo dell' Aterno, the Italian Minister of Agriculture, for the 1937 Congress to take place in Italy.

THE Empire Forestry Association, founded in 1921, has recently issued a small brochure entitled "Forests, an Imperial Treasure", which briefly puts the case of the importance at the present day of the forests of the Empire and their proper development; a personal appeal is also made for more funds, in the shape of additional subscriptions to the membership of the Association. At first sight, the value and the possibilities of propaganda and active assistance to the cause of forestry in all its branches open to such an Association would appear to be of the first magnitude. In some Continental countries the membership of similar associations comprises professional forest officers, private owners of forests, timber merchants, and representatives of many other important industries the raw products of which come from the forest. The trouble in the British Empire has been, and still is, that our people, from cabinet minister downwards, do not possess that instinctive recognition of the value of the forest to the countryside and the benefits, direct and indirect, which the possession of areas of well-managed forests confer upon a country and its people. The brochure of the Empire Forestry Association rightly recognises the enormous potential value of existing Empire forests, a value which, in the opinion of many, has become greatly enhanced as a result of the War. In spite of all substitutes, timber still remains of prime importance. The brochure states, "Timber cannot be immediately produced. . . . It is a question of years—of slow, steady growth, and careful tending from sapling to the forest giant", and the same remains true for the controlling forest staff. It takes time to secure a fully trained and organised forest staff with a graduated service of from 1 to (say) 30 or 35 years. Irregularities in recruiting, cutting down in hard times, and over-recruiting in periods when revenue is abundant, may be a sound policy in the spending departments. But when applied to a forest department, it spells disorganisation both in administration and, more important, out in the forests, where the loss in potential forest revenue is accumulative. The brochure does not make specific mention of this aspect, the foundation of all successful forest management.

THE introduction in 1869 of a number of egg clusters of the gipsy moth into the United States led to no serious consequences until twenty years later. In 1889 the larvæ of this insect caused severe defoliation

of trees in the neighbourhood of Boston, Mass., and the rapid spread of the pest into other States led to Congress making an appropriation in 1906 to enable adequate control measures to be taken. The brown-tail moth was first found in 1897 in Somerville, Mass., and its initial spread was more rapid than that of the first-mentioned species. The two kinds of insect demand very similar methods of control, and the whole subject is reviewed by Mr. A. F. Burgess in *Farmer's Bulletin*, No. 1623, issued by the U.S. Department of Agriculture in December. The Federal Government is largely concerned with checking the spread of these insects into uninfested areas, while the affected States themselves aim at reducing the infestations within their own administrative territories. The Government of Canada and several of the Provinces have also organised control and eradication measures within the Dominion. In so far as Canada is concerned, the gipsy moth appears to have been eradicated and the brown-tail moth is found in decreasing numbers. In the United States, the brown-tail moth has also declined very appreciably, and imported parasites have been responsible for a considerable proportion of the good results obtained. Other factors, including spraying operations, have also played their part. With the gipsy moth, imported natural enemies have reduced its numbers in many localities ; but they are not equally effective over the entire infected area, and the best mechanical and chemical methods of control have to be energetically applied. The establishment of a barrier zone, 25-30 miles broad, is an important measure in an attempt to check the westward spread of the insect, and, so far, this appears to have accomplished its purpose.

IN northern Italy the Italian State railways electrified many railway lines with three-phase supply at the low frequency of $16\frac{2}{3}$ cycles per second. To increase the output of their converter sets in substations or placed in the open beside the railway, they possess a number of portable substations. These can help any substation that is overloaded or even replace a unit which is temporarily out of commission. The output of a substation must be sufficient for the greatest traffic load even although it occurs very rarely. With portable substations these peaks can be provided for, and so the size of the requisite buildings and machinery for these substations can be reduced. In southern Italy the State railways are now being electrified with 3000 volts direct current. Very favourable results with this system have been obtained on the Benevento-Foggia line, which is being extended to Naples. Further main line railways are being electrified on this system. For example, the railway connecting Bologna and Florence and the railway between Rome and Naples. With direct current obtained from a three-phase supply, the use of portable substations is particularly convenient, as mercury arc rectifiers can be used which occupy little space and are not too heavy. A full description of one of these portable rectifier substations capable of converting 2000 kilowatts, which has been constructed for the Italian State railways, is given in the *Brown Boveri Review* for June. The rectifier is fitted with a high vacuum pump, and so the set can be put into use at once even after a long journey. A photograph is given in the *Review* of a portable rectifier substation, two of which will be in operation this year.

THE generation of water gas by blowing a coke bed alternately with air and steam has an industrial importance which has increased since the process came to be used for preparing hydrogen on a large scale for synthetic and other purposes. This has led to a considerable study of its thermal economy by the Institution of Gas Engineers and by the Fuel Research Board. The preparation of accurate heat balances of a process which consists of a series of rapid alternations of operations at a high temperature presents much difficulty. One method of checking the measurements is to equate, if possible, the heat set free in the 'air blow' with the heat absorbed in the 'steam run', and the results of such a study made at the Fuel Research Station are described in a paper, "The Water Gas Process: a Study of the Carbon and Thermal Balance" (*Technical Paper* No. 30, H.M. Stationery Office, 9*d*. net). Great attention was given to devising methods for metering the gas streams involved and measuring the hitherto indeterminate quantities. In spite of the difficulty of the task, it was possible to account as heat absorbed on the 'run' for 90 per cent of the heat evolved in the 'blow'. The remainder unmeasured is equivalent to about 3·3 per cent of the coke fed into the generator. It is of the same order as estimated losses during clinkering and by radiation.

WE have received the first number of a new publication, "Occasional Notes of the Hong Kong Horticultural Society" (No. 1, February 1931), edited by Dr. G. A. C. Herklots. In a foreword, the editor points out that within the small territories of Hong Kong very diverse conditions prevail, from the point of view of the gardener, from Victoria Peak with its winter fogs and cool nights to the warmer conditions of the lower levels and Kowloon. It is proposed in the new journal to deal with the special problems relating to the cultivation of particular plants in Hong Kong (sweet peas are dealt with in this number) and also to describe various genera of interesting plants, species of which have been introduced to Hong Kong gardens, and five species of *Thunbergia* are thus dealt with and illustrated in four simple line drawings. Mr. R. A. Nicholson contributes notes on the cultivation of various garden favourites, roses, carnations, dahlias, etc., under Hong Kong conditions; whilst the editor contributes a note upon the soils of the Hong Kong territories. These soils, formed by the weathering of igneous rocks under tropical conditions with relatively heavy rainfall, tend to be of the red laterite type, poor in the necessary salts and becoming acid in reaction. This note is useful as pointing the way both to empirical manurial treatment and also to a more thorough scientific study of the soils of the territories when the workers are available. If this new journal can fulfil the task it has set itself, it should prove a very useful medium for spreading information and stimulating inquiry and research upon

horticultural problems both in Hong Kong and in a wider field.

THE annual report of the Smithsonian Institution upon its "Explorations and Field-work" for 1930 reveals again that energy and lavish expenditure which are the envy of other countries. Field expeditions, not content with concerning themselves with twenty-three of the States of their own country, touched upon every continent and upon many islands. The subjects of the expeditions were as different as their objectives; they included the radiation of the sun, the ancient Eskimo culture of Alaska, Indian music, the fauna and flora of central China, birds of Spain, fossil horses in Idaho, and so on. It might be said that the scientific value of the expeditions varied also. That to Spain, for example, must have partaken rather of a collecting excursion for the replenishing of cabinets, for European zoologists have already done pretty well by the birds of Spain; one feels, indeed, that such a theme might well be left to them, and that energies should rather be concentrated on work lying to hand likely to yield fresher results. Many of the expeditions, however, were of fundamental importance; we need only cite Dr. J. W. Gidley's collecting in the fossil bone deposit at Hagerman, Idaho, which seems to have been a watering place for the wild creatures of the region, so many hundreds of skeletons remain there. Sufficient material of the rare extinct horse, *Plesippus*, was collected to build three or four complete skeletons.

WHILE progress has been made in Great Britain in the study of oil-paintings by microscopic analysis, largely through the work of Prof. A. P. Laurie, experts on the Continent have also been turning their attention, with great effect, to this recent and fascinating branch of research. The variety of aims and methods employed is so considerable that an International Conference, organised by l'Office International des Musées, was held on Oct. 13–17, 1930, in Rome, "for the study of scientific methods applied to the examination and preservation of works of art". With commendable promptitude the papers read at the Conference have been published in the journal of the International Office of Museums, *Museion* (vols. 13-14, 1931). Subjects of discussion included the optical examination of paintings, the chemical and micro-chemical analysis of paintings and mural decorations, the importance of the use of X-rays and its limitations; and an introductory paper by J.-F. Cellerier deals generally with scientific methods and usages in the examination of paintings. Otherwise the magazine contains much information of interest to curators of art collections. There is a short summary in English of the chief papers.

"POSITIVE Eugenics in Practice" is the title of an article in the April issue of the *Eugenics Review* (vol. 23, No. 1). The writer, Mr. Alfred Dachert, conceived the idea many years ago of founding a township for the express purpose of housing couples who would be likely to raise healthy families. In 1921 the city of Strasbourg, realising the significance of the work, placed a site at his disposal, and with funds contributed by the company he managed, building was commenced and 140 houses are now completed, specially planned so as to avoid unnecessary labour for the young housewife. As tenants for the purpose in view, it was necessary to find healthy, vigorous, and comely young couples who really wanted children, and a system of selection was adopted, based upon the application, an interview, visitation of the present home, and medical examination. The experiment seems to be an unqualified success, the birthrate is much higher than in the city of Strasbourg itself, and the behaviour of the citizens has been exemplary. To maintain its purpose, infertile couples have to be replaced by others, but this has been necessary only in nine instances during the seven years since the birth of the township.

VITAMIN A has been shown by Green and Mellanby to be of value as an anti-infective agent when given in large doses. The British Drug Houses, Ltd., London, N.1, have recently put on the market a preparation made from mammalian liver under the name of Avoleum, which, unlike their original product, Radiostoleum, contains no added vitamin D. As mammals, unlike fish, do not store the latter in their livers, the concentrate may be considered to be free from the anti-rachitic factor. The blue value by the antimony trichloride test is about ninety times higher than that given by an average good codliver oil. The concentrate is also standardised in rats by its power of promoting growth and preventing and curing xerophthalmia in comparison with a known sample of codliver oil. Avoleum is suitable for administration in acute conditions in which massive doses of vitamin A are required and also in cases in which vitamin D is contra-indicated. It is issued in capsules, each containing 3 minims of the solution: the dose is 1–3 capsules daily.

IT is announced in *Science* that the Roosevelt Memorial Association, New York, has awarded a Roosevelt Medal to Dr. C. Hart Merriam, chief of the U.S. Biological Survey from 1885 to 1910, and since then research associate of the Smithsonian Institution.

THE following have been elected to fill the vacancies which will occur in the Council of the Institution of Electrical Engineers on Sept. 30: *President*, Capt. J. M. Donaldson; *Vice-Presidents*, Mr. J. M. Kennedy and Mr. F. W. Purse; *Hon. Treasurer*, Mr. E. Leete; *Ordinary Members*, Lieut.-Col. A. G. Lee, Mr. C. le Maistre, Mr. H. A. Ratcliff, Dr. E. H. Rayner, Mr. R. H. Schofield, Mr. J. W. J. Townley, and the Viscount Falmouth.

THE International Congress of Mathematics will be held at Zurich on Sept. 4–12, 1932. There will be general discussions on the present position of mathematics, also short papers of recent research work. In connexion with the Congress, receptions and excursions are being arranged. Further details will be available in October.

REFERRING to a paragraph that appeared in NATURE for July 4 (vol. 128, p. 15), the Rev. J. P. Rowland, *S.J.*, informs us that, with the aid of addi-

ditional records (the total number used being twenty), he has made a new determination of the position of the epicentre of the North Sea earthquake of June 7. This he finds to be in lat. 53° 57′ N., long. 1° 25′ E., or about 22 miles to the north-east of the position previously assigned, the corresponding time at the origin being 0 h. 25 m. 24 s. G.M.T.

THE London Natural History Society has recently published a pamphlet describing its constitution and activities. Founded in 1858, its present headquarters are at the London School of Hygiene and Tropical Medicine. The president is the Right Hon. Viscount Grey of Fallodon. Members of the Society enjoy the privileges of admission to all lectures, use of the Society's collection and library, receipt of the annual copy of the *London Naturalist*, and access to places of interest. The Society is divided into archæological, botanical, entomological, ornithological, plant galls, and rambling sections. The annual subscription is 7*s*. 6*d*., with an entrance fee of 2*s*. 6*d*. Application for membership should be made to the Secretary, 91 Queen's Road, Buckhurst Hill, Essex.

THE Empire Marketing Board has made a grant of £15,790, spread over five years, towards a scheme for the development of rice research in India which aims at increasing the yield and improving the quality of Indian rice. The scheme is organised by the Imperial Council of Agricultural Research of the Government of India. The Empire Marketing Board has offered to bear half the cost of developments in Burma, the principal rice-exporting Province, and Bengal, where Patna rice is grown for export. Schemes for development of research in the remaining five Provinces are to be financed entirely by the Imperial Council. About 33,000,000 tons of rice are produced annually in India, of which only a small proportion is exported. The scope for research is immense. Improvement may come through breeding better varieties of rice already grown in India, or through establishing there new and better kinds of rice from other countries. A beginning has already been made and more than a million acres are under improved varieties.

THE Ministry of Health has published a "Review of certain Present Aspects of Smallpox Prevention", which deals with the subject particularly in relation to the vaccination acts (*Reps. on Pub. Health and Med. Subjects*, No. 62. H.M. Stationery Office. 1*s*. net). It is concluded that in spite of the fact that England and Wales, of the population of which some forty per cent are unvaccinated, are intrinsically more vulnerable to the serious and rapid spread of severe epidemic smallpox than are countries where the population is compulsorily vaccinated and re-vaccinated, the protective methods which are part of ordinary British administration should prove efficacious in protecting the community from invasion. Post-vaccinal encephalitis is also discussed, and the vaccination requirements of certain European countries are summarised.

THE *Annual Report* of the Calcutta School of Tropical Medicine, Institute of Hygiene, and the Carmichael Hospital for Tropical Diseases, 1930, recently issued (Calcutta: Bengal Government Press, 1931), contains summaries of the work, routine and research, carried out in the laboratories and wards. Lieut.-Col. Acton, the director, in his introduction, after alluding to some of the administrative difficulties of the post, gives a useful review of the recent advances in tropical medicine. Recent investigations indicate that epidemic dropsy, vast epidemics of which have occurred in Calcutta from time to time, is connected with the consumption of badly stored rice, and is related to beriberi. Promising results have been obtained in the treatment of oriental sore with local injections of a 2 per cent solution of acid berberine sulphate. The growth of the *Leishmania* parasite of this disease in culture is completely inhibited by a dilution of 1 : 80,000 of this drug.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—An assistant master for science and engineering at the Oswestry Technical Institute—The Clerk to the Governors, Technical Institute, 18 Arthur Street, Oswestry (July 26). A lecturer in civil engineering in the Faculty of Engineering of the University of Bristol—The Secretary and Acting Registrar, University, Bristol (July 27). A temporary investigator under the Department of Agriculture for Scotland, in connexion with an investigation of the marketing of grain and grass seeds in Scotland—The Establishment Officer, Department of Agriculture for Scotland, Queen Street, Edinburgh (July 29). A lecturer in biochemistry (fermentation industries), at the Heriot-Watt College, Edinburgh—The Secretary, Heriot-Watt College, Edinburgh (July 31). A part-time assistant in the Department of History and Method of Science of University College, London—The Secretary, University College, Gower Street, W.C.1 (Aug. 4). A veterinary education officer under the Derbyshire Education Committee—The Director of Education, County Education Office, St. Mary's Gate, Derby (Aug. 5). A head of the Building Department of Woolwich Polytechnic—The Principal, Woolwich Polytechnic, S.E.18. A master for manual instruction, principally in woodwork, under the Middlesex Education Committee—The Secretary, Education Offices (H), 10 Great George Street, S.W.1. A teacher of carpentry and joinery at the Tottenham Polytechnic—The Principal, Tottenham Polytechnic, High Road, N.15. Teachers of electrical science, workshop calculations, workshop drawing, workshop science, and engineering drawing at the Guildford Technical College—The Director, Technical College, Park Street, Guildford. Part-time instructors in practical work in the engineering shop, practical geometry, engineering drawing, mathematics, chemistry, physics, and mechanics at the Watford Junior Technical School in Engineering—The Principal, Technical School, Watford. A temporary scientific assistant at the Air Defence Experimental Establishment—The Superintendent, Air Defence Experimental Establishment, Biggin Hill, Kent. A laboratory attendant in the senior physical laboratory of Oundle School—W. Llowarch, 6 Milton Road, Oundle.

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.*]

Constitution of Lithium.

THE first measurements of the relative abundance of the isotopes 6 and 7 of lithium were made by Dempster with his magnetic spectrograph.[1] As the instrument indicated ratios so high as 37 and so low as 4·8 with means around 7–10, the results are of little value. Morand,[2] using a heated anode and measuring simultaneously the currents carried by Li^6 and Li^7, arrived at the figure 14·9, a ratio agreeing well with the atomic weight 6·94 on the assumption that the atoms had exact whole number masses. Costa's measurements (1925) recalculated from my own results [3] indicate the masses to be 6·012 and 7·012 ($O^{16} = 16$) respectively. This reduces the ratio calculated from the chemical atomic weight to about 13. Quite lately, v. Wijk and v. Koeveringe,[4] from observations on band spectra, calculate the ratio to be 7·2.

Recent improvements in technique have enabled me to apply the principle of accelerated anode rays to my high resolution mass-spectrograph. Using the method of intermittent exposures and correcting for the position of the lines, I find a provisional value of the ratio to be $10·2 \pm 0·5$, which gives:

Atomic weight of Li $\equiv 6·923 \pm 0·006$.

The correction for position is unfortunately a maximum, about 20 per cent, for the lithium lines. In addition, it must be noted that the velocity of the Li^6 atom exceeds that of the Li^7 atom by about 8 per cent, and will certainly enhance its photographic effect. Any correction for this will increase the ratio, and although it seems unlikely that it could bring it up to the high value given by Morand, it can only accentuate the very serious discordance between the ratio calculated from band spectra and the more direct results of the mass-spectrograph. It seems highly desirable that measurements similar to those of Morand should be made with an instrument of higher resolving power; the magnetic spectrograph of Bainbridge would seem to be admirably suited to the purpose.

F. W. ASTON.

Cavendish Laboratory,
Cambridge, July 12.

[1] *Phys. Rev.*, **18**, p. 415; 1921.
[2] Thesis for Ph.D., Paris (1927).
[3] *Proc. Roy. Soc.*, A **115**, p. 509; 1927.
[4] *Proc. Roy. Soc.*, A **132**, p. 98; 1931.

Polarisation of a Beam of Electrons by Scattering.

MOTT [1] has predicted that a polarisation of an electron beam is possible under certain conditions. These conditions are that a fast electron shall be scattered successively by two heavy nuclei through large angles. The intensity of the twice-scattered beam should then depend on its azimuth with respect to the original unscattered beam. Many attempts have been made to detect such an effect, with either negative or inconclusive results; but in none of them have the conditions laid down by Mott all been fulfilled. Chase,[2] who finds a small positive result, scattered β-rays through 90° from solid targets. The scattering in a solid target is multiple, that is, consists of a large number of small angle collisions, and Mott's theory is completely inapplicable. The same criticism applies to the work of Langstroth,[3] who, moreover, uses too small a velocity (due to an error in Mott's paper) for the polarisation to be detectable. In the recent work of Rupp [4] and Rupp and Szilard the arrangement is still further removed from that considered by Mott.

When the conditions of nuclear scattering are satisfied, it appears from the work described below that there is a small polarisation of the beam, in the direction predicted by the theory. Electrons of velocities up to 70 kilovolts (0·47 of the velocity of light) are scattered through 90° by a target of the thinnest commercial gold leaf (thickness $< 10^{-5}$ cm.). The scattered beam, defined by suitable diaphragms, meets an exactly similar target, and is scattered again through 90° to a Faraday cylinder, where it may be measured. The second target and Faraday cylinder can rotate about an axis joining the two targets. A thin aluminium foil (thickness 8×10^{-5} cm.) placed between the second target and collecting cylinder, holds back all slower secondary electrons, but allows the greater part of the scattered beam to pass. Precautions were taken to exclude all electrons coming from other parts of the apparatus than the two targets, and also all photoelectrons produced by X-rays.

The difference in intensity of the scattered beam in the two positions, parallel and antiparallel to the original beam, proved very small and of the same order of magnitude as the natural asymmetry introduced by the apparatus itself. In order to eliminate the latter, the difference in the polarisation produced at 70 kv. and at 20 kv. has been observed. The results are given in the accompanying table, where the differences in the intensities of the two scattered beams are shown as percentages of the antiparallel beam. The table represents some 140 determinations at each velocity; each group represents a taking down and reassembly of the apparatus to replace the filament or one of the foils. One group is omitted which gave a result, discordant with all the others, of 9 per cent.

Group.	Difference in Polarisation 70 kv.-20 kv. (per cent).
A	$1·60 \pm 0·77$
B	$2·48 \pm 0·75$
C	$3·66 \pm 1·12$
E	$0·59 \pm 0·62$
F	$3·93 \pm 0·65$
G	$1·36 \pm 0·37$
	$0·65 \pm 0·48$
H	$1·57 \pm 0·58$
J	$3·80 \pm 1·24$
O	$2·09 \pm 0·42$
Weighted mean	$1·74 \pm 0·32$

The theory of Mott indicates that the amount of polarisation should depend on the square of the atomic number of the scattering nuclei. In order to check whether the very small effect found is not entirely instrumental, one of the gold foils was replaced by aluminium (thickness 8×10^{-5} cm.). The total scattered intensity was too small to allow both scatterers to be of aluminium. The result found (for the difference at 70 kv. and 20 kv. again) is $0·01 \pm 0·23$ per cent, justifying the view that a real polarisation effect has been observed.

The work of Mott indicates a value of 0·4 per cent (with an arithmetic mistake on p. 439 of his paper corrected) for gold, as the difference in the polarisations at the two velocities used; this is one quarter of that actually found, but I am assured by Mr. Mott that for an atomic number so high as 79 his series cease to converge and the final formula loses all

validity. The problem requires working out to a higher approximation before the results can be applied to scattering by the heavier nuclei.

It should be mentioned that the experimental result of 1·74 per cent is more likely to be low than high. The foils used were highly inhomogeneous, and multiple scattering, which is not expected to contribute to the polarisation, from the thicker parts is certainly present, but to an unknown degree.

It is hoped to publish a fuller account of the experiments in the near future.

E. G. DYMOND.

Cavendish Laboratory,
Cambridge,
July 7.

[1] Mott, *Proc. Roy. Soc.*, A **124**, p. 425; 1929.
[2] Chase, *Phys. Rev.*, **36**, p. 1060; 1930.
[3] Langstroth, NATURE, **127**, p. 891; 1931.
[4] Rupp, *Naturwiss.*, **19**, p. 109; 1931. Rupp and Szilard, *ibid.*, p. 423.

A Curious Phenomenon shown by Highly Charged Aerosols.

IN the course of investigations on the electrification of aerosols, a curious phenomenon was noticed. The aerosols were volatilised in a glass chamber of about four cubic metres capacity. During the dispersal a unipolar discharge was produced by connecting one pole of a large electrostatic machine to a metal brush inside the chamber. The contents of the chamber were agitated by an electric fan during dispersal and for a minute or so afterwards.

Whenever this type of aerosol is produced in our chamber, a striking phenomenon makes its appearance. Directly the fan has stopped, large particles begin to arrive in the centre of the chamber, and these gradually draw together to form a large, loose, more or less spherical cluster about 20 centimetres in diameter, the particles, however, retaining their individuality. The particles composing the sphere appear to be highly electrified, since, if a charged wire is pushed towards it, the sphere as a whole is rapidly attracted and absorbed when the wire is of one sign and repelled by the other. In this way the sphere may be pushed right across the chamber, though it may be distorted in the process. If now the wire is removed, the sphere tends to return again to the centre.

The greater number of particles when examined by the electric cell, which we have previously described,[1] are seen to be very highly charged to the same sign as the brush discharge. The particles composing the sphere, on the other hand, are highly charged to the opposite sign. Thus if the aerosol is charged positively by a positive brush discharge, the sphere is made up of negatively charged particles and vice versa. The phenomenon is exhibited by all aerosols which we have examined, but is especially striking in the case of a dyestuff such as *p*-xylene-azo-β-naphthol. An aerosol of this material when dispersed at a concentration of about 15 mgm. per cubic metre is greenish blue in a Tyndall beam, and after electrification retains this colour. The sphere which forms in the centre of the chamber, however, is bright red, this being the colour of large particles of the material.

By inserting a cover-glass into the cluster, it was found possible to collect some of the particles, and microscopic examination showed that they consisted of long chains or ropes of particles containing apparently thousands of units.

The phenomenon may probably be explained as follows. Suppose we consider an aerosol which has been positively charged by a positive brush discharge. The outside of the glass walls of the chamber immediately after dispersal is found to be highly positively charged. This implies that the inside is negatively charged by induction, though we have not been able to verify this experimentally. If then complexes carrying a high negative charge are present in the chamber, they will certainly be repelled towards the centre. On reaching the centre, their mutual repulsion will prevent very close approach, so that a loose sphere should be formed.

The complexes themselves may be formed in the following way. Whilst, for example, the positive brush discharge is in action, heavy negative charges must be induced on any objects near the brush. Now experimentally we find that if there are two point electrodes with a field of a few hundred volts per cm. between them in an aerosol, long chains of particles will gradually form and project out from the points. These chains may easily be detached by an air current, and will presumably remain as long chains, providing that the cohesive force between the particles is greater than the repulsive force due to their charge. A similar state of affairs will probably obtain whilst the brush discharge is in action. When the fanning ceases, the negatively charged chains will obviously be repelled to the centre of the chamber, whilst those positively charged will be attracted to the walls.

It may be noted that if the sphere is once completely removed in any way, it will not reform, and that in any case it tends to disperse with lapse of time. This latter may be attributed partly to gradual neutralisation of the charges on the complexes by coagulation with particles of opposite sign and partly to loss by leak of the charge induced on the glass walls.

The existence of such a spherical, highly charged assemblage of particles suggests that globular lightning may owe its origin to an analogous effect, in which particulate matter, either liquid or solid, is charged to a very much higher potential.

W. CAWOOD.
H. S. PATTERSON.

The University, Leeds,
June 12.

[1] *Proc. Roy. Soc.*, A, vol. 124, p. 523; 1929.

Temperature Stability and Denaturation of Serum Albumin.

IT has been shown by Svedberg and Sjögren[1] that at ordinary temperature serum albumin is stable (that is, homogeneous with regard to molecular weight) in a region of *p*H varying between 4 and 9. These authors have also shown that outside of the stability region, but not too far from it, the serum albumin molecule is dissociated into smaller molecules. This first stage of breaking up of the molecule probably means the formation of particles of half the weight of the original molecule. The complete breaking up of the molecule follows immediately after this stage. The first stage has been shown to be reversible with regard to the molecular weight.

Now the influence of different heat treatment on serum albumin in different buffered solutions has been studied by means of the ultracentrifugal technique worked out by Svedberg and the electrophoretic technique worked out by Tiselius,[2] and it was found that there is a distinct difference in the behaviour of the serum albumin inside and outside the stability region. Inside the stability region, different proportions of the total quantity of the serum albumin will undergo change and give aggregation products, the number and size of these aggregation products varying according to the *p*H and to the salts of the solution, to the temperature and the time during which the heat treatment has taken place. That part of the serum albumin which has undergone aggregation may, if not already coagulated, be removed by centrifuging, and

it is then found that the serum albumin in the remaining solution is quite unchanged. It was found to have exactly the same sedimentation constant, the same molecular weight, the same electrophoretic movement, and the same light absorption as the original solution. This may be a property peculiar to serum albumin.

Some preliminary experiments with amandin have shown that this protein undergoes quite a different change by heat treatment. In this case the protein is partially split up into very small particles, so small that they do not show any sedimentation in the ultracentrifuge. But, as in the case of serum albumin, the main part of the amandin is found to be unchanged in the solution, if the treatment has not been too strong.

The aggregation products can be centrifuged off and washed, and they can be suspended in a buffer solution. Such suspensions have been examined by electrophoresis, and they were found to be homogeneous with regard to electrophoretic movement, in spite of being quite polydisperse in the ultracentrifuge. The *p*H mobility curve of this denatured serum albumin was found to be nearly parallel to that of the native serum albumin, but the isoelectric point was found to lie between *p*H 5·1 and *p*H 5·3 instead of at *p*H 4·88 for the native serum albumin in the same buffer solutions. This seems to indicate that the native serum albumin has undergone a definite chemical change when transformed into the denatured serum albumin.

The acid limit of the stability region was found at about *p*H 3·8. At this point the solution was treated for six minutes in boiling water, and yet the sedimentation constant was unchanged and there were no aggregation products, but the diffusion constant showed a drift indicating that the particles were not quite monodisperse.

Outside the stability region, at *p*H less than 3·8, it was found that the serum albumin particles were split up into smaller particles giving a sedimentation constant of about $s_{20} = 3{\cdot}5 \times 10^{-13}$ instead of $s_{20} = 4{\cdot}3 \times 10^{-13}$ for native isoelectric serum albumin, and this was the case even if the solution had been treated in boiling water for five to ten minutes. Inside the stability region in buffers containing the same ions this treatment would always cause coagulation or the solution would at least be opalescent, indicating the formation of aggregation products.

By electrophoretic experiments it was found that the heat-treated solutions (at *p*H less than 3·8) gave such mobilities as would be expected for denatured serum albumin at these hydrogen ion concentrations. After standing one day at room temperature, an untreated solution of serum albumin (at *p*H less than 3·8) showed the same mobility as the one treated by heat.

When the hydrogen ion concentration of a heat-treated solution (at *p*H less than 3·8) was changed to about the isoelectric point, it was in some cases found that such a solution in the ultracentrifuge was not distinguishable from a solution of native serum albumin, but in some other cases there was found a sedimentation constant of about $s_{20} = 3{\cdot}6 \times 10^{-13}$; but in these cases the electrophoretic mobilities were not those of native serum albumin but those of denatured serum albumin.

Some preliminary experiments have shown that serum albumin solutions at *p*H 3·5 exposed to ultraviolet light are strongly changed, and it is found that the light absorption increases very much, the odour becomes very peculiar and strong, the solution remains clear, but the sedimentation constant is about twice that of native serum albumin, and the diffusion constant shows a strong drift.

Experiments to reverse the coagulation either with potassium thiocyanate or acetic acid were negative; the results were inhomogeneous polydisperse solutions. An experiment with heat treatment at *p*H about 10 showed that the serum albumin was split up and gave a sedimentation constant of $s_{20} = 3{\cdot}5 \times 10^{-13}$, but the diffusion constant showed a strong drift, and the light absorption was about five times as large as usual, which indicates that a deeper chemical change had taken place.

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June 28.

[1] *J. Am. Chem. Soc.*, **52**, p. 2855; 1930.
[2] *Nova Acta Regiæ Soc. Scient.*, Uppsala, **4**, 7, No. 4; 1930.

A New Relation between Electrical Resistance and Energy of Magnetisation.

IN two recent papers [1] I have shown that there are two effects of a magnetic field on the electrical resistance of ferromagnetic wires. At temperatures appreciably below the Curie-point (*C-P.*) there is an increase $+\Delta R$ of the resistance by magnetisation which attains a saturation value exactly at the saturation of the magnetisation. The relation between the magnetisation I and the change of the resistance is $+\Delta R = c(I^2 - I^2_0)$, where I_0 is a critical value of the magnetisation process; for example, in crystals the component of the spontaneous magnetisation in the direction of the field. So far as the limit I_0 of the magnetisation, there is practically no change of resistance. The greater part of the resistance increase takes place in the region approaching saturation.

At temperatures in the neighbourhood of the *C-P.* the magnetic field decreases the resistance. Just below the *C-P.* there is at first a small increase and then a decrease of the resistance; above the *C-P.* we find only a diminution of the resistance. We have put forward the hypothesis that in a ferromagnetic material the spontaneous magnetisation produces a diminution of the resistance, and have shown that in the absence of an external field this effect is exactly proportional to the inner magnetic energy: that is, to the square of the spontaneous magnetisation. Since in the neighbourhood of the *C-P.* an external magnetic field gives an augmentation of the magnetic energy (proportional to the square of the 'true' magnetisation), the resistance should be diminished by a field, as is observed. There, however, a difficulty appeared; for we found that between 0 and 500 gauss $-\Delta R$ is approximately proportional to the first power of the field. In a letter to NATURE,[2] H. H. Potter has confirmed our results, and has also shown that, in fields high enough and at temperatures above the *C-P.*, the decrease of resistance is proportional to the square of the field, as would be expected from our theory.

In continuation of our experiments, we have measured again as exactly as possible the diminution of the resistance and also the magnetisation at temperatures above the *C-P.* at low field-strength. We have found that the decrease of resistance is always proportional to the square of the true magnetisation $-\Delta R = c.\sigma^2$ and is independent of the relation between R and H. Just above the *C-P.* the external field has a double influence on the magnetisation: it produces a true magnetisation and also a certain form of ferromagnetic magnetisation. The fact that there the two effects will be superposed, explains our observation that the negative change of resistance can be approximately proportional to the first power of the field.

We would suggest that these experiments, in connexion with the results of Potter, *show definitely that true magnetisation diminishes the electrical resistance proportionately to the true magnetic energy.*

WALTHER GERLACH.
ERNO ENGLERT.

University, Munich,
June 26.

[1] W. Gerlach u. K. Schneiderhan, *Ann. d. Phys.*, **6** (V), 772; 1930. W. Gerlach, *Ann. d. Phys.*, **8** (V), 649; 1931.
[2] H. H. Potter, NATURE, April 11, 1931, p. 555.

Wires drawn through Rotating Dies.

A CHANCE observation by one of us (H. G.) that if the die through which a wire was being drawn was simultaneously rotated the tension required was appreciably reduced, has led to results of considerable interest. The following series of values refer to an 80:20 cupro-nickel wire reduced from 0·073 in. to 0·0635 in. in diameter, that is, 24 per cent. A sintered tungsten carbide die of 6° taper was used, with 'Oil-dag', a suspension of colloidal graphite in oil, as a lubricant.

Speed of Rotation. r.p.m.	Tension required. lb.	Decrease. Per cent.	Power to rotate Die. ft. lb./min.
0	82	0	..
50	61	26	200
80	58	29	450
160	51	38	700
1920	26	68	1000
2660	23	72	1300
3300	21	75	1400

Since the speed at which the wire was drawn in these tests was only 3 in. per min., it will be appreciated from the values given in the last column that the observations are at the moment of theoretical interest only, and have no industrial significance. Whether this still holds at higher rates of drawing we have not yet determined, but work in this direction will be undertaken.

Up to the present we have been unable to detect with certainty any change in the structure of the wire drawn through fixed and rotating dies, nor have we found any alteration in the recrystallisation on annealing. The very few mechanical tests so far carried out reveal no modification in the tensile properties of the wire, though the number of twists withstood—on a length of 100 times the diameter of the wire—appears to be less with the rotating die than for wire drawn through a stationary one. Typical results, which refer to a 70:30 brass wire again reduced 24 per cent from an initial diameter of 0·073 in., are given below.

Die.	Maximum Stress, Tons/sq. in.	Elongation Per cent on 2 in.	Reduction of Area. Per cent.	Torsions. 1	2	3	Mean.
Fixed .	34·5	25	55	115	106	111	111
Rotating	34·3	25	55	87	65	72	75

The Brinell hardnesses of the wires were again almost identical. Using a 1 mm. ball and a load of 30 kgm. the Brinell number was 125 for the fixed die and 123 for the rotating one.

H. GREENWOOD.
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University of Manchester,
June 23.

Diamagnetism of Liquid Mixtures.

MR. S. P. RANGANADHAM states, in NATURE of June 27, that he has obtained values for the specific susceptibility of mixtures of organic liquids which differ markedly from those obtained by us.[1] It is impossible to answer Mr. Ranganadham's assertion without a full knowledge of his data, consequently we must await the publication of his results before we can reach an opinion as to the comparative value and accuracy of the two sets of values. In the meantime, however, we must justify our continued belief in the accuracy of our work. In the first place, as pointed out in our paper, the specific susceptibilities of the pure liquids used in our experiments were found, with a single exception, to be closer to Pascal's calculated values than any values hitherto published. We attribute this fact to the carefully checked purity of the material used. The susceptibility values used in plotting our curves were, in every case, obtained several times with fresh portions of the mixtures; the symmetry of the curves and the fact that they exhibit maxima in the same positions as other property-composition curves is confirmatory of the accuracy of our results.

It is well known that acetone-chloroform mixtures show greater deviations from the mixture law than almost any other pair of organic liquids; it would, therefore, not appear to be extraordinary that the specific susceptibility should also show a very marked deviation such as we find. Furthermore, as pointed out in our paper, we found it possible to calculate a mass action constant for the reaction between the constituent liquids and an equimolecular compound from the specific-susceptibility-composition curve for acetone and chloroform.

Mr. Ranganadham sees with astonishment that this curve passes from the diamagnetic to the paramagnetic region. Whilst this fact is remarkable, it is of experimental origin and, in our opinion, not open to doubt. In our view, the astonishing fact is that although we have no evidence that acetone and chloroform combine under our conditions to give dimethyltrichloromethyl carbinol, this substance, originally made by Willgerodt, is considerably more paramagnetic ($\chi = +2{\cdot}564 \times 10^{-6}$) than any of our mixtures of acetone and chloroform. Further work on the physical properties of acetone-trichloroethylene and bromoform-acetone mixtures is about to be published, and this fully supports our published curves for the specific susceptibility of mixtures of these substances.

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JAMES F. SPENCER.

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[1] Trew and Spencer, *Proc. Roy. Soc.*, **131**, A, 209; 1931.

Excretion of Uric Acid.

DR. WIGGLESWORTH'S communication in NATURE of July 18 raises some very interesting points regarding the physiology of animals which possess uricotelic metabolism. Evidence in favour of his suggestion that a circulation of base takes place, as well as of water, in the excretion of uric acid, can, it seems to me, be found in the facts already known about the development of the chick embryo.

The use of the term 'urates' for the solid masses present in the allantoic liquid during the last week of incubation rests on nothing more than an assumption. For (1) the inorganic cations of the allantoic liquid are completely accounted for by the inorganic anions, as is shown by the recent work of Iseki.[1] Moreover, (2)

the concentration of ash on the fourteenth day of development in the allantoic liquid is almost exactly the same as it was on the ninth, although a 550 per cent increase in the concentration of uric acid has taken place. (3) The uric acid cannot be combined as ammonium urate, for there is not enough ammonia present in the allantoic liquid. About ten times as much as what is found there [2] would be required to form ammonium urate. (4) The slimy masses of uric acid in the allantoic liquid towards the end of development, when washed in distilled water and ashed, give an ash content of only 3·9 per cent. Sodium urate would require 12 per cent and potassium urate 18 per cent. (5) The *p*H of the allantoic liquid, which is about 6·3 during the last week of incubation [3] also strongly suggests that the uric acid is not present as urate.

It seems justifiable, then, to conclude that the uric acid which accumulates in the developing chick's allantoic cavity is free. It may enter the allantois in the form of the sodium or potassium salt, and the cation may then be reabsorbed as carbonate or in some other way, but such an absorption of base might presumably take place just as well in the developing kidneys or cloaca. However, it is known that the allantoic blood-vessels absorb water from the allantoic liquid after the tenth day, and, as they certainly take part in a circulation of water, they may take part in a circulation of base as well.

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Biochemistry, Cambridge.

[1] *Zeit. f. physiol. chem.*, **171**, 101; 1928.
[2] Needham, *Jour. Exp. Biol.*, **4**, 114 and 145; 1926.
[3] Aggazzotti, *Archives Ital. de. Biol.*, **59**, 305; 1913.

The Slow Combustion of Acetylene.

IN a recent paper, Bodenstein [1] has propounded a theory of the slow oxidation of acetylene, which accounts extremely well for the observed [2] kinetic phenomena. However, he considers the chain length to be of the order of one link, contrary to the generally accepted mechanism of hydrocarbon oxidation. That acetylene and oxygen form a reaction chain of considerable length is evident from the following experiments, carried out at 320° C. in a circulating apparatus of the same design as that described by Spence and Kistiakowsky.[2] Using an unpacked pyrex glass furnace of 75 c.c. volume, with an internal diameter of 20 mm., and circulating a mixture of 276·6 mm. of acetylene and 147·2 mm. of oxygen, 51·4 mm. of acetylene reacted in one hour. When, however, a furnace packed with pyrex glass tubing of 2 mm. internal diameter and having a total free gas volume of 75 c.c. was substituted for the unpacked vessel, using the same initial amounts of acetylene and oxygen, less than 1 mm. of acetylene had reacted after one hour. Also, a much slower reaction was observed when the surface of the unpacked vessel was coated with potassium chloride.

There can be no doubt, then, that under the conditions stated the amount of reaction taking place upon the glass surface itself is insignificantly small, while it seems most probable that reaction chains originate upon the surface, undergo considerable branching in the gas phase, where some deactivation by oxygen occurs, and finally are broken at the walls of the vessel. Chain reactions of this type have been discussed by Semenoff [3] (see also Bursian and Sorokin [4]), who shows that they are accompanied by an induction period the duration of which depends upon the concentration of active centres, that is, upon the nature of the surface, upon the total probability of forming another link, and upon the time necessary for the propagation of each link in the chain. A more detailed account of other experiments bearing on this point will be published shortly. R. SPENCE.

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[1] Bodenstein, *Z. ph. Chem.*, B, **12**, 151; 1931.
[2] Spence and Kistiakowsky, *J. Am. C. S.*, **52**, 4837; 1930.
[3] Semenoff, *Z. ph. Chem.*, B, **11**, 464; 1931.
[4] Bursian and Sorokin, *Z. ph. Chem.*, B, **12**, 247; 1931.

Diamagnetism and the Colloidal State.

SOME preliminary experiments by Vaidyanathan [1] show that the diamagnetic susceptibility (χ) decreases as the size of the particle is reduced in the cases of the colloids of bismuth, antimony, and graphite. Detailed and careful experiments by me with much stronger fields have in general confirmed this result. The quantitative variation of χ with the diameter d of the particle has also been studied. The results for bismuth and antimony are affected by oxidation, but in the case of graphite there is no such trouble. A graph drawn between χ and $1/d$ for this element gives a straight line. The inverse of the diameter is a measure of the surface or boundary area of a number of spherical particles in unit mass of the substance. It is thus found that χ decreases proportionately as the boundary area of a given mass is increased.

The results for bismuth and antimony are equally interesting. The curves between χ and $1/d$ are such as could be explained on the basis that the decrease of χ is due to two causes, namely, oxidation and the genuine fall on account of the reduced particle size.

It is interesting to note that as the boundary area is increased the orbits of a large number of *structure electrons* postulated by Prof. O. W. Richardson [2] will decrease in size. This, on the orbital theory, may account for the decrease in the diamagnetic susceptibility value as d is reduced. The fact that χ decreases proportionately as the boundary area is increased seems to lend considerable weight to this view.

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[1] *Ind. Jour. Phy.*, **5**, 559; 1930.
[2] *Proc. Roy. Soc.*, A, **128**, 41; 1930.

The late Mr. Herbert Tomlinson, F.R.S.

THE obituary notice of Mr. Herbert Tomlinson in NATURE of July 11, p. 58, reminds me that, about a year ago, I came across what appears to be a complete collection of his published work for sale in a second-hand bookseller's shop in Worthing.

This collection consists of three thick octavo volumes which were evidently bound for his private use, as the pamphlets and articles are interlined with letters to and from the secretary of the Royal Society, the Editor of NATURE, etc., and there is an index in his own handwriting.

It contains, in addition to his formal scientific papers, many cuttings of letters to the *Times*, and articles which were printed in chemical journals and in North London papers. There are also quite a considerable number of literary articles, mainly on the subject of Italian poetry; and several metrical versions of Dante and Tasso which indicate that the author was no mean poet.

The volumes are now in the library of King's College, Strand, W.C.2, where they are available for reference by anyone interested.

J. JOHNSTON ABRAHAM.
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Research Items.

Pit-Dwellings at Kiatuthlanna, Eastern Arizona.—Ruins on the Long H ranch, Twin Salt Lakes, in Apache County, were excavated by Mr. Frank H. H. Roberts, jr., on behalf of the Bureau of American Ethnology in 1929, the results being described in *Bulletin* 100 of the Bureau. By the end of the field season, eighteen pit-houses, the remains of jacal structures, and a pueblo ruin with forty-nine rooms and four kivas had been recovered. The chronological sequence was in the order named. There were two forms of pit-house, of which the larger was a later development of the smaller. In each case there was a rectangular superstructure of poles with flat ceiling and sloping sides. The framework was covered with brush, leaves, etc., and a rectangular hole in the centre of the ceiling served as an entrance and smoke escape. Characteristic furnishings were a ventilator, fire-pit, a *sipapu* or symbolic representation of the mythical place of emergence, and a hole for the storage of small objects. This group of features survived in the later ceremonial chamber of the communal dwelling, a survival for ceremonial purposes of the old original type of house. The pit-houses occur in groups of four to six, perhaps representing a single family group or clan. Several might constitute a village. In some groups the central house was larger, suggesting that a definite ceremonial significance was becoming attached to a particular building, possibly representing the prototype of the kiva of later periods. The smaller houses were found to be reminiscent of structures belonging to the end of Basket Maker III. period, the larger of Pueblo I. of the Chaco Canyon of New Mexico and south-west Colorado. In general the pit-houses show a greater resemblance to dwelling forms excavated in the north than they do to those of the south and south-west. The jacal dwellings, which have upright walls of poles covered with mud and ranging from a single to several rooms, were contemporary with the large pit-dwellings.

The 'Vital' Factor in Diet.—In connexion with the letter on "Photographic Effects of Vitamins A and B", by Sophie Botcharsky and Anna Foehringer, published in our columns recently (NATURE, vol. 127, p. 856; June 6, 1931), and the note on p. 864, Dr. Chalmers Watson has sent us a paper by him on "The 'Vital' Factor in Diet: A Theory of the Nature of Vitamins", published in the *Edinburgh Medical Journal*, June 1931. He was impressed by the early experiments on rats in which it was shown that immediate and dramatic recovery was brought about when animals previously fed on abnormal diets were given a diet of bread and milk; by the capacity of irradiated milk to bring about a rapid healing of rickets in children; and by the valuable therapeutic effects of the 'Gerson' diet, which includes vegetable and fruit juices freshly prepared, wholemeal bread and milk, vegetables cooked in oil and potatoes cooked in their jackets, but with restricted amounts of meats and salt. Dr. Watson points out that the effectiveness of irradiated milk in the cure of rickets appears to be much greater than can be accounted for by its vitamin D potency as determined by tests on rats. Solar energy acts on the cells of plants and initiates the chemical energy which promotes healthy growth; this energy is passed on to the animal kingdom when the vegetable food is consumed. Artificial irradiation has the same effect as exposure to the sun's rays. The best source of vitamins is living food; much of that in common use is more or less dead or devitalised; in fact, the amount of vitamins present varies inversely with the nearness of the food to the original source of its energy. Dr. Watson considers that the plant tissues hold some of the original vital (or solar) energy which initiated the chemical changes; in other words, they are activated. When the tissues are consumed by animals or man, that energy is in turn transmitted to them as a so-called vitamin.

Ringed Plover and its Eggs.—A series of simple and instructive experiments relating to the eggs of the ringed plover (*Charadrius h. hiaticula*) has been carried out by George Marples in an area where he had more than forty nests under observation (*British Birds*, vol. 25, July 1931). When eggs were removed a short distance from the nest, the birds found them and dragged them back; but they also dragged and sat upon egg-shaped pebbles which had been painted to resemble their own eggs, although the disguising of the shape of their own eggs by the addition of lumps of plasticine did not deceive them, nor did the painting of the eggs with bright yellow, blue, and red colours. A curious observation of Mr. Hughes, that the ringed plover keeps its eggs in the positions of the cardinal points of the compass, was tested, with the result that after the deliberate derangement of the clutches in 121 cases, it was found that 80 were rearranged exactly north and south, 11 were nearly but not quite restored to the cardinal point position, and 30 clutches remained in disarrangement, north-east and north-west. Tests with various scents placed upon the eggs indicated that the birds were deficient in sense of smell (though it may be merely that the parental instinct overcame any sense objection), and the numbering of the eggs and frequent examination of their relative positions in the nest failed to prove that there was systematic rotation of the clutch, though it was clear that movement, as distinct from rotation, usually takes place.

South American Sea Stars.—Mr. W. K. Fisher, of the Hopkins Marine Station, Pacific Grove, California, describes a number of star fishes, based on material collected by Dr. Waldo L. Schmitt, of the United States National Museum, in 1926 and 1927 during an investigation chiefly of the higher Crustacea of South America in various parts (*Proceedings of the United States National Museum*, vol. 78, No. 2859, art. 15). There are some very interesting finds, especially three forms of *Anasteria* from the Falkland Islands, which, although here recorded as three species, may very likely all belong to *A. minuta*. The handsome species *Ophidiaster agassizii* Perrier is figured for the first time, two specimens having been collected in Juan Fernandez, and there are, further, very good photographs of several other species.

Japanese Dinoflagellates.—In continuation of the series of papers dealing with the fauna and flora of Mutsu Bay, Prof. Charles A. Kofoid describes the unarmoured dinoflagellates (*Report* of the Biological Survey of Mutsu Bay; Number 18, "Protozoan Fauna of Mutsu Bay. Subclass Dinoflagellata: Tribe Gymnodinioidæ". Science Reports of the Tohoku Imperial University, Fourth Series (Biology): Sendai, Japan; vol. 6, No. 1, 1930). This is one of the contributions from the Marine Biological Station, Asamushi, Amori-Ken; No. 61. These lovely organisms must be studied alive, as the usual methods of preservation destroy their characters: 33 species are recorded, including 14 which are new to science, and these are figured in three striking coloured plates, the colours

ranging from pale yellow and green to pink, purple, and bright blue. A new *Nematodinium* bears large nematocysts, and there are two new species of *Pouchetia* having conspicuous eyes with complicated lenses. Prof. Kofoid's notes on *Pronoctiluca* are very interesting. The period of the prevalence of *Pronoctiluca pelagica* in Mutsu Bay coincides with that of sporulation of *Noctiluca*, and the theory that it is possibly a stage in the life cycle of *Noctiluca scintillans*, "representing the earliest stage in the life of that species before inflation by hydrostatic vacuoles", is very suggestive. *Noctiluca* itself has periods of great abundance in Mutsu Bay, especially in May and June, forming local shoals by wind action so dense that the water is much discoloured. In the same report and also from the Marine Biological Station of Asamushi (No. 19, "Notes on Recent Foraminifera from Mutsu Bay"), Dr. Yoshine Hada records 94 species and 6 varieties, 11 of the species being new to science. The paper is beautifully illustrated with text figures.

Additions to the British Coleopterous Fauna.—For a number of months past, a special feature of the *Entomologists' Monthly Magazine* has been the contributions of Mr. H. St. J. Donisthorpe on additions to the British coleopterous fauna. These articles are in the form of an annotated list of all additions made to this division of the fauna since the publication of the supplementary volume (6) of Fowler's standard work on the order. The excellent coloured plates that have appeared from time to time greatly enhance the value of these articles, and it is hoped that when the series is completed it will be available as a separate publication. The 'list' serves as an admirable example of how much work there still remains to be done, even in so well explored an order of insects as the Coleoptera, before our fauna can be regarded as having been fully studied. Many of the species, now rightly claimed as British, are only known from a single locality, or perhaps from but one or two places, and there is consequently plenty of work for the assiduous collector still to do in determining their actual ranges of distribution.

The Rift Valleys of South Australia.—The problem of the structural origin of the gulfs of South Australia and the Lake Torrens basin is discussed at some length in a paper by Dr. C. Fenner on the major structural features of South Australia in the *Transactions and Proceedings* of the Royal Society of South Australia, vol. 54. Dr. Fenner argues against the use of the term rift valley and prefers to call the features Spencer-Vincent and Torrens Sunklands, but maintains that there is insufficient evidence to support either the tension or compression theory of origin. Nevertheless, he believes that in the Mount Lofty and Flinders Ranges there is much to suggest that thrust movement and not tension has been the dominating factor. The fault block movements are generally considered to have occurred in late Miocene and Pliocene times, but there is much evidence of an intense phase in early Pleistocene and of differential movements along fault lines in late Pleistocene to recent times.

A New Uranium Mineral.—The uranium minerals of Spruce Pine, North Carolina, include a central core of black uraninite surrounded by a dark reddish brown zone, which is followed successively by brilliant orange-red gummite and an outer shell of bright yellow uranophane. The reddish brown zone has now been investigated in detail by Ross, Henderson, and Posnjak (*Amer. Min.*, May, 1931, pp. 213-220) and found to be a new mineral with distinctive chemical and optical properties and X-ray spectrum. They propose to call it *clarkeite*, after the veteran geochemist F. W. Clarke. Henderson's analyses show a composition of the type $RO \cdot 3UO_3 \cdot 3H_2O$. The mineral is a direct hydrothermal alteration product of uraninite, and as it is rich in soda it was probably formed during the stage of pegmatitic alteration characterised by the replacement of microcline by albite. At a later stage the solutions became poorer in alkalis and richer in silica, and clarkeite, being unstable in their presence, altered to gummite, which in turn was changed to uranophane with still higher silica and more lime and water. A reinvestigation of gummite is foreshadowed, the authors having discovered that the optical properties of the Spruce Pine gummite differ from those given in the literature.

Nitrate Deposits of California.—The nitrate deposits of southern California are generally associated with the soils resting on tilted beds of Tertiary clays and shales. A typical section shows a few inches of *caliche* underlying a layer of soil that is efflorescent below and compact above. The caliche contains most of the nitrate, though the percentage is small compared with that of the associated chlorides and sulphates. The various occurrences and the problem of origin are dealt with by L. F. Noble in *Bull.* 820 of the United States Geological Survey. Three hypotheses are considered: (*a*) upward movement of soluble salts by sub-surface moisture through capillary action; (*b*) downward movement from the soil and other surface sources; and (*c*) enrichment at the contact zone between soil and bedrock by general erosion. The last of these is regarded as the dominant process, subject to there being a sufficient quantity of saline material available, ample time for concentration, and a favourable arid climate. Although the deposits investigated do not appear to justify commercial exploitation, workable deposits of other useful commodities have been found in the course of the investigation. These include bentonite and various clays, boron minerals, strontium minerals, rock salt, gypsum, and magnesite.

Luminous Phenomena accompanying Earthquakes.—There can be little doubt that the destructive Idu (Japan) earthquake of Nov. 26, 1930, was closely associated with the lights seen shortly before, and for at least an hour after, the earthquake. They were observed by Mr. K. Musya, who collected records from about 1500 observers on both sides of the Idu peninsula, in the valley of the Sagami river, and on the shores of Tokyo Bay and the Boso peninsula (*Earthq. Res. Inst. Bull.*, vol. 9, pp. 177-215; 1931). The lights were very strong—in one place brighter than moonlight. They were usually described as bluish in colour, but sometimes as reddish yellow, yellow, or reddish blue. In shape, they resembled the rays of the rising sun, search-lights, and fireballs. The duration of each light was longer than that of lightning, and some careful observers report that the same light continued more than a minute. The directions in which they were seen pointed usually, but not always, to the epicentral region of the earthquake.

The Raman Effect.—The issue of the *Physikalische Zeitschrift* for May 15 contains an account, which extends to 20 pages, by Prof. K. W. F. Kohlrausch, of the University of Gratz, of the present position of our knowledge of the Raman effect. The author points out that Lommel in 1878 predicted the production of oscillations of frequency $n \pm w$ when light of frequency n impinged on a substance having a free frequency of w; and that the theory of the production of such oscillations was further developed by Smekell, Herzfeld, Kramers, and Heisenberg from the quantum point of view in the years 1923–25, although Raman

and Krishnan were only able to establish their existence experimentally in 1928 (NATURE, 121, p. 501). After a short account of experimental methods, the author reviews the theories and deals with the structure of the undisplaced lines, the entry of rotational frequencies, the intensities of the displaced lines, and the relation between the displacement of the lines and the structure of the molecule of the substance. References to 103 papers on the subject are given.

Absolute X-Ray Wave-lengths.—Since it has been found possible to measure the wave-lengths of X-rays by diffraction from an ordinary ruled grating, there has been some doubt as to the value of the charge on an electron, which can be calculated from the X-ray data, and has appeared higher than Millikan's value. Some new absolute measurements of X-ray wave-lengths are described and discussed critically by J. A. Bearden in the second May number of the *Physical Review*. The lines measured were the K lines of copper and chromium, which are as long as can be used conveniently without an exhausted spectrometer. Gratings were used which had been ruled by Prof. R. W. Wood and under the direction of the late Prof. Michelson, and in some cases as many as eighty orders of diffracted lines were obtained. The results are of high accuracy, the wave-length of the $K\beta$ line of copper, for example, being given as 1·39225 A., with a limiting error of ± 0·00014 A., which is definitely about 0·2 per cent greater than the wave-length from crystal measurements. The corresponding charge upon the electron is $4{\cdot}806 \times 10^{-10}$ e.s.u. This could be taken to indicate that the standard value of $4{\cdot}77 \times 10^{-10}$ e.s.u. is wrong, and has at times been so interpreted. Dr. Bearden, however, now takes the contrary view, that the charge as found from the X-ray measurements is too high, and that there is a flaw in one step in the deduction of the electronic charge, in neglecting the imperfections in crystal structure the existence of which has been pointed out by Zwicky. If the difference found is entirely due to this cause, it gives in fact a precise method for determining quantitatively the magnitude of the effect in crystals, and further, if a good independent estimate of the flawing existed, the present data could be applied to the determination of the electronic charge with higher precision than has been attained by other methods.

The Jet-Wave Rectifier.—The extending use of direct current for electric traction has caused a great demand for devices which will rectify alternating current into direct current. High power rectifiers based on the valve patented by Cooper Hewitt in 1903 are widely used. The Hartmann jet-wave rectifier, which is a purely mechanical device based on interrupting a jet of mercury carrying a current by means of a tungsten knife, is also being used in practice, but they each have special fields where they do not compete with each other. In a treatise entitled "The Jet-Wave Rectifier: an Account of its Constructional Development during the Years 1919–1929" (*Danmarks Naturvidenskabelige Samfund: Ingeniørvidenskabelige Skrifter*. A, Nr. 24. Pp. 300. København: G. E. C. Gad. 30·00 kr.), Jul. Hartmann gives a fairly complete account of the research work carried out by the Hartmann Rectifier Co. in Copenhagen on this rectifier. The author gives an interesting account of the development of the invention. When preparing for his master's degree at Copenhagen, in 1906, he was given by Prof. Christiansen the problem of determining the velocity and the charge-mass ratio of the particles of a cathode ray using the method of deflection in a magnetic field. A few months later, when using induction coils with mechanical interrupters, he found them very unsatisfactory. Thinking over his previous work, it suddenly struck him that a mercury jet might be deflected by a magnetic field in the same way as a cathode ray, and this led him to devise the jet-wave rectifier.

Astronomical Topics.

Encke's Comet.—A letter from Mr. H. E. Wood, Director of the Union Observatory, Johannesburg, announces that he detected this famous comet a week earlier than Mr. Bobone at Cordoba; but as he did not send a telegram, the announcement of the latter arrived first. The comet was so low in the evening twilight when first photographed that part of the field of the object-glass was cut off by the wall of the dome. In spite of this, the comet gave such a strong image with eight minutes' exposure that Mr. Wood estimates its magnitude as fully 7, which is 2 magnitudes brighter than Mr. Bobone's estimate. The plates have not yet been accurately measured, but the following rough positions are sent:

1931	R.A. (1931.0)	N. Decl.
June 14·7 U.T.,	$7^h\ 1{\cdot}6^m$,	15° 23′
June 16·7	7 10·8	13 38

These positions fully confirm those of Mr. Bobone in indicating that perihelion passage was about 18 hours earlier than Matkiewicz's prediction, which was June 3·84757 U.T.

This is the thirty-eighth observed apparition of the comet; it was seen in 1786, 1795, 1805, 1819 (when its periodicity was recognised by Encke), and at every return since then. The reason for the unbroken records held by this comet and by that of Halley is that their perihelion distances are small, so that they are easy objects when near their perihelion.

As a proof that Encke's comet is gradually fading, it may be mentioned that in 1865 the perihelion passage was 5·7 days earlier than in 1931, so that the conditions of observation were similar; in 1865 the comet was observed in February with instruments of moderate size; but in 1931, Prof. G. van Biesbroeck, using the powerful instruments at Yerkes Observatory, failed to obtain the faintest image of it on his photographic plates in February and March.

Impact of Stars with Nebulæ.—Mr. K. Hirayama, of Tokyo Observatory, investigates in *Proc. Imperial Acad. Japan* (7, No. 5; 1931) the effects of the impact of a star with a spherical nebula. The relative velocity is probably hyperbolic before impact, but it may be reduced by the impact below the parabolic value, in which case there will be repeated impacts, which will result in the capture by the star of part of the matter of the nebula, while the star's orbit relatively to the nebula will be reduced in size. The author suggests that the nebula might in time be so reduced and broken up as to form a system of planets revolving round the star; this is an alternative to the theory that explains the formation of the planets by the tidal action of a star passing near the sun. The paper goes on to show that a binary system passing through a nebula would have the size and eccentricity of the orbit diminished and the masses of the components increased. It also suggests that a large spherical nebula might, by capturing a great number of stars, form a globular cluster, while the repeated impacts of the stars with nebulous matter would end in the absorption of most of the latter.

Jubilee Celebrations of the Society of Chemical Industry.

THE celebration of its jubilee by the Society of Chemical Industry will long remain as a landmark in the history of both pure and applied science, and as a very convincing demonstration of the progressive narrowing of the gap between industry and pure research. The members of the Society were welcomed at the inaugural ceremony at Guildhall by the Lord Mayor of London and the Vice-Chancellor of the University of London. The close association which has always existed between the Corporation and the livery companies of the City and chemical education and research was manifested by the presentation of plaques and addresses to a number of the companies. The importance of chemical technology in this industrial age will render the meeting a not unimportant event even in the long history of Guildhall.

The first day of the celebration was marked also by the opening of the British Chemical Plant and Research Instruments Exhibition by the president of the Society, Sir Harry McGowan. A similar exhibition has not been held since 1926, and the progress made during the past five years in the application of pure metals such as aluminium, nickel, and silver, of stainless iron and steel, and of special alloys, is very striking; although it cannot yet be said that an alloy may be selected to meet any given set of requirements relating to corrosion resistance, ease of working, and mechanical strength, nevertheless such an ideal state is approaching rapidly. Methods of fabricating plant have also made strides, largely as a result of the work carried out by the British Non-Ferrous Metals Research Association on the welding of, especially, copper and special alloys; of particular interest was what is believed to be the first public exhibit of welded copper plant. Despite these developments, fused silica is still making progress and widening its scope and the size of unit available; recent productions include a valveless plunger pump, a water-driven gas injector, and a new type of lamp in which the shorter wave-length rays of the quartz mercury arc are utilised to produce ozone but are removed from the light by a filter in order to obviate danger to the eyes. New aids for the laboratory were represented by the Meta-filter, a continuously operating still for the production of conductivity water, stainless steel and iron apparatus, and a flow meter for gases at high pressure; a notable demonstration was that of the cinematographic method of studying crystal growth, which should be of considerable value to the research worker and to the industrial chemist.

A special section of the exhibition was arranged by the Chemical Engineering Group to illustrate some of the work carried on by the Department of Scientific and Industrial Research and the various industrial research associations. One of the most important advances made in physico-chemical science during the past decade or so, namely, the investigation of structure by means of X-rays, was illustrated in its technical applications by a variable anti-cathode X-ray tube and some forms of X-ray spectrograph designed for studying the change of structure of alloys on heat treatment and cold working, and for examining such materials as rubber and wool. Other exhibits in this section included a quartz spectrograph for the routine quantitative analysis of metals and alloys, apparatus for testing the surface conductivity of materials such as ebonite, for measuring plasticity and plastic yield, and for bringing about artificial weathering and ageing. The development of the chemical autoclave from Papin's digester of 1681 to the modern vessel, which, thanks to special forged alloy steels, is capable of being used at several hundred atmospheres pressure and at temperatures up to 450° C., formed the subject of a series of drawings and exhibits by the National Physical Laboratory. The products of high pressure synthesis shown included hydrogenation products of low temperature tar, reduction products of fluorine compounds, and a variety of condensation products.

Other activities of the Chemical Research Laboratory at Teddington, demonstrated when the laboratories were opened for inspection by the members of the Society, related to the investigation of tars, the production of synthetic resins, and to studies on the corrosion and protection of metals, and notably the protection of aluminium by anodic oxidation and of magnesium alloys by films of selenium. An attractive collection of co-ordination compounds, chemotherapeutic substances, and chemicals of historic interest, such as organic antimonials and arsenicals, were also on view.

One of the most valuable of the week's activities, and one which merits wider attention than that of those directly engaged in the relevant industries, was the discussion of a series of papers on fuel, selected by the Fuel Committee. The paper by Dr. C. H. Lander summarised the present position of Great Britain with regard to fuel supplies, and discussed the economic practicability of the hydrogenation of coal and of the production of our oil fuel requirements by this process and, to a limited extent, by pre-carbonisation of some of the coal which is now burned in its raw state. The application of hydrogenation to the treatment of petroleum residues is regarded by Dr. A. E. Dunstan, of the Anglo-Persian Oil Co., as a definite technical success, although its objective is no longer the production of petrol, but of, for example, lubricating oils from low grade stocks; the relative values of the refinery products are bound to alter in the not very distant future, when petrol is ousted from its present premier position by the development of the high-speed Diesel engine. It appears likely that a by-product industry, based on petroleum and comparable in magnitude with that based on coal tar, will become established during the next few years as a result of the increasing utilisation of refinery gases and gases obtained by cracking for the production of solvents such as glycols, esters and alcohols, and of 'anti-knock' substances; the growing demand for asphalte for road use and of carbon black for rubber manufacture is also of importance in this connexion. The future of fuel is a controversial subject, but it seems clear that the production of oil from coal in quantities sufficient to meet the demands of Great Britain is, at the moment, economically impossible; but the striking and constantly increasing yields of oil which are now obtained suggest that the processes available may compete seriously if and when oil prices rise from their present abnormally low values.

Another aspect of the same problem was presented by Mr. Taylor in his paper on the production of liquid fuels from water gas. The most promising of the many processes which have been investigated is that of F. Fischer, which yields 75–80 per cent of the calorific value of the water gas as hydrocarbons; this yield corresponds with about twenty-five per cent of the heat value of the coke required for the production of the gas. Although processes of this type resemble hydrogenation in being economically impracticable at the moment, it is probable that when

the price of petrol rises, more direct and therefore cheaper methods will have been perfected. Other important papers in the fuel section included that by Prof. R. V. Wheeler on gaseous combustion, which dealt with the industrial applications of recent research work on the combustion of gases, and especially on flame propagation and the influence of diluents; and papers on low temperature carbonisation, the utilisation of low temperature tar, and fuel developments in iron and steel practice. A closely related subject, at least from the theoretical aspect, was dealt with in Prof. Wheeler's lecture on a subject of both academic interest and increasing technical importance, namely, dust explosions—delivered, very appropriately, at the Home Office Industrial Museum.

Sir Harry McGowan's presidential address dealt mainly with the reaction of scientific progress on the finance and economy of the modern State, and constituted an opportune appeal for economic unity between the nations of the Empire, for still greater unification of the various industries of each country, and for a deeper appreciation of the economic background of all industrial activity. The address by Dr. H. Levinstein, on the occasion of the presentation to him of the Society's medal, urged that the lessons to be learned from the history of the dyestuffs industry should be taken to heart by other national industries, and that the 'buy in the cheapest market' maxim should be reconsidered.

Dr. G. Engi, conveying the congratulations of the Society of Chemical Industry in Basle in an address delivered at the Salters' Hall, gave an account, in considerable detail, of recent developments in both the scientific and technical aspects of the chemical industry in Switzerland. The development of the dyestuffs industry in that country has resulted largely from fertile inventive activity and a reasonable degree of rationalisation; recent developments include the production of thioindigo dyes of the naphthalene series, of vat dyes obtained by introduction of the cyanuric ring into the anthraquinone molecule and by the synthesis of indigoid and thioindigoid derivatives of the anthracene and anthraquinone series, and of complex chromium and copper azo-dyes. Important advances have been made also in connexion with pharmaceutical products, synthetic resins, textile chemistry, and electrochemical processes. Addresses were given also by two of the new honorary foreign members of the Society, that by Dr. Sørensen dealing with hydrogen ion concentration, and that by General G. Patart with the technique of gaseous syntheses at high pressure; the development of, for example, synthetic methanol demands considerable reduction of costs, which, since the raw materials are available at almost zero cost, must be concerned mainly with the plant and equipment used. The large part played by catalysis in this type of reaction, however, necessitates improved methods of purification of the raw materials in order to remove 'poisons', and further work on the preparation of highly active catalysts. The importance of the outlets for these synthetic products justifies continued research and the expenditure of relatively large sums of money.

The very full programme for the jubilee week was completed by a series of visits to factories engaged in the chemical and related industries and to various research laboratories, and by a number of purely social functions. H. F. GILLBE.

Congress of Universities of the Empire, 1931.

THE congress of the seventy universities of the British Empire began its official programme in London on July 1 and continued its work in Edinburgh on July 6-11. On July 3 in Guildhall—"the centre of the Empire in London, which has been for centuries a financial, and is this day an educational clearing-house of the world"—H.R.H. the Prince of Wales in his address of welcome as president of the Congress observed that "one of the things the world requires most to-day is organised knowledge and the means of distributing it". This truth crystallised in a sentence world necessities in a time of crisis. Pope said a little learning, not a little knowledge, was a dangerous thing; and assuredly in these days it is not learning which the peoples of the world require. They have enough of that from the popular press and the politician.

That millions are anxiously seeking "the two noblest things, sweetness and light" in the matter of post-War reconstruction, presented to the Empire universities an opportunity of discussion and decision on the question of the best method of disseminating organised knowledge and of promoting a closer co-ordination of their activities so as to ensure that they play their part in bringing order out of chaos. It was realised by all who participated in the work of Congress that it is in the universities, and possibly in the universities only, that the problems of to-day and the policy of to-morrow can be examined with that detachment of view, that width of judgment and that patience of understanding which alone will ensure their solution, and that these centres of knowledge must become more and more the training grounds of the young men and women who will have to do the work of the Commonwealth in the future. Lord Meston presented this point of view in another form when he said that there were certain things, essential to the well-being of their peoples, which he believed their universities were doing, which ought to be done by their universities and which could not be done systematically except by their universities. It was further realised that universities, any more than individuals, cannot live to themselves alone. The social functions—a natural and necessary part of the work of a congress of this kind—contributed to the formation of friendships, the creation of mutual understanding and trust and to that action and interaction of minds which, in Burke's words, "draw out the harmony of the universe". From every part of the Empire an instinctive desire for closer association was revealed.

Universities, however, are naturally jealous of their autonomy. Sometimes, perhaps, they are disposed to convert their conceptions of autonomy into a fetish. It is, none the less, a condition of their very existence that they should be responsible neither to individuals nor to the State for the direction of their affairs. They must develop along the lines set by tradition, by geographical accident, and by their charters. It will be a tragedy if that independence which the universities have rightly and sacredly cherished is sacrificed to expediency or to financial necessity. Not even the benefactions of the wealthy must detract from the purposes for which they have been established and which they must subserve.

The calm of the cloisters has, in these post-War years, however, been disturbed by repercussions from world politics, and in his observation that Imperial necessities demanded from the universities support of the Universities Bureau of the British Empire, the Vice-Chancellor of Manchester lifted a discussion on financial commitments out of the sphere of self-

commiseration into that of bounden duty. By this one observation, the Congress was called upon to decide whether one of "the strongest and soundest links of Empire", in the Prince's words, should be the universities of that Empire.

The question of the financial support of the Bureau arose out of the proposals formulated by the executive committee of that Bureau for its reconstitution. The amended articles of association circulated for consideration by Congress were directed to the creation of a central institution which should be a genuine university organisation. Three main principles were enunciated in these draft articles: that the Empire universities should be the members of the reconstituted Bureau; that these members should pay a fixed annual subscription, the amount of which is to be determined by the members themselves acting through their representatives at the first annual general meeting held after the adoption of the articles; and that the policy and the administration of the Bureau should be controlled by a council composed of twenty-one of these representatives selected by regional groups of university representatives. In considering the proposals of the executive committee, the question that excited the greatest interest at the Congress business meeting was whether the fourteen individuals representing, but not directly responsible to, the Empire universities, who at present constitute the association known as the Universities Bureau, should continue to control and direct its administration; or whether the time has come to express a resolute faith in the solidarity of the universities of the Empire, to create an organisation which shall be truly representative of these universities, and to provide funds which will enable these members to give effect to the late Lord Balfour's policy of "promoting greater co-ordination and power of mutual consultation". A third possibility, which was indirectly raised but was rejected, was whether the Universities Bureau, which has been the creation of the universities themselves, should or should not be dissolved.

Doubt was cast by a few, dwelling in a past of fond imaginings, upon the new form of constitution, and it was even suggested that the scheme promulgated by the committee should be referred back for further consideration by the universities. It is significant, however, that Congress refused to accept this suggestion of flinging the work of two years again into the melting-pot, and satisfied the apprehensions of the ultra-orthodox with the assertion of the principle that the powers of the Universities Bureau of the British Empire should not be exercised in any such way as to restrict the powers and duties exercised by the constituent members under the several charters, statutes, regulations, and other instruments of their self-government.

This discussion finally asserted the view—a view which was unquestionably a distinctive feature of this Congress—that the Bureau has a definite place in the hegemony of Empire universities. The recognition by the Prince of Wales of the invaluable work done by the Bureau in publishing the "Universities Yearbook", a compendium which, since Sir H. Frank Heath assumed the office of editor, has become of ever-increasing value—by its administration of trusts, by its organisation of congresses and conferences, and by its centralised machinery, was affirmed by Congress itself. Indeed, during the subsequent sessions of Congress, it was frequently suggested that the Bureau might be of greater utility to overseas universities in many more directions than has hitherto been contemplated as feasible.

The addresses delivered by the Lord Provost of the City of Edinburgh, in which he hinted at the citizens' pride in their university; by the Marquess of Linlithgow, which in its insistence on the value of the trained mind was tinged with the sage reflections of an administrator; by Lord Meston, who as a layman prescribed not panaceas but useful and suggestive 'dietary' regulations and denounced illusions, claptrap and clichés, and by Sir Donald MacAlister, who from a wealth of experience warned universities of the dangers arising from overcrowding, directed attention in different ways to some of the more important questions with which universities are faced severally and collectively.

The discussions on the university graduate in commerce and industry, the Ph.D. degree, the conditions of admission to universities, general honours courses, post-graduate study in medicine and surgery, and facilities for overseas students, were all followed with interest by delegates from the universities both at home and overseas. The members of Congress had facilities provided for them to visit the Universities of Oxford, London, Reading, Glasgow, and Edinburgh, their colleges and their departments, and also visited a number of London County Council and other educational institutions, and two of the largest new schools in Edinburgh. The hospitality which was extended to all throughout their stay in London and Edinburgh has left an indelible impression of friendliness and goodwill.

This Congress will have more than served its purpose if it has helped to eradicate that feeling of isolation in which many of the overseas universities have to discharge the trust imposed upon them as repositories of organised knowledge, and to create in them a sense that the kinship of universities is not a localised relationship but is world-wide. It has also served to suggest, and perhaps this is its most remarkable achievement, that it is through a centralised agency that information of value to all parts of the Empire may best be distributed and that a community of interest may be created and maintained at full strength.

Annual Conference of the Museums Association.

THE forty-second annual conference of the Museums Association was held at Plymouth on July 6–11, by invitation of the Mayor and Corporation, who kindly placed at the disposal of the delegates the ancient Prysten House of St. Andrew's Church, now being restored under the name of the Abbey Hall. Here some two hundred delegates assembled under the presidency of Sir Henry A. Miers, whose address dealt with the recent and the impending work of the Association.

The chief event of the year has been the legal incorporation of the Association as a "company limited by guarantee", and this has led to the recognition of the Association by the Government. A directory of all museums in the British Isles, to which the public has access, has been issued. With the co-operation of the Carnegie United Kingdom Trustees, a short school for curators was held in London last October, and schools for this autumn are being organised in both London and Edinburgh; to interest educational authorities in the work done by museums in connexion with schools, an exhibition of circulating cases and collections was arranged at the London County Hall; grants to a total of £1220 have been made to six museums to aid

them in reorganising their exhibited collections, and other applications are being considered; to accomplish all this work a permanent office with a paid secretary and staff has been provided.

Other matters on which Sir Henry Miers commented were "the growing magnitude and importance of the *Museums Journal*"; the discussion with the Library Association of needed new legislation for public libraries and museums; the federations of museums in Lancashire and Cheshire and in Yorkshire; the reorganisation of various museums in the direction of local education, as at Portsmouth, Salisbury, Port Sunlight, Wisbech, Norwich, and Aylesbury; and the recent visit of the secretary, Mr. S. F. Markham, M.P., to the United States. More in the future were the suggestions made by the Association to the Standing Commission on Museums; the preparation of a survey of museums throughout the British Empire, and the completion of the directory by a volume including them (this is with the help of the Carnegie Corporation of New York); the growing realisation by the educational departments of the British Government and by the World Institute of Adult Education of the educational possibilities of museums, long since realised by the Association.

The meeting was noteworthy for the increased time devoted to papers and for the animated discussions. Following the president's address, Dr. W. T. Calman, while approving modern attempts to illustrate the problems of biology, urged that on one hand they should be kept distinct from the systematic series, and on the other that there should be an exhibit definitely explaining the principles and main outlines of taxonomy. Mr. J. Bailey, formerly head of the Circulation Department at the Victoria and Albert Museum, complained that the 1924 and 1931 Loans Acts had not been put into operation, at least so far as the Bloomsbury departments of the British Museum were concerned; his view that the national treasures should be more widely lent out did not find much support from subsequent speakers. An instructive talk on "Plymouth Porcelain", illustrated by the epidiascope, was given by Mr. A. J. Caddie, curator of the Plymouth Museum. "Why do we use Plate-glass in Museums?" was the provocative title of Mr. Leney's account of his proposals for an unenclosed reconstruction of the county's natural scene in the Norwich Museum; while sympathising with their colleague's bold and beautiful dream, the practical curators present supplied satisfactory replies to his question.

On Wednesday morning an account of the Courtauld Institute of Art by its director-elect, Mr. W. G. Constable, set at rest doubts that had been raised by the letters of Lord Lee of Fareham and other notices in the daily press. A fluent and witty speech by Mr. S. C. Kaines Smith, director of the Birmingham Museum, on "Art Museum Problems", provoked much applause and some criticism. After this, "A Suggested System of Museum Registration", by Mr. K. de B. Codrington, of the Indian Section of the Victoria and Albert Museum, fell a little flat, though it was clearly the fruit of experience and careful thought; there would doubtless have been more discussion had the author not been prevented by illness from attending. The important but somewhat dry subject of paper for museum labels was made interesting by Dr. L. J. Spencer, Keeper of Minerals in the British Museum.

On Thursday, Lieut.-Col. J. M. Mitchell, secretary of the Carnegie United Kingdom Trust, expounded the principles of the Trust's action as laid down by its founder, and thus showed what kind of help museums might expect to receive; this was a revelation to many of those present. Mr. H. J. M. Maltby, of the Salford Museum, showed, perhaps unintentionally, that the "Present-Day Problems of Provincial Museums" are much the same as the problems that have vexed curators ever since the Association was founded; among them the local town council looms large.

Friday produced three very diverse papers. Mr. J. H. Iliffe, recently professor at the University of Toronto, in charge of classical archæology at the Royal Ontario Museum, spoke on "The Museum Situation in Canada", and urged the importance of personal contact between Canadian curators and their colleagues in the home country, so that the latter might realise the great diversity of outlook and the distinctness of the several regions in the Dominion. Dr. C. Hay Murray, of the Liverpool Museum, recounted his attempts at estimating the value of the Museum to the public by the length of time spent in the building by visitors; he had found that the average duration of a visit had notably increased of recent years. The final paper, an account by Mr. C. A. Ralegh Radford of the Roman remains discovered at Exeter by excavation, was a valuable contribution to archæology, with no obvious bearing on museum questions.

The only exception that could be taken to the number of papers was that they left little time for visits to museums. Members would gladly have given up the walk round Devonport Dockyard for more opportunity of studying the Plymouth Museum and the recently restored Elizabethan house. They were, however, hospitably and instructively entertained at the Marine Biological Laboratory, and were courteously received at the Athenæum, where is a museum said to be one of the oldest in the country and an excellent example of a learned society's museum in the day of our grandfathers. Too short a stay was made among the delights of Cotehele, visited by kind permission of Lady Mount-Edgcumbe. Other grateful entertainments were a luncheon offered by the Mayor, a Mayoral reception and dance at the Guildhall, and tea at the Abbey Hall on the invitation of Lady Astor, who at the annual dinner proposed health and prosperity to the Museums Association.

Imperial Sugar Cane Research Conference, 1931.

THE first Imperial Sugar Cane Research Conference, which was opened on July 20 by Dr. Drummond Shiels, M.P., is the second of these conferences of overseas research and administrative men convened by the Empire Marketing Board on a crop rather than on a science basis. The first was the Wool Research Conference held last year. The object is to get a clear picture of research in widely scattered countries, so that the gaps can be clearly seen and a general programme of research for the Empire worked out.

The Board has already made grants for research in Mauritius, where a Cane Research Station was started last year, and in Barbados, and it supports the Imperial College of Tropical Agriculture in Trinidad, where a beginning has been made in fundamental research on cane genetics. Other applications have been received, and the Board decided to consider the broad questions of research policy and of where the work could best be carried out. Besides delegates from home organisations, such as the Imperial Bureau of Plant Genetics at Cambridge (the director of which, Sir Rowland Biffen, attended the Conference), there

were representatives from India, South Africa, Trinidad, Barbados, British Guiana, Fiji, Mauritius, and the Leeward and Windward Islands.

The economic position in each sugar-producing country was outlined, and this was followed by a sketch of the scope and aims of the research stations. Genetics and cane-breeding have hitherto overshadowed the other branches of research, although more attention has lately been given to the control of insect and fungus pests. Interesting details were given of the breeding work at Coimbatore, in South India, where improved varieties of the north Indian hardy cane have been evolved which are estimated to give an increased yield of 50 per cent over the ordinary varieties. Attention is now being given to intergeneric crosses with cereals which aim at reducing the ripening period. One of the Java canes, *POJ* 2725, has been crossed with *Andropogon sorghum* and the hybrid has matured in five months, instead of the normal 10-12 months, and yielded a sucrose content of 16 per cent in the juice. Equally remarkable results have been obtained with tropical or 'noble' canes (*Saccharum officinarum*) in Barbados, where the whole system of cane-breeding first originated. The Department of Science and Agriculture pots out about 16,000 seedlings a year, largely for distribution throughout the West Indies, and one variety in particular, *BH* 10 (12), is now known all over the world.

Each country, however, has its own peculiar requirements, often depending as much on economic as on climatic or edaphic factors, and has to work out its own salvation as regards varieties. But the fundamental aspect has barely been attacked in the Empire, and there is clearly a case for some central station to undertake long-range research admitted to be outside the scope of the ordinary department of agriculture.

University and Educational Intelligence.

CAMBRIDGE.—The managers of the Frederick James Quick Fund have elected Mr. David Keilin, Magdalene College, to the Quick professorship of biology for a period of three years from Nov. 1, in succession to Dr. G. H. F. Nuttall, Magdalene College, who has held the professorship since 1906, when it was founded.

W. J. Heasman, of Trinity Hall, has been appointed senior curator, and G. J. Kerrich, of Christ's College, junior curator of the Museum of Zoology.

E. E. Pochin, St. John's College, has been elected to the Michael Foster research studentship in physiology.

LONDON.—Prof. C. Burt, part-time professor of education at the London Day Training College, has been appointed professor of psychology in University College, as from Aug. 1, 1932.

The Sir George Jessel studentship in mathematics awarded to Mr. T. E. Garstang, of University College, for 1930–31, has been renewed for the session 1931–32, and a similar studentship awarded to Mr. H. Kestelman, of University College, for the session 1931–32.

IN a note in NATURE of July 18, p. 124, in referring to the reception at the new premises of Messrs. H. K. Lewis and Co., Ltd., it was stated that Prof. Thane discussed text-books; we are informed that the speaker was Prof. H. R. Kenwood, emeritus professor of hygiene in the University of London.

THE following scholarships have been awarded by the Council of the Institution of Naval Architects: Royal Commissioners for the 1851 Exhibition post-graduate research scholarship in naval architecture (1931), £250 per annum for two years, to Mr. William John Roberts, University of Liverpool; Sir William White post-graduate scholarship in naval architecture (1931), £150 per annum for two years, to Dr. J. A. J. Bennett, University of Glasgow.

SIR CAMPBELL STUART has been appointed chairman of the Beit Fellowships for Scientific Research Trust, and Sir Alfred Beit, a trustee, both in succession to the founder of the fellowships, the late Sir Otto Beit. New fellowships of the value of £250 a year tenable for two years, beginning September 1931, have been awarded to Mr. W. H. Wheeler (University of Cambridge and the Imperial College) for research on the effects of electric and magnetic fields upon gaseous explosions and detonations and to Mr. J. I. Armstrong (Queen's University, Belfast, and the Imperial College) for research on the respiration of Fungi with special regard to inorganic nutrition.

UNDER the patronage of the New Education Fellowship, a prize of 10,000 francs is being offered for the best treatise on "Total Education (Physically, Intellectually, and Morally)". Realising that the total education of an individual is conditioned chiefly by heredity and environment, the object of the competition is to emphasise the necessity of making inherited qualities the best possible, and of a careful development of such characteristics. Each individual can train himself and others in the world-wide propagation of this education, and it is essential that there should be an understanding between educationists, especially from the universal point of view. Further particulars concerning this prize competition can be obtained from either Groupe Français d'Éducation Nouvelle, 41, Rue Gay-Lussac, Paris V^{e}, or the Institut de l'Entente Universelle, Terres Rouges, Toulon, Var., the latter of which remains open during vacations.

AT the British Commonwealth Education Conference which is being held at Bedford College, London, on July 24–30, under the presidency of Sir Percy Nunn, the general theme will be "Education in a Changing Empire". Native education in Africa and India occupies a considerable part of the programme of the proceedings of the Conference. The education of the non-European in Africa will be considered by the Rev. R. C. Blumer, Dr. G. G. Gillie, Miss Sara Burstall, Dr. S. Rivers-Smith, Mrs. Macgregor Ross, Mr. J. H. Driberg, and Mr. F. S. Livie-Noble. Education in India will be dealt with, under the chairmanship of Sir Phillip Hartog, by A. Yusif Ali, Fakhruddin Ahmad, and others, and the problem of bilingualism in Indian schools will be considered by Dr. Michael West. The Right Hon. W. Ormsby Gore, M.P., will give an address on "Some Education Problems of the Tropical Dependencies". Considerable attention, too, will be directed to interracial understanding, which is all to the good, showing how alive educationists are to this serious problem. Mr. H. Chaning Pearce and Miss A. Purvis will give addresses on the problem, and a discussion will be introduced by Mr. Arnold Lloyd. This subject will be closed by an address by Prof. H. J. Fleure. Among other subjects to be considered are vocational guidance, university problems in Africa south of Zambezi (Sir Carruthers Beattie), rural science and schools (Sir John Russell and others), the physical needs of children from 2 to 7 (Dr. James Kerr), growth (Prof. A. H. Harris), an Imperial Film Institute (Dr. T. Drummond Shiels, M.P., Mr. G. T. Hankin, Mr. J. R. Orr, and Prof. J. L. Myres) and modern psychology. Demonstrations of new aids to education include one by the British Broadcasting Corporation. Sir Percy Nunn will consider the question of an Imperial Institute for Education.

Birthdays and Research Centres.

July 26, 1872.—Prof. J. BARCROFT, C.B.E., F.R.S., professor of physiology in the University of Cambridge.

Until recently it was scarcely realised that an appreciable proportion of the blood in the body is not being used, except as occasion requires. Either it is side-tracked in such places as the spleen, the skin when congested, and possibly the large uterine veins of some pregnant animals, or it is 'held up' as in the liver (Maunter and Pick, Rein, Dale). Where are these depots? How long does blood remain in them? By what mechanisms is it held? For what purpose is it released?

July 28, 1864.—Prof. C. H. LEES, F.R.S., emeritus professor of physics in the University of London (East London College).

My objects of chief investigation now in progress are: The laws of plastic flow in overstressed materials; improvements in the methods of determining heat conductivities, with special reference to geothermal problems; the solubilities of gases in liquids at very high pressures, and the equilibrium of such solutions in gravitational fields; tests of theories of magnetisation with special reference to the effect of temperature on dia- and paramagnetic materials; and the solution of physical problems which arise in the study of flame propagation.

July 30, 1889.—Prof. J. KENDALL, F.R.S., professor of chemistry in the University of Edinburgh.

I am at present much concerned to find time for research in the short intervals between performance of administrative duties and attendance on committee meetings. An examination of the atomic weight of calcium contained in very old potassium-rich minerals from Portsoy and Rhiconich is, however, now being initiated. If a significant fraction of the small percentage of calcium present has resulted from the slow radioactive disintegration of the potassium, results of considerable interest in several directions may be anticipated.

Societies and Academies.

DUBLIN.

Royal Dublin Society, June 16.—**M. J. Gorman and H. A. Lafferty**: On a method of distinguishing the seedlings of Swedish turnip (*Brassica napus* L. var. *napobrassica* (L.) Reichb.) from those of broad-leaved rape (*Brassica napus* L. var. *biennis* (Schubl et Mart) Reichb.). Characteristic differences in the shape of the first foliage ('rough') leaf and the relative length of first internode are recognisable in the seedlings of these two plants in fourteen to twenty days from the time of sowing the seeds.—**T. Dillon and Annie McGuinness**: On alginic acid: its mode of occurrence and its constitution. Alginic acid cannot occur in the free state in seaweeds, since no carbon dioxide is evolved during the solution of the fronds of *Laminaria* in sodium carbonate. Dialysis of alginic acid prepared from fresh fronds gives rise to an increase in the ash-content. This suggests that in the plant the acid is combined with non-polar colloidal compounds of calcium and iron. Dry alginic acid has the formula $(C_6H_8O_6)$; but this is a lactone. The polymerising unit is not an anhydride as in the case of starch and cellulose but the complete acid $C_6H_{10}O_7$. The units are therefore not pyranose or furanose rays; but open chains.—**M. Grimes and A. J. Hennerty**: A study of bacteria belonging to the sub-genus *Aerobacter*. The paper describes two species of bacteria previously unknown. These have been named *Aerobacter hibernicum* and *Aerobacter liquefaciens* respectively.

Royal Irish Academy, June 22.—**J. Reilly, B. Daly, and P. J. Drumm**: Studies in the pyrazole series—Diazotisation of aminophenylpyrazoles. The condensation of *p*-nitro phenylhydrazine and benzoyl acetone gives *p*-nitro phenyl 3 methyl 5 phenyl pyrazole, and the corresponding amino compound on reduction. This compound on diazotisation gives comparatively stable diazonium salts, and these as well as related azo compounds have been prepared and compared.—**J. Reilly, M. Hayes, P. J. Drumm**: Lichenin. Purified lichenin has been nitrated and a compound of the type $C_{12}H_{15}O_5(NO_3)_5$ prepared. It is closely related to the corresponding cellulose nitrate.—**P. J. Drumm**: The constitution of Fischer and Bülow's pyrazole. The pyrazole obtained by Fischer and Bulow by the condensation of benzoyl acetone with phenyl hydrazine has been re-examined and found to be 1 : 5 diphenyl 3 methyl pyrazole. Evidence of the formation of the isometric 1 : 3 diphenyl 5 methyl pyrazole has not been obtained.

EDINBURGH.

Royal Society, July 6.—Clerk Maxwell Centenary: **Prof. E. T. Whittaker** delivered an address on James Clerk Maxwell and mechanical descriptions of the universe.—**J. Phillip, J. D. Scott, and J. Y. Moggridge**: Photochemical measurements of light intensity in two common vegetation types in tropical Africa, by means of the improved Eder-Hecht photometer. The paper records the high photochemical values registered under the light canopy of that very widely distributed woodland type, the *Berlinia Brachystegia*—other spp. community or 'Miombo'—and shows how the Bunsen-Roscoe values are correlated with duration of sunshine and with the readings of the Livingston radio-atmometer, and directs the attention of biologists to the usefulness of the Eder-Hecht photometer in the study of habitats in Nature.

PARIS.

Academy of Sciences, June 1.—The president announced the death of Eugène Cosserat, non-resident member.—**A. Lacroix**: The ægyrine nepheline syenite minerals of the north of the island of Kassa. The various pneumatolytic phases of the nepheline syenites of the Los Archipelago.—**Jules Drach**: Partial mean values and their application to the problems of mathematical physics.—**P. Villard**: The titration of phosphoric acid. Discussion of the results of Sanfourche, Cavalier, and Joly.—**M. d'Ocagne**; Remarks on interpolation with reference to a recent note by Wolkowitsch.—**Jean Baptiste Senderens**: The catalytic dehydrogenation, in the gas phase, of the fatty alcohols in the presence of pumice carrying sulphuric and phosphoric acids. Phosphoric acid has a less active dehydrating action upon alcohols in the gas phase than in a liquid system. Sulphuric acid, on the contrary, acts more readily in the gas phase.—**Georges Giraud**: The determination of tensors by partial differential equations connected with conditions at the boundary.—**G. Pólya and G. Szegö**: Some qualitative properties of the propagation of heat.—**S. Stoilow**: The inversion of the continued transformations of two variables.—**Gr. C. Moisil**: A system of functional equations.—**N. Aronszajn**: A remark on the singularities of Dirichlet's series.—**R. Gosse**: The integration of an equation of the first class.—**Florent Bureau**: Some properties of uniform functions in the neighbourhood of an isolated essential singular point.

—F. E. Myard: A closed chain with five rotoid couples, deformable at the first degree of freedom.—E. Crausse and J. Baubiac: The application of a recording method to the study of the vortices produced in liquids.—H. Mineur, Varchon, Barbier, and Mlles. Canavaggia, Chevallier, and Roumens: The movements of the stars as a whole.—J. Renaux: A new contribution to the study of the reduction of photographic negatives.—G. Fayet: The proximities of cometary orbits and the orbit of Pluto. From a study of 241 orbits of comets it was found that one parabolic comet and seven elliptical comets might come within the range of action of Pluto.—Paolo Straneo: The unitary theory of gravitation and of electricity.—E. Estanave: The projection in relief in space of the composite image recorded by the autostereoscopic plate.—V. Dolejšek and J. Kubiček: The complexity of the L series of barium.—E. Huguenard and A. Magnan: An ultra-rapid cinematograph giving from 2000 to 3000 images per second. The method employed consists in separating the film into a certain number of bands, each acted upon by a special objective, the various objectives working in turn at equal intervals of time. The apparatus has been applied to the study of the flight of a large fly, the wings of which were found to beat 100 times per second.—S. Takvorian: The search for element 61 by means of optical spectrography. These results confirm those given in a recent communication; neither the X-ray spectrum nor the optical spectrum shows any trace of element 61.—La. Goldstein: Atoms of recoil in the rare gases.—Mlle. L. S. Levy: Adsorption equilibria on previously precipitated manganese dioxide.—E. Rinck: Diagram of solidification of the calcium-sodium alloys. An account of a general method for determining, with satisfactory accuracy, the temperature-solubility curve of two partially miscible metals.—M. Lemarchands and H. L. Roman: The action of anhydrides upon metals. A study of the reaction between carbon dioxide and the metals sodium and potassium, and of the conditions giving the highest yield of oxalate. With potassium, at temperatures between 230° C. and 240° C., the maximum yield was 17 per cent of oxalic acid.—Charles Baron, Charles Boulanger, and René Le Grain: Contribution to the study of petrol-alcohol-benzene mixtures. A mixture of 70 per cent aviation petrol, 20 per cent benzene, and 10 per cent alcohol avoids the formation of hoar frost, possesses great stability at low temperatures, and retains the valuable properties of the alcohol-benzol mixture.—André Chrétien: The dielectric constant and chemical constitution. Method of measurement. As a source of current, the induction coil is replaced by a triode valve, and a galvanometer with a rectifying valve replaces the telephone as a detector. Data are given for benzene, chloroform, hexane, and acetal.—Deluchat: Ortho- and meta-divinylbenzenes. Ortho- and meta-diacetenylbenzenes.—Charles Dufraisse and Raymond Buret: Researches on the dissociable organic oxides: a dimethoxyrubrene. The introduction of two methoxy groups into the molecule of rubrene does not modify the essential properties of this hydrocarbon, except that the proportion of oxygen set free by the dissociation of the oxide (52 per cent of theoretical) is less.—R. Quelet: The monomethyl and monoethyl ether oxides of para-xylylene glycol.—P. Carré and P. Mauclère: The preparation of hydrobenzoin. The benzoin-hydrobenzoin system.—Lespieau and Reginald L. Wakeman: 1-methyl-2-ethyl-cyclopropane.—Georges Lévy: β-ethylnaphthaline and its hydrogenation products. Starting with carefully purified β-ethylnaphthaline, reduction with sodium and amyl alcohol gives only a dihydride: catalytic reduction with nickel gives a tetrahydride and finally a decahydride.—St. Pavlovitch: The transformations of braunite under the action of heat.—F. Diénert: Contribution to the study of the origin of subterranean waters.—Montagne: The yields of springs under uninfluenced régime.—Mlle. Germaine Py: The evolution of the cytoplasmic constituents of the pollen cells of *Vincetoxicum officinale*.—Labergerie: The action of oscillating circuits on the degeneration of the potato.—F. Maignon and J. Guilhon: The influence of the seasons on respiratory metabolism in the dog.—A. Machebœuf: Researches on the function of lipoids and proteins of the blood in the exchanges of water in the organism.—Léon Binet and J. Magrou: Glutathione, growth and cancer of plants.

LENINGRAD.

Academy of Sciences (*Comptes rendus*, No. 24, 1930).—A. Archangelskii and D. Perkin: A note on the origin of the ferrous deposits in the Lipetsk area. The deposits found in the Moscow region contain remains of *Lepidodendron* and should have been formed during the Carboniferous period as sedimentary rocks.—N. Demjanov: The isomerisation of the cyclic amines with the lateral chain CH_2NH_2. A brief outline of the history of the problem.—D. Prianischnikov and V. V. Butkevitch: A contribution to the physiological characteristics of potassium salts. The physiological acidity of potassium chloride is not the same for different plants; while Gramineæ, like oats and barley, absorb both potassium and chlorine at the same rate, in the case of sugar beet there is a marked excess in the absorption of potassium as compared with chlorine. Similar results were obtained for potassium sulphate.—L. Mysovskii and R. Eichelberg: The radioactivity of rubidium by observations in Wilson's camera. No definite proofs of the radioactivity of rubidium have been obtained by the method used.—A. A. Birula: A note on the metacarpalia and metatarsalia of *Ursus spelæus* Rosenm. In the cave bear these bones always have a shallow pit at the verticillum of the apical end. This character is absent in all recent bears, except *Melursus ursinus* Shaw.—E. Cheisin: Some new marine infusoria, symbiotic in molluscs of Lake Baikal. Three new genera of infusoria, *Tiarella*, *Ancistrina*, and *Ancistrella* found in the mantle cavity of various molluscs are described. The infusoria belong to the families Ancistridæ and Boveridæ, both known only from marine molluscs.

Comptes rendus, No. 25.—G. Gause: Logistic curves of the growth of the population of Leningrad and of the U.S.S.R.—K. Nikolskii: The geometry of the Dirac matrices.—J. Medvedev: The kinetics of the alcoholic fermentation. An equation is discussed which expresses the relation of the rate of fermentation to the initial concentration of the sugar and to the time.—D. Eropkin: The problem of studies of the solar spectrum at different altitudes above the horizon.—N. Putochin: α-Pyrrolidine-methylamine and the action of nitric acid on it and on α-pyrrol-methylamine. Experiments on the isomerisation of a pyrrole ring under the action of nitric acid into a pyridine ring.—P. I. Tolmatchev: The equilibrium in solutions of barium nitrate in nitric acid at the temperatures of 0° and 25°. The investigations proved that the solubility of barium nitrate becomes less with the increase in the concentration of the nitric acid.

WASHINGTON.

National Academy of Sciences (*Proc.*, Vol. 17, No. 3, Mar. 15).—Elsie H. Field: Reactions of dermal melanophores in *Necturus* to heat and to cold. As in

other amphibians, the melanophores expand at very low temperatures and contract at moderately high ones; unlike those of other amphibians, they expand at relatively high temperatures.—**Stanley G. Warner**: Histological polarisation of lateral giant-fibres in the crayfish. Demonstrated by treating sections with Vom Rath fluid containing some 5 per cent acetic acid instead of the usual 1 per cent solution and afterwards with a 5 per cent solution of pyrogallic acid.—**Tsai-Han Kiang**: On the groups of orientable two-manifolds.—**G. A. Miller**: Inverse commutator subgroups.—**Arthur E. Kennelly**: The convention of equidimensional electric and magnetic units. A set of electromagnetic unit dimensions is derived, based on the hypothesis that the dimensions of permittivity κ_0 and permeability μ_0 for free space are the same. The dimensions obtained are in every case arithmetical means of the Maxwellian electrostatic and electromagnetic dimensions.—**Richard C. Tolman**: On thermodynamic equilibrium in a static Einstein universe. A discussion of the thermodynamic equilibrium between matter and radiation. It is concluded that the equilibrium concentration of matter would be exceedingly small even for masses as small as the electron and temperatures as high as 40,000,000°.—**Paul S. Epstein**: Answer to Prof. Størmer's remark. Comment on the fact that whereas Prof. Størmer's method of dealing with the motion of electrons in the magnetic field of the earth is based on classical mechanics, the author's method takes relativity into account.

Official Publications Received.

BRITISH.

Journal of the Royal Microscopical Society. Series 3, Vol. 51, Part 2, June. Pp. xvi+109-220. (London.) 10*s.* net.

Department of Scientific and Industrial Research. Index to the Literature of Food Investigation. Vol. 3, No. 1, March. Compiled by Agnes Elisabeth Glennie. Pp. iv+167. (London: H.M. Stationery Office.) 2*s.* net.

India: Meteorological Department. Meteorology of the Persian Gulf and Mekran. By Dr. B. N. Banerji. Pp. iii+65+9 plates. 3 rupees; 5*s.* 3*d.* Scientific Notes, Vol. 3, No. 24: On the Utility of Observations of Barometric Characteristics and Tendencies for Local Forecasting in North-West India. By Flight-Lieut. R. P. Batty. Pp. 61-76. 8 annas; 10*d.* (Calcutta: Government of India Central Publication Branch.)

Committee on Bird Sanctuaries in Royal Parks (England). Report for 1930. Pp. 22. (London: H.M. Stationery Office.) 6*d.* net.

Royal Dublin Society. Bi-Centenary Celebrations, 1931: Official Handbook and Catalogue of Museum. Pp. xxxii+116. (Dublin.)

Abstracts of Dissertations approved for the Ph.D., M.Sc. and M.Litt. Degrees in the University of Cambridge for the Academical Year 1929-1930. Published by Authority. Pp. 128. (Cambridge: Printed at the University Press.)

The Welsh Journal of Agriculture: the Journal of the Welsh Agricultural Education Conference. Vol. 7. Pp. 431. (Cardiff: University of Wales Press Board.) 2*s.* 6*d.*; cloth, 4*s.*

Proceedings of the Royal Society. Series A, Vol. 132, No. A819, July 2. Pp. 352. (London: Harrison and Sons, Ltd.) 18*s.*

South Australia: Department of Mines: Geological Survey of South Australia. Bulletin No. 15: Report on the Geology of the Region to the North and North-West of Tarcoola. By Dr. R. Lockhart Jack. Pp. 31+map. (Adelaide: Harrison Weir.)

Quarterly Journal of the Royal Meteorological Society. Vol. 57, No. 240, July. Pp. 243-344. (London: Edward Stanford, Ltd.) 7*s.* 6*d.*

Report on the Phenological Observations in the British Isles from December 1929 to November 1930. No. 40. (From the *Quarterly Journal of the Royal Meteorological Society*, Vol. 57, No. 241.) By J. Edmund Clark, Ivan D. Margary, Richard Marshall, C. J. P. Cave and L. C. W. Bonacina. Pp. 345-404. (London: Edward Stanford, Ltd.) 3*s.*

The Royal Society for the Protection of Birds. Fortieth Annual Report, January 1st to December 31st, 1930; with Proceedings of Annual Meeting 1931. Pp. 54. (London.)

Chemistry and Industry. Special Jubilee Number, July 1931. Pp. 52+272+53-110. (London: Society of Chemical Industry.) 10*s.*

Annals of the (Mededelingen van het) Transvaal Museum. Vol. 14, Part 2, July 3. Pp. 49-220. (Pretoria.)

Journal of the Indian Institute of Science. Vol. 14A, Part 1: Studies on the Chemical Composition and Physical Properties of Plant Tissue Fluids. Part 1: Effects of Age and Environment on the Tissue Fluids of French Beans (*Phaseolus vulgaris*). By C. Narasimha Acharya and B. N. Sastri. Pp. 9. (Bangalore.) 12 annas.

Medical Research Council. Eleventh Annual Report of the Industrial Health Research Board (formerly the Industrial Fatigue Research Board) to 30th June 1931; including an Analysis of Work published during the Years 1926-30. Pp. ii+85. (London: H.M. Stationery Office.) 1*s.* 6*d.* net.

Southern Rhodesia Geological Survey. Short Report No. 25: The Geology of the Country around the Norah, Molly and Umboe Copper Claims, Lomagundi District. By A. M. Macgregor. Pp. 10+1 map. Short Report No. 26: A Geological Traverse down the Lower Inyantue Valley, Wankie District. By H. B. Maufe. Pp. 10+1 map. (Salisbury.)

Department of Health for Scotland. Second Report of the Scottish Advisory Committee on Rivers Pollution Prevention. River Esk (Midlothian). Pp. 44. (Edinburgh and London: H.M. Stationery Office.) 9*d.* net.

Biological Reviews and Biological Proceedings of the Cambridge Philosophical Society. Edited by H. Munro Fox. Vol. 6, No. 3, July. Pp. 221-344. (Cambridge: At the University Press.) 12*s.* 6*d.* net.

Empire Marketing Board, May 1930 to May 1931. (E.M.B. 41.) Pp. 75. (London: H.M. Stationery Office.) 1*s.* net.

FOREIGN.

Publikationer og mindre Meddelelser fra Københavns Observatorium. Nr. 76: The Possible Solutions of the "Equations of Fit" on the Standard Model. By Bengt Strömgren. Pp. 8. Nr. 77: The Point-Source Model with Coefficient of Opacity $k=k_1\rho T^{-3\cdot5}$. By Bengt Strömgren. Pp. 28. (København.)

Publications de l'Observatoire Astronomique de l'Université de Poznan. Tome 1. Pp. xi+75+5 planches. (Poznan.)

Smithsonian Institution: Bureau of American Ethnology. Bulletin 100: The Ruins at Kiatuthlanna, Eastern Arizona. By Frank H. H. Roberts, Jr. Pp. viii+195+47 plates. (Washington, D.C.: Government Printing Office.) 65 cents.

Statens Meteorologisk-Hydrografiska Anstalt. Årsbok, 10, 1928. iv. Meteorologiska iakttagelser i Sverige, Band 70. Pp. x+179. 7.00 kr. Årsbok, 12, 1930. i. Månadsöversikt över väderlek och vattentillgång jämte anstaltens årsberättelse. Pp. 98. 2.50 kr. Årsbok, 12, 1930. ii. Nederbörden i Sverige. Pp. 160. 5.00 kr. (Stockholm.)

Journal of the Faculty of Science, Imperial University of Tokyo. Section 2: Geology, Mineralogy, Geography, Seismology. Vol. 3, Part 3. Pp. 131-183+10 plates. (Tokyo: Maruzen Co., Ltd.) 1.20 yen.

Collection des travaux chimiques de Tchécoslovaquie. Rédigée et publiée par E. Votoček et J. Heyrovský. Année 3, No. 6, Juin. Pp. 285-332. (Prague: Regia Societas Scientiarum Bohemica.)

Ministry of Finance, Egypt: Coastguards and Fisheries Service. Report on the Fisheries of Egypt for the Year 1929. By R. S. Wimpenny. Pp. iii+92. (Cairo: Government Press.) 5 P.T.

Report of the National Research Council for the Year July 1, 1929–June 30, 1930. Pp. iv+119. (Washington, D.C.: Government Printing Office.) 15 cents.

U.S. Department of Agriculture. Farmers' Bulletin No. 1642: Chalcid Control in Alfalfa-Seed Production. By V. L. Wildermuth. Pp. ii+14. (Washington, D.C.: Government Printing Office.) 5 cents.

Proceedings of the United States National Museum. Vol. 79, Art. 9: A new Species of Troödont Dinosaur from the Lance Formation of Wyoming. By Charles W. Gilmore. (No. 2875.) Pp. 6+5 plates. Vol. 79, Art. 12: A new Pearl Oyster from the Hawaiian Islands. By Paul Bartsch. (No. 2878.) Pp. 2+2 plates. (Washington, D.C.: Government Printing Office.)

The Science Reports of the Tôhoku Imperial University, Sendai, Japan. First Series (Mathematics, Physics, Chemistry), Vol. 20, No. 2, May. Pp. 197-322. (Tokyo and Sendai: Maruzen Co., Ltd.)

Report on the Cloud Observations made at the Mera Meteorological Observatory, Mera, near Tokyo, April 1927 to March 1929. By M. Watanabe, Y. Isimaru and K. Yosinari. Pp. iii+50+72+137 plates. (Tokyo: Central Meteorological Observatory.)

Kungl. Sjökarteverket, Stockholm. Ergebnisse der Beobachtungen des magnetischen Observatoriums zu Lovö (Stockholm) im Jahre 1929. Bearbeitet von Sven Aslund. Pp. 29. (Stockholm.)

CATALOGUES.

Bulletin No. 3: Spectrum Analysis. Pp. 19. (London: Adam Hilger, Ltd.)

Verlag: Publications: Livres de Fonds. Pp. 141. (Berlin: W. Junk.)

Diary of Societies.

SATURDAY, JULY 25.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS (South-Eastern District) (at Hastings Town Hall), at 11.30 A.M.

TUESDAY, JULY 28.

QUEKETT MICROSCOPICAL CLUB (at 11 Chandos Street, W.1), at 7.

CONGRESSES.

JULY 17 TO 25.

BRITISH MEDICAL ASSOCIATION (at Eastbourne).

JULY 24 TO 30.

BRITISH COMMONWEALTH EDUCATION CONFERENCE (at Bedford College).—Subject: EDUCATION IN A CHANGING EMPIRE:—

Education in India.
Individual Education.
Modern Psychology in Education.
Examinations and Tests.

JULY 26 TO 31.

INTERNATIONAL CONGRESS ON RADIOLOGY (at Paris).