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Rationalisation of Research.

FOR the plain man and, even more, for the scientific worker and many Empire industries, it is extremely desirable that some authoritative pronouncement should be issued detailing the *raison d'être* and the lines of work of the several institutions and research centres in Great Britain which are endowed or supported by Government grants. Even the scientific worker of the present day may be pardoned if he finds it difficult, amongst an apparently bewildering number of institutes and research centres, to pick out the one at which he can obtain the most authoritative information upon the work in which he is interested; for the industrial inquirer the position is even more difficult; whilst the farmer is often hopelessly lost, when all he requires to know is the reason why a portion of his crop is failing. The farmer wants the answer at once: he has lost all interest (having lost that part of his crop) six months later, when an answer may arrive, after he has been sent from pillar to post.

The last few years have witnessed the advent of the Imperial Economic Committee, the Empire Marketing Board, the Government research laboratories connected with the Army, Navy, and Air Force, the several agricultural research and experimental stations now in existence in the country, increased by special lines of research undertaken at the Universities of Cambridge, Edinburgh, and so forth; the Forest Products Research Laboratory at Princes Risborough, the Imperial Forestry Institute at Oxford, etc. Among these centres are some which are not directly endowed with Government grants. The rest, under the supervision of the first or second body above mentioned, are, it is believed, influenced or stimulated to carry on work and to build up collections; the latter being either on a local or home standard, or on the far larger and more costly Empire one—these collections requiring buildings for housing and staff to look after them. In other words, the pendulum has swung with a vengeance and the pre-War apathy appears now to be leading the country into unnecessary (because unorganised) duplication of centres, buildings, exhibits, and so forth.

Before the War the scientific inquirer had a few well-known centres to which he resorted for information. To take two examples: Kew, with

its unrivalled collections of plants, timbers, and so forth—a collection of such excellence that it would take years to reproduce anything similar; and anything of less value would still necessitate the inquirer or student, having access to it, visiting Kew to complete his studies and investigations. Another centre designed for answering economic inquiries and for housing collections of economic products was the Imperial Institute—starved of funds for many years, it is true, but still inaugurated with a definite economic aim.

What is the position of the Imperial Institute to-day? From the annual report for 1929, written by the director, Lieut.-General Sir William Furse, and recently issued, it would not be easy for any but the highly technical expert to frame an answer: and the ordinary scientific worker and specialist inquirer would perhaps find it extremely difficult. For the report furnishes plentiful evidence that the Institute is engaged upon a wide series of economic inquiries and investigations involving elaborate research work. How is this co-ordinated with other research centres receiving Government grants?

It may be assumed that both the home government and all the dominion governments have a full belief in the importance and value of the work of the Institute. The high commissioners of all the latter are members of the board of governors; the trustees include several cabinet ministers; government departments are represented on its managing committee, as also are well-known men of science and others representing commercial interests. The Institute consists of several departments: for example, plant and animal products department, of which Sir David Prain is chairman of the advisory council; mineral resources department, of which Sir Richard Redmayne is chairman of the advisory council; Ceylon rubber research scheme; sericulture research. Investigations into vegetable fibres, timbers, crops for Kenya Colony, improvement of Burma rice, and many other important investigations are dealt with in the annual report.

The work carried out by the Institute with the approbation of the Government, and more important still, the Treasury, is of the greatest value, and its inception, although for so long cold-shouldered, may be regarded as an inspiration. The Institute is a centre to which all can resort, the serious investigator and the citizen who wishes to understand something of the great Empire of which he is privileged to be a member. The educational value of the Institute has been increased by the addition of a cinema, and the provisions made for the visits of parties of school children; and no finer educational centre for the youth of Great Britain could be found.

This being the present position, has not the time arrived when it becomes the duty of Government, in the interest both of the taxpayer and to prevent the wasteful and unnecessary duplication of work, buildings, and exhibits, to have a list drawn up of all institutions existing in Great Britain which are maintained either wholly or in part from Government funds or grants? This list should give details as to the exact nature of the work carried out by each; the reason or necessity for acceding to the demands for extra buildings to accommodate exhibits, perhaps already existing in other institutions in the country, extra staff, and so forth. With such a list available it might be found that Government was making grants to institutions for the purpose of carrying out work which was already being undertaken efficiently by existing institutions.

There would appear to be little doubt that such an inquiry is needed to avoid further waste of money both on the part of the home government and on those of dominions and colonial governments. The latter, as is well known, have received many calls of recent years to collect and forward specimens of a varying nature, many of these requirements being duplications of previous ones already furnished to other institutions. Further, in certain cases these governments are being invited to make grants of money to specialised educational or research centres in Great Britain. It would seem a duty imposed on the home government to be in a position to place before them a list of all centres engaged in the particular line of education or research.

It is known that duplication of the kind to which attention is here directed does exist. It is also known that the average scientific investigator and the commercial man, unless in close touch with the centre of affairs, is bewildered by the apparent multiplicity of institutes and research centres some of which are apparently undertaking work, or competing with each other (in some instances unknowingly), in the same field. A list of Government aided research institutions such as we have suggested above would largely prevent this duplication of effort and, what is perhaps indirectly even more important, would lead to wider use and fuller appreciation of the services which they can render to both science and industry.

The Compleat Anthropologist.

Notes and Queries on Anthropology. Fifth edition. Edited for the British Association for the Advancement of Science by a Committee of Section H. Pp. xvi+404. (London: Royal Anthropological Institute, 1929.) 6*s*.

THE first edition of this indispensable guide to field anthropology was published in 1874 "to promote accurate anthropological observation on the part of travellers, and to enable those who are not anthropologists themselves to supply the information which is wanted for the scientific study of anthropology at home". This was a counsel of perfection; but there were no schools of anthropology in Britain then, and very few elsewhere, and the risks of mistakes of observation were not fully appreciated, as a glance at the first edition shows. Successive editions, and especially the fourth, in 1912, substituted for many of the original lists of direct questions a short outline of the kind of information already acquired, with hints as to topics most worth elaborating. It was realised that the whole subject of physical anthropology was best left to medically trained observers, and psychology to psychologists; and the general advance in method was held to necessitate careful definition of many of the commoner phrases and terms, especially for those complex social systems which were now attracting the special attention of home-workers, and eliciting some valuable observations in the field.

In the present fifth edition, the 'notes' have still further been expanded at the expense of the 'queries', and the whole work has grown almost beyond pocket-book size: the fourth edition runs to 288 pages, the fifth to 404. The increase is mainly in the section for "sociology", which has been more than doubled in length; "marriage and sexual relations" alone being allowed seventeen pages instead of three, and the "regulation of public life" twenty instead of about six differently grouped. The economic sections also have been very much remodelled. All this reflects current tendencies in "anthropology at home", and the realisation that customs are much more difficult to collect than war-clubs. The numerous definitions which have been thought necessary are very carefully done; but some of them may have to be undone before this edition is exhausted. Too often one has seen the definition of an anthropological word in an earlier edition of "Notes and Queries" used as a starting-point for a systematic restatement of a whole problem. The new section on "Law and Justice" is admirably planned, and should be of the greatest use to administrators of native communities: it puts the old sections on "property", "land tenure", and "inheritance" into a coherent setting, and it is a question whether "slavery" should not be grouped with them. The old section on "morals" seems to have vanished; but "psychology" has come back, with sections on "primitive mentality" and on "dreams". It is always difficult to draw the line between pure and applied science, and usually the compilers of this edition have been discreet; but there is a lapse on p. 171 where, in a matter of child-psychology, "this point has been brought forward not so much for its anthropological as for its administrative value"; followed by remarks about depopulation, its causes, and a "better position to deal with the problem", which are not anthropology at all.

When the fourth edition was published, the study of magic and of religion was in a chaotic and transitional phase, which gave popularity to the comfortable term 'magico-religious' to describe this whole group of facts. This usage apparently persists; but it is qualified by quite wholesome attempts to define both 'religion' and 'magic' before going on to discuss what may turn out to be either; and the suggestions supplementary to the general requirement of "sympathy and gentlemanly behaviour" in an anthropologist are excellent. It is a much-needed caution (pp. 177-178) that while very few occurrences in the life of uncivilised peoples are without their religious aspect and ingredient, quite as few religious beliefs or observances are unrelated to some occurrence or need in daily life: "pure religion and undefiled", in the philosophical and personal sense, is one of the more ethereal distillates of advanced cultures; and the occasions for religious acts are rightly noted as being no less social than economic. The importance of native accounts of what happens, and of the native terminology for 'gods', 'devils', and other 'magico-religious' paraphernalia, is also very properly emphasised. The short section (p. 184) on "hero-cult" would have afforded almost no help at all to a field worker in ancient Greece, and would be little more useful anywhere else. Of how many known 'heroes' is it true that "when a hero is associated with war a cult begins to appear"? and when heroes are "associated with death", what does this mean?

Under "Arts and Sciences" the section on "decorative art" has been remodelled, and occasion should have been taken to bring its terminology up-to-date, and emphasise the import-

ance of descriptions to supplement sketches. An unusually detailed specification of 'musical' instruments reflects the current interest in jazz; there are apparently about fifty ways of making a noise by hitting something, and for sheer self-expression give me the "open tubes which are stamped on a man's thigh" (p. 298). The directions for recording native languages are entirely re-written; much doubtless good advice is given; the "wise observer will resist the temptation to invent an alphabet of his own"; but the Royal Geographical Society's excellent rules for transliterating place-names (and they can be used for much besides) have been cut out. The alphabet of the International Phonetic Association is recommended instead, but not supplied.

The valuable sections at the end, on photography and the collection of specimens, have been brought up-to-date; and there is a fresh note on the kinematograph, in which the sole omission is advice on the difficult art of bringing scientific films into Great Britain.

For the very moderate price of six shillings, this is a very handsome outfit of instruction, and suggestion also: and the convenient arrangement is continued whereby the book, though prepared for the British Association, is published and distributed by the Royal Anthropological Institute from its library at 52 Upper Bedford Place, W.C.1.

J. L. M.

Early Literature of Acarology.

Tijdsdchrift voor Entomologie. Uitgegeven door de Nederlandsche Entomologische Vereeniging onder redactie van Dr. J. Th. Oudemans, Prof. Dr. J. C. H. De Meijere en Dr. A. C. Oudemans. Deel 69, Jaargang 1926. Supplement: *Kritisch historisch overzicht der Acarologie.* Eerste Gedeelte, *850 v.C. tot 1758.* Pp. viii+500. Deel 72, Jaargang 1929. Supplement: *Kritisch historisch overzicht der Acarologie.* Tweede Gedeelte, *1759–1804.* Pp. xvii + 1097. ('s-Gravenhage: Martinus Nijhoff, 1926–1929.)

AMONG the Arthropoda, the Acarina, or mites and ticks, would not generally be considered the most attractive group. It is, therefore, somewhat surprising to find that they have received a large amount of attention from the earliest times. This is no doubt due to the fact that to their presence is attributable a long series of highly disagreeable consequences; and that man himself, his food materials and his domestic animals, have suffered conspicuously from their depredations.

The two parts now published of Dr. Oudemans' historical review contain an exhaustive account of everything that has been written on the subject down to the year 1804; a forthcoming part will carry the story on to the year 1850. The scope of the work being mainly historical, we do not find much space devoted to classification or to minute structural detail; the wealth of information, however, on such points as the external characters, habitat, life-history, and distribution of the various species is amazing, and gives evidence of extraordinary labour on the part of the author. As an encyclopædia of the knowledge of the subject up to the beginning of the last century, these volumes will have a permanent value.

Whether the opprobrious terms addressed in the Iliad by Ares to Athene, and applied by Hera to Aphrodite, can be held to refer to any member of the Acarina may be thought doubtful, but that Dr. Oudemans is right in identifying the tormentors of Argus, the faithful dog of Odysseus, with a well-known species of the Ixodidæ need not be questioned. Other references in the classics that may apply to mites or ticks are numerous, but in many cases there is an evident confusion between the Acarine pest and the true louse, which was naturally not recognised as belonging to another class of the Arthropoda. Aristotle, however, distinguishes clearly between the louse and the tick: the ass, he says, is not infested by either; oxen, on the other hand, suffer from both. Ticks, but not lice, are found on sheep and goats. The name that he gives to the external parasite of the dog is the same as Homer's in the Odyssey; and also in a fable which he attributes to Æsop the same word is used of vermin that were draining the blood of an unfortunate fox.

The uncertainty that besets all attempts at identification of the forms mentioned by ancient authors becomes gradually cleared away as we approach our own times. It is not, however, until the introduction of the binomial system of nomenclature by Linnæus in the tenth edition (1758) of his "Systema Naturæ", that the determination of species becomes to any large extent possible. Some descriptions of an earlier date are, however, sufficiently exact to enable us to be reasonably sure that we know the species referred to. The *Araneus indicus coccineus major*, for example, brought from the coast of Coromandel, and described by Petiver in 1701, is without doubt the mite now known as *Trombidium gigas*. There are, moreover, many records of observations made in the seventeenth and eighteenth centuries which anticipate in a remark-

able manner the results obtained by work conducted on the lines of modern systematics. Among those dealt with by Dr. Oudemans are the discovery by Leeuwenhoek (1694) of the six-legged larva of the mites; the description of the mouth parts of ticks in a letter by an anonymous contributor to the *Philosophical Transactions* of the Royal Society (1703); the observation by Linnæus that *Tetranychus telarius*, commonly known as the 'red-spider', spins threads with which it covers the stems and leaves of trees. A graphic account of the habits of the larval *Thrombidium pusillum* (the too-well-known 'harvest bug'), with some mention of structural details, was given by Baker in 1753. Some years before this the earliest description of the larva of a Hydrachnid, or water-mite, was published by Joblot, who adds to his account a figure, obviously exaggerated, of the dorsal sculpture of this creature, showing a grotesque resemblance to a human face.

In his second volume Dr. Oudemans treats of the further information gained on the whole assemblage since the year 1759; ending his survey with the year 1804. A brief summary is given of the earlier attempts made at a classification of the group, a problem which even at the present day is far from having received a satisfactory solution, Trouessart's scheme, adopted in the main by Warburton in the "Cambridge Natural History", being probably at present the most convenient in practice. By the naturalists of the seventeenth century the term *Acarus* was used in a very wide sense, including, according to Dr. Oudemans, larvæ of Coleoptera, Lepidoptera, and Diptera. Successive approximations to a reasonable restriction of the term were made by O. F. Muller (1769), Fabricius (1775), and Latreille (1795). Dr. Oudemans, being an advocate of strict adherence to the rule of priority in nomenclature, has thought it his duty to revive several of the older names in place of those now commonly used. Thus in the subgenus *Platyseius* he sinks his own specific name *subglabra* in favour of *tendens* Schrank, which dates from 1803. The well-known pigeon-tick, hitherto generally spoken of as *Argas reflexus* Fabr., reverts to its original designation of *Argas columbarum* Shaw. So, too, Latreille's *Caris vespertilionis* (1802) becomes *Acarus testudo* Risso (1790). The author is no lenient critic of mistakes in nomenclature; he does not spare what he considers to be the mistaken following of Neumann in the Cambridge "Monograph of the Ixodoidea".

The numerous illustrations, reproduced from the figures in the original works of authors up to the beginning of the nineteenth century, serve to justify Dr. Oudemans' contention that many Acari were well described and figured in quite early times. There is, nevertheless, much evidence that the producers of these descriptions and figures, careful observers as they were, did not always succeed in appreciating fully the significance of what they saw. Through the maze of conflicting records and determinations, Dr. Oudemans' important work is a safe and sufficient guide.

Apart from a few trifling printers' errors, the only serious misprint that we have noticed occurs in a passage cited from Aristotle on p. 51 of Part 1. Here, though all the words are good Greek, the opening sentence of the speech is unintelligible as it stands. Fortunately the necessary emendation is quite obvious. F. A. D.

Modern Volumetric Analysis.

Volumetric Analysis. By Prof. Dr. I. M. Kolthoff, with the collaboration of Dr. H. Menzel. An authorised translation based on the German Text by Prof. N. Howell Furman. Revised and enlarged by the Author. Vol. 2: *Practical Volumetric Analysis.* Pp. xiv + 552. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1929.) 25*s.* net.

FOLLOWING on Vol. 1 dealing with the general theory of volumetric analysis, Dr. Kolthoff has produced a work on practical methods which in its way is different from the well-known standard works dealing with the subject. The author does not claim to deal particularly with special methods of applied chemistry, but, as a matter of fact, the general considerations and the exhaustive discussion of general methods suffice to give the reader the necessary indications for accurate procedure. As an example of this, we have in Chap. xiii. what appears at first sight to constitute a general discussion of certain methods. Actually the chapter is a very full description of iodometric processes for both inorganic and organic compounds. The limitations of the methods and the author's experience are given, the discussion of the errors and details being full enough for most purposes: for example, the discussion of the hydroquinone titration on p. 453. A short chapter is devoted to the useful iodate method developed by Andrews, and the use of bromate is likewise properly stressed.

The greatest interest of the book lies in its development of the fundamentals of volumetric analysis. The chapter on calibration of measuring vessels, for example, puts the subject as succinctly

as can be desired from a general point of view. There are some considerations, however, on this matter which might have been further emphasised. It should be pointed out even more strongly than is done in this work that for the highest accuracy in volumetric analysis, the weight burette is essential if drainage and wetting errors are to be avoided. For micro-work these errors are even more important. We are furnished with tables of 'tolerances' for measuring vessels as laid down by various standardising institutions, but it is not clearly indicated that an error of nearly 0·5 per cent in a volumetric determination of a constituent is possible, even when the highest grade of volumetric apparatus (with the usual tolerances) is used. This is apart from errors due to purity of the standard reagents (see Stott, *J. Soc. Chem. Ind.*, **40**, 64 T; 1921).

Chap. ii. deals with a most important—and perhaps the most important—requirement of accurate volumetric analysis, namely, the selection of a true standard substance and the specification of such a standard. Wagner, Kühling, Sörensen, and others have advocated rightly the selection of the least number of 'standard' substances and have laid down certain principles for testing the standard. Various suggestions to this end receive consideration and the arguments advanced by different authorities are considered, with the result that rules are laid down (p. 47) for the requirements of a standard substance, particularly the all-important question of stability and keeping properties. There is one point in this connexion that we do not think receives adequate recognition. It is not difficult to apply certain tests for purity to a standard substance, but an important matter is to determine as accurately as possible the actual content of the standard substance, for example, sodium chloride, by an accepted gravimetric method of high accuracy. Such a test settles the adequacy of the standard, particularly of a stable standard.

In the section dealing with standardisation of acids, a number of primary standards is given, and it is satisfactory to note that the potassium iodate method receives proper consideration. The methods of 'argentometry' are described in great detail in Chap. viii., which likewise contains a full account of Fajan's adsorption indicators. This section makes pleasant reading, inasmuch as it indicates very clearly indeed that the subject is really a branch of physical chemistry. The last two chapters deal shortly with some of the more recent oxidising agents such as ceric sulphate, and with the general applications of titanous solutions. The work is very fully indexed.

Two points of criticism need to be made, namely, the continued use of the atomic weights of 1925, which includes titanium as 48·1, and the use of c.c. instead of ml. It is difficult to understand the latter feature in a book of this character, so philosophical in other respects. Dr. Kolthoff's two books on "Volumetric Analysis" occupy a position by themselves, inasmuch as they deal with the subject from the point of view of modern theoretical chemistry. The reader cannot fail to perceive a new presentation of old subjects, for example, pp. 279-284 on permanganate oxidations. The whole work is to be commended, alike for the use of students and for general reference.

J. J. F.

A Directory of the Learned World.

Index Generalis: Annuaire Général des Universités, Grandes Écoles, Académies, Archives, Bibliothèques, Instituts scientifiques, Jardins botaniques et zoologiques, Musées, Observatoires, Stés Savantes. Publié sous la direction de Dr. R. de Montessus de Ballore. Pp. vi + F170 + BE228 + US213 + E39 + 2322. (Paris: Éditions Spes, 1929–30.) n.p.

IN scope, as indicated by the sub-title, this annual is akin to the well-known "Minerva Jahrbuch der gelehrten Welt". It is, however, very much less exhaustive, and the two publications differ in the methods of arrangement of their material. "Minerva" presents, gazetteer-fashion, a single series of sections arranged in the alphabetical order of the names of towns. The "Index Generalis" provides a catalogue *raisonné* under the following group headings: Universities and "grandes écoles" (1147 pages), astronomical observatories (95 pages), libraries and archives (270 pages), scientific institutes (118 pages), learned societies and academies (190 pages). Within each of the first four groups the arrangement is by countries; the last group is subdivided according to subject and, within each subject, by towns, irrespective of country. There is, of course, an alphabetical index of names of persons—65,000 references—and, finally, there are geographical tables enabling one to find one's way to the whole of the information given regarding any particular place.

Many of the notices of the various institutions, etc., some 6500 in number, are in their native languages, where these are French, English, German, Spanish, or Italian. The date (year) up to which the information has been corrected is in most cases

given. Prefixed to the sections relating to the universities of France, the United States of America, Spain, and Italy, are short accounts of the organisation of higher education in those countries. An account is also given of the organisation of studies in the University of London, as being typical of British universities in general. In the index of persons' names references are not merely to pages but also to subdivisions of pages. The pages being small and the names being printed in bold type, this makes the tracing of references an easy matter. Provision is made for enabling authors who wish to exchange original memoirs with others to advertise the fact.

In the preface, contributed by M. Appell, the well-known Rector of the University of Paris, it is claimed as a merit of the method of arrangement adopted that it shows "avec une clarté toute française le rang de chaque pays au point de vue intellectuel": a thankless service, of dubious value, more likely to attenuate than to strengthen those relations on the intellectual plane between the peoples of the world which are to pave the way, according to M. Appell, for the advent of the veritable League of Nations. It would be easy but profitless to compare and comment on the allocations of space in the "Index" to the various countries, but there is one country the almost total exclusion of which compels remark, the more so in that its cultural relations with France were once very close—Russia. The only references under the heading U.S.S.R. are to two astronomical observatories, and the same remark applies to the Ukraine and Turkestan. It would seem that the editor holds the conditions of a socialist State to be such as to vitiate the pursuit of all branches of knowledge, except knowledge of the celestial bodies! Minerva (1930) devotes 59 pages to Moscow alone and gives information about universities at fourteen places in Russia which are not even mentioned in the "Index Generalis".

The preparation of the chapter relating to universities in the British Empire was, or could have been, made comparatively easy by using the "Universities Yearbook of the British Empire". Recourse to this could have prevented such mistakes as omitting the University College of Swansea and London Day Training College, and the teaching staff of the largest English university college for women (Bedford).

Although still marred by deficiencies in regard to balance and too many inaccuracies in detail, the "Index Generalis" has greatly improved since its first appearance in 1919.

Our Bookshelf.

Hyde Park: its History and Romance. By Mrs. Alec. Tweedie (*née* Harley). Abridged revised edition. Pp. vii + 239 + 29 plates. (London: Besant and Co., Ltd., 1930.) 3*s.* 6*d.* net.

THIS is an abridged and revised edition of a book published in 1908, which in many parts has been largely rewritten. For Mrs. Tweedie's point is that of to-day. She brings the story of Hyde Park down to its mobilisation in 1926 during the great strike, and refers to the danger of Socialist proposals to-day for its popularisation as a sports ground. She follows the Park through its many vicissitudes from the grants of land east of Tyburn from the King to St. Dunstan in 960 and of Geoffrey de Mandeville, who fought at Hastings, of the Manor of Hyde to the abbey at Westminster. Under the Tudors after the suppression of the monasteries it became a Royal hunting-ground; but it was not until the return of Charles II. that it really entered upon its function as a centre of social gathering, primarily for the Court and its hangers-on. For long the people were not admitted. Nevertheless, Hyde Park serves as focus for more than one side of our earlier social history. Its neighbourhood was infested with footpads and highwaymen, and Tyburn, with its sinister associations of the hangman and the 'Triple Tree', was within its purlieus.

Mrs. Tweedie's book is an entertaining and gossipy narrative, instructive in its glimpses of English life and history; but she is a mistress of irrelevance. This is not entirely a fault, as it usually permits her to introduce matter which adds colour to her background. Little asides of social incidents and changes to-day, perhaps not even remotely connected with the Park, will have a value for the historian of the future. Their place and meaning become clearer when it is understood that the pageant "Heart of Empire" to be held at the Albert Hall in October next while the Imperial Conference is sitting is based upon the book. No doubt Mrs. Tweedie had in mind the public before whom the book will be brought in this way. They will treasure it in the future when overseas, perhaps most of all for these same little touches from the London of to-day.

L' atomistica moderna e la chimica. Per Dott. M. Haissinsky. Pp. xiv + 315. (Milano: Ulrico Hoepli, 1930.) 35 lire.

THE enormous strides made during the past few years in the knowledge of the inner structure of the atom, developed principally by physicists making use of physical and physico-mathematical methods, have led to the publication of numerous works dealing with this branch of modern physics. The author considered, however, that a need existed for a book dealing with such subjects more from the chemical point of view. In the preparation of the present volume, the requirements of the chemist in particular have, therefore, been borne

in mind, and the treatment adopted should present little difficulty to any reader conversant with the ordinary fundamental conceptions of physical chemistry.

The first two chapters are devoted to elementary notions concerning molecules, atoms, electrons, thermodynamics, and the quantum theory. The third treats of the Bohr atom as the basis of modern atomistics, emphasis being laid on points of immediate importance in the study of chemical problems. The remainder of the book is concerned with atomic chemistry proper, and is dominated by the fundamental idea that chemical phenomena are due to the laws governing physical phenomena in general, namely, the laws of energetics and probability. The extent of the ground covered may be judged from a brief summary of the contents of the book, these including: Electronic theory of valency; Bohr's theory and its applications; electronic structure and ionic radii; deformation of electronic orbits; photochemistry; radiochemical hypothesis; catalysis and adsorption; wave mechanics, and Fermi's statistics.

Each chapter is followed by a useful bibliography, and an author index and a list of the tables included in the text are given at the end of the book. The print is good, the proofs have been carefully revised, and the whole is well up to the Hoepli standard of production. The price is commendably moderate.

Mechanism of Enzyme Action and Associated Cell Phenomena. By F. F. Nord. Pp. ix + 78. (London: Baillière, Tindall and Cox, 1929.) 9*s*. net.

WITH our present knowledge of enzyme processes any conception of their mechanism must be essentially highly speculative. In the work under notice the author makes no claim to deal comprehensively with the subject of enzyme chemistry, but confines himself to a limited aspect of this wide field. The book deals almost exclusively with the subject of yeast fermentations, while the probably related subject of muscle chemistry and the various other enzyme processes of animal physiology receive little or no attention.

The work of Harden and Young on alcoholic fermentation is summarised and discussed in conjunction with the findings and views of other workers in this field. Evidence for the presence and rôle of intermediate compounds in yeast fermentations is examined, and a short account is given of the information obtained as to the course of fermentation reactions by the use of alkaline sulphite as a means of influencing the part played by acetaldehyde as an intermediary. A whole chapter is devoted to the discussion of the problem of 'activation' of enzymes, and particular attention is directed to the part played by simultaneous reduction and oxidation in fermentation processes.

In its literary style the work is somewhat laboured and occasionally obscure, while the execution of the diagrams also leaves much to be desired in the way of clarity. The information presented has obviously been carefully collated; nevertheless, the reviewer has been unable to find authority for the statement, on p. 10, that the gamma fructose present in cane sugar is partially enolised.

A good bibliography greatly increases the value of the book as a concise presentation of the chemistry of yeast fermentations.

Histoire des sciences mathématiques dans l'antiquité hellénique. Par Prof. Gino Loria. (Science et civilisation: Collection d'exposés synthétiques du savoir humain.) Pp. vi + 215. (Paris: Gauthier-Villars et Cie, 1929.) n.p.

THIS is probably the best short history of Greek mathematics which has yet been published. It has all the clearness and charm of a French popular exposition of a difficult subject; it also gives, unfortunately (in the copy submitted for review), a striking proof of the carelessness of French book-production, fourteen pages being entirely blank!

Prof. Loria gives a brief general sketch of the earliest steps, with the presumed debt to Egypt and Babylonia, takes a conservative view as to Thales and Pythagoras, and reserves most of his space for the later mathematicians whose works are extant. He is particularly good on Euclid, Archimedes, and Apollonius, and enlivens the end of his little book by several examples of the amusing concrete problems in which the Greeks delighted and which were sometimes engraven on the tombs of their ancestors.

There is a very useful short chapter at the end, giving the applications of Greek mathematics to their astronomy and views of the universe. This supplies the link needed in many accounts of early Greek science. The bibliography is well chosen and up-to-date, giving both the latest editions of the texts and the best books discussing the results.

F. S. M.

List of the Vertebrated Animals exhibited in the Gardens of the Zoological Society of London, 1828–1927. Centenary edition in 3 volumes. Vol. 2: *Birds.* By Dr. G. Carmichael Low. Pp. viii + 832. (London: Zoological Society, 1929.) 25*s*.

A COMPANION volume to that on "Mammals", already noticed in NATURE, and like it a most useful work of reference. It includes the names of 2330 birds which have appeared in the London Zoo, and in addition gives the geographical races of many of the forms. All the essential catalogue information accompanies each scientific name—the most important synonyms, the geographical distribution, references to a good description and to a coloured figure where such exists. The English name or names of each species is given—an important item for the museum official who has to label birds, and, since each name is indexed, for the reader who wishes to know the exact significance of colloquial names used in books of travel and the like. So authoritative a list should help to stereotype the popular names of foreign birds, which are sometimes in danger of having as many popular as scientific synonyms.

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.*]

A New Theory of Magnetic Storms.

AN attempt to infer the course of events when a neutral ionised stream of particles from the sun is directed towards the earth has now led to results which we believe indicate how magnetic storms are produced. A full discussion of the phenomena involves the solution of numerous intricate mathematical problems, many of which have not yet been attacked in detail; but it seems possible to outline the main sequence of events.

The motion of a neutral ionised stream in the earth's magnetic field was investigated by one of us in 1923,[1] and it was concluded that the stream would be scarcely deflected by the field, though some slight convergence would occur within about one earth-diameter from the earth's centre O (Fig. 1).

No indication as to how such a stream could produce magnetic storms and auroræ was obtained. It would seem that this failure was due to the assumption there made that the stream had enveloped the earth for a time long enough to enable a steady state to be set up, whereas it now appears that magnetic storms are essentially connected with the *approach* of the stream towards the earth. The important changes in the stream occur within a few earth radii from O, and beyond this distance the former conclusion that the stream travels almost without deflection remains valid.

The stream is in effect a highly conducting body, and as it enters the earth's field electric currents flowing parallel to its surface are induced in the surface layers, so that the interior of the stream is nearly shielded from the earth's field. Outside the stream the magnetic effect of the currents is roughly equivalent to that of an 'image' magnetic doublet at a certain point inside the stream; in the equatorial plane the field between the earth and the stream is increased in intensity. It is as if the current layer, as it advances towards the earth, pushes forward and crowds together the earth's lines of force.

We identify this change with the observed increase in the earth's horizontal force during the first stage of a magnetic storm. Detailed examination shows that the magnitude of the effect, and its time scale, depend almost entirely on the kinetic energy of the stream per unit volume; if the velocity of the stream is of the order 1000 km./sec., the density requisite to explain the first phase of an average magnetic storm (taking account of the shielding effect of the Heaviside layer) is roughly of the order 10^{-22} gm./c.c.; this might be provided by about 1·5 calcium ions or 60 hydrogen ions per c.c.

The magnetic energy of the field is increased during this phase at the expense of the kinetic energy of the stream; the retardation of the particles occurs in the current layer, which is continually increased in mass-density by the oncoming of particles from behind. The retardation is greatest at that part of the front of the stream (A in Fig. 1) which is moving along the direct line from the sun to the earth's centre O; on either side of A the stream will advance relatively to A, and the earth will become partly enclosed by the stream; the surface $B'BACC'$ will continually close in, at a diminishing rate, upon the earth; whether it actually reaches the earth's atmosphere, in the equatorial plane, will depend on the density of the stream, and the length of time during which it is directed towards the earth (this is determined by the angular breadth of the stream viewed from the sun).

In the second (which is the main) phase of a magnetic storm the earth's horizontal force is decreased. We attribute this to the formation of a westerly current round the earth, due primarily to the flow of charges across the space 'behind' the earth (viewed from the sun). Along the sides BB', CC' of the enclosure there will be charged layers, BB' positive and CC' negative, due to the polarisation of the stream by the magnetic field. The charges in these layers will be subject to an outward electrostatic force, and the positive ions along BB' will cross over to CC', partly guided by the earth's field. The electrons along CC' cannot flow along the reverse path because of the greater deflecting influence of the field upon them, but negative charges from 'above' and 'below' the equatorial plane will travel along the earth's lines of force to neutralise the charge of the ions moving from BB' across the gap. The details

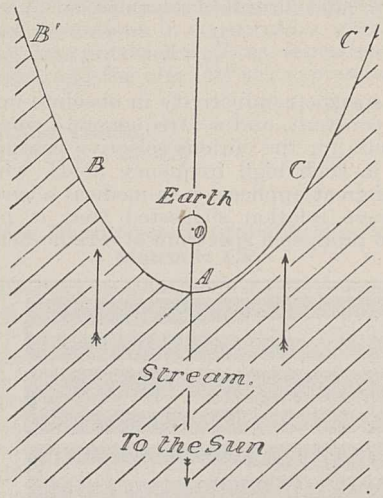

FIG. 1.

of the process are not yet clear, but it appears likely that a westerly current can thus be set up round the earth. It can be shown that the current-ring, if formed, can persist in mechanical and electromagnetic equilibrium for some days after the cessation of the onward flow of particles from behind. The gradual dissipation of this ring current corresponds to the final phase of the storm.

One of the distinctive features of the theory here outlined is the distance from the earth within which the main electric currents flow, namely, a few earth radii; they are outside the earth's atmosphere (though secondary currents are induced therein), but they are much nearer the earth than the currents (in the equatorial plane) discussed by Birkeland, or the equatorial current proposed by Prof. Størmer and associated by him with the decrease of latitude of auroræ during magnetic storms.

We have not examined closely the extent to which the stream will cause inflow of ions and electrons into the earth's atmosphere in the polar regions, or how this inflow will give rise to the observed currents along the auroral zones; but it seems likely that present theories of the auroræ will need to be modified, because the particles of a neutral stream can approach much closer to the earth, in the equatorial

plane, than the single charged particles hitherto considered. This must also have an important bearing on the theory of radio echoes, should it be proved that these are produced outside the earth's atmosphere.

S. CHAPMAN.
V. C. A. FERRARO.

Imperial College of Science,
South Kensington,
London, S.W.7,
June 26.

[1] *Proc. Camb. Phil. Soc.*, **21**, 577; 1923.

Method of obtaining a Visible Spectrum of Waves of Radio Frequency.

IN the course of a research on the heating effects of radiation of wave-lengths 10 to 200 metres, it was found that for a given wave-length there is a maximum heating effect produced in a medium the specific conductivity and dielectric constant of which are connected with the frequency by a simple law. This law, proved theoretically as well as shown experimentally to hold for dilute solutions, is

$$\frac{2c}{nD} = 1,$$

where c = specific conductivity in absolute units, D = dielectric constant, and n = frequency of wave. This law accounts for the curious selective heating effects observed in such high frequency fields, which give promise of great application in medical science.

The above relation suggested that it might be possible to produce a spectrum of a radio-field, where

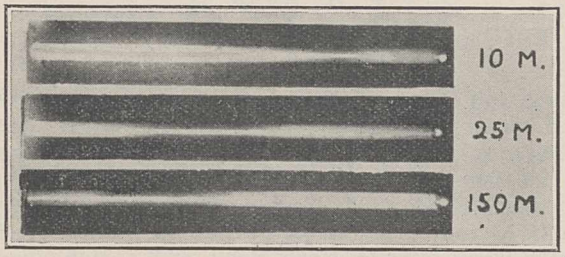

FIG. 1.

a line would by its position in the spectrum indicate the wave-length emitted by a valve oscillator. A jelly of about four per cent agar-agar in distilled water was impregnated with finely powered tetriodomercurate of silver. This substance is orange-red when hot and canary-yellow when cold, the change being quite sharp at about 35° C. (It is used and described by Pariseau, *Can. Med. Assoc. Jour.*, 20, 146; 1929.) A glass tube was filled with the jelly, a small section at a time, a few drops of an electrolyte being added to the hot jelly before each addition, so that the conductivity increased as we passed along the tube. When the completed tube was placed in the field of radiation of an oscillator, it was found that if there was sufficient intensity, a red patch appeared in the jelly in a position where the conductivity was that determined by the relation given above. The accompanying photograph (Fig. 1) shows how the device acts as a crude spectrograph. The colour change is quite marked but is difficult to record photographically.

Neither the dispersion nor the resolving power are at present great, but an attempt is being made to prepare a film of the substance in which the conductivity will vary continuously. Interesting results might be found with ultra-short waves, as any changes in the dielectric constant would show themselves as anomalous dispersion, as do changes in the refractive index with light.

J. C. MCLENNAN.
A. C. BURTON.

The Physical Laboratory,
University of Toronto,
June 28.

Isolation of the Film Responsible for the Passivity of an Iron Anode in Acid Solution.

A RECENT paper (*J. Chem. Soc.*, 1930, p. 478) showed that the *direct* solvent action of dilute sulphuric acid on ferric oxide films is very slow. The *rapid* removal of a ferric oxide film from iron by acid is due to the formation of the local cell iron/acid/ferric oxide, which produces cathodic reduction of the ferric oxide to the rapidly soluble ferrous oxide. If the whole surface receives anodic treatment, this cathodic reduction is prevented, and hence an iron anode may remain passive in acid solution.

Further work has now shown that it is possible to isolate the film responsible for this type of passivity. The electrodes used consist of cold-rolled electrolytic iron abraded with No. 1 emery and degreased in carbon tetrachloride. The anode, fixed at 70° to the horizontal at a distance of 4·5 cm. from a vertical cathode, is viewed continuously through a binocular microscope. The electrolyte is normal sulphuric acid, and time is allowed for the dissolution of any 'air-formed' films. An e.m.f. of 6 volts is then applied to the cell; the anode at first is active, suffering corrosion, but soon passivity sets in, and evolution of oxygen commences. If the circuit is now broken for a short time, and restored, the anode is found once more to be active, and iron passes into solution; in due course, passivity returns, and in this way the iron can be made active and passive alternately.

Microscopic observation shows that during the passive periods, the anode is quite bright; but when, after the 'off' period, the current is again turned on, a series of horizontal shadow-fringes pass upwards over the surface, due to the wrinkling of a surface film. This film must have been present in optical contact with the metal during the passive stage; but it only becomes visible when the metal immediately below it is dissolved away. By alternately making and breaking the circuit (with variation of the e.m.f. between 4 and 6 volts, if required), it is possible to separate the transparent film intact from the electrode over quite large areas. Success depends on making and breaking the circuit at the right moments, chosen by watching the appearance of the skin through the microscope. The current is employed to undermine the skin, and prevent its destruction, whilst the 'off' periods serve to produce the local failure of the skin required for the commencement of undermining, and at later stages may be used to destroy the film at any points where it adheres too obstinately to the metal (this destruction is caused by the formation of the local cell iron/acid/oxide).

The film is less easy to preserve than that obtained from iron rendered passive in potassium chromate solution (*J. Chem. Soc.*, 1927, p. 1020); the fragments readily twist themselves into masses recalling 'cobwebs', whilst in some cases the film, as it peels from the anode, rolls up 'like a carpet' into long tight rolls, which under low magnification may be mistaken for fibres. But although mechanically flimsy, the films are stable chemically and can survive an hour in normal sulphuric acid, provided they are free from

metallic iron. Some specimens of iron have yielded a skin containing opaque inclusions—no doubt a further example of the 'interlocking' of oxide and metal studied in earlier work (Evans and J. Stockdale, *J. Chem. Soc.*, 1929, p. 2651).

The results confirm the views of Hedges (*J. Chem. Soc.*, 1928, p. 976), that anodic passivity—like other types—is due to a protective film. Since Benedicks and Sederholm (*Z. Phys. Chem.*, **138**, 123; 1928) have photographed the film which causes passivity in nitric acid, it may now be claimed that, for each important type of passivity, the film responsible has been rendered visible.

The removal of oxide-films by the cell iron/liquid/ferric oxide, which takes place so rapidly in acid, occurs slowly in neutral solutions. Mr. S. C. Britton, working in this laboratory, has found that heat-tinted iron kept in oxygen-free $N/10$ potassium chloride for two weeks loses its colour; a similar treatment appears to be capable of removing much thicker films, such as mill-scale, and also films too thin to be visible; the removal proceeds at least in part by undermining. These facts may explain the important discovery of McAulay and Bastow (*J. Chem. Soc.*, 1929, p. 85), who found that mere immersion in oxygen-free potassium sulphate brought iron specimens to a 'standard state', in which subsequent movements of the electrode potential were reproducible and independent of the previous history.

ULICK R. EVANS.

University Chemical Laboratory,
Cambridge, July 1.

Nutritional Status and Sex Determination.

RECENT correspondence in NATURE (R. R. Gates and D. V. Daran, Mar. 1, p. 309, and D. M. Cayley, April 5, p. 527) indicates that diversity of opinion still exists in regard to the question of 'multiple sexes' or 'nutritive heterothallism' in the fungi. The lower plants have yielded a great deal of information of a fundamental nature on sex, and the outcome of such correspondence must certainly be a further advance of knowledge with its applications not restricted to the fungi.

Nutritional status was long ago considered to play a part in sex determination in animals, but, largely through lack of well-controlled experiments, the idea lost favour. Nevertheless, evidence from a variety of sources is redirecting attention to the question. That nutritional state, without any relation to such phenomena as parasitism, may affect the ultimate sex expression in insects is the conclusion I have reached as a result of studies on the 'flour beetle' *Tribolium confusum* Duval. The evidence will be published in greater detail in the near future, but a summary at the present time may be of interest.

The sex ratio of newly hatched unfed larvæ, under controlled conditions of temperature, humidity, light, nutrition of the parents, and subsequent nutrition of the larvæ, has been altered by starvation. The alteration in sex ratio was not due to differential mortality of the sexes, since the change was considerably larger than the total mortality up to pupation, when it was possible to determine the sexes by genitalia characters. (The mortality ranged from 0 to 2 per cent, with an average of 1·2 per cent.) However, the change in sex ratio is not a simple relation between starvation and the production of a preponderance of one sex, or between time of starvation and resultant sex ratio, for with one day's starvation there is an increase in the preponderance of males, while with two and three days' starvation the number of males decreases and there is a preponderance of females. The net result is that while life lasts there is an oscillation of the sex ratio. Graphically, the curve representing this oscillation has an axis which slopes somewhat from a slight excess of males to a lower proportion of males with increase in starvation period.

The oscillating nature of the change in sex ratio indicates that either some forms change from one sex and back again, or that certain forms of both sexes change to the other sex after different periods of starvation. The conclusions reached are that either:

1. A proportion of the population is stable as regards its expression of sexuality, while a proportion is more easily converted to the opposite sex one way or the other; or

2. That forms of either sex may be changed to the opposite sex but that there are gradations of sexual stability only upset after varying periods of time.

The effect of nutrition on sex determination undoubtedly takes place *per medium* of its effect on the biochemical and biophysical state of the body fluids, and through them also on the germ cells. In insects one does not consider that more than two sexes occur, but the results briefly quoted above indicate that there are at least gradations in constitution which show a relation between nutritional status, dependent on time of starvation, and the ultimate sex expression.

F. G. HOLDAWAY.

Australia House,
London, W.C.2, June 25.

A New Band System probably due to a Molecule CP.

WHEN investigating the band spectra of phosphorus I tried a discharge in a mixture of argon and phosphorus vapour. This discharge, with suitable arrangements of the concentrations of the two gases, shows an intense and extended band system in the wave-length region λ4000-λ2900 A. which does not occur in pure phosphorus vapour. So far as I am aware it has not hitherto been recorded. At the same time the Swan bands of the C_2 molecule are very intense in the visible region, obviously due to tap grease and sealing wax. As in a mixture of argon and a small trace of nitrogen, under the same conditions of discharge, the CN bands are specially strong (the C_2 bands of course also being present), it seems very probable that the new band system is due to a molecule CP which would be the analogue of CN. So far as I know, such a molecule, or a molecule $(CP)_2$ which would be analogous to $(CN)_2$, has not been found chemically. If the above conclusion that the new band system is due to CP is correct, it might be possible also to get chemical evidence of some simple CP compound. In order to obtain a further test of the above conclusion, an attempt is being made to get exposures strong enough to show the bands due to the isotope molecule $C^{13}P$ which would make possible a definite identification of the emitter of the bands in question.

The structure of the band system and the single bands is very simple and in agreement with the assumption that they are the analogue to the $^2\Sigma$-$^2\Sigma$-CN bands. The fine structure is clearly resolved except near the heads. Only one R- and one P-branch seem to be present. The distance between head and origin of the bands is very small, corresponding to a large alteration of nuclear distance. A preliminary vibrational analysis yields the following formula for the heads:

$$\nu = 29103{\cdot}6 + [832{\cdot}4(v' + \tfrac{1}{2}) - 5{\cdot}44(v' + \tfrac{1}{2})^2] - [1239{\cdot}0(v'' + \tfrac{1}{2}) - 6{\cdot}75(v'' + \tfrac{1}{2})^2].$$

The above formula does not represent all the bands which have been found, because there are certain striking perturbations in the vibrational levels of the upper state involved. The 3rd, 4th, and 5th vibrational levels of this state are shifted in the direction of higher energy by an approximately constant amount of about 4·5 cm.$^{-1}$ (the measurements being accurate to within 1 cm.$^{-1}$ or probably less). This is seen especially well in the ω-curve for the upper state, which is approximately linear, only the 2nd and 5th points lying far off it by about the same amount but in opposite directions. Similar perturbations have been found in an extended band system of P_2 (λ3500-2000 A.) which is also under investigation.[1] In this case these perturbations make the vibrational analysis very difficult because they occur both in the upper and in the lower state.

G. HERZBERG.

H. H. Wills Physical Laboratory,
University of Bristol,
July 3.

[1] Part of this band system was discovered twenty-three years ago by Geuter (*Zeit. f. wiss. Phot.*, 5, 1, 1907).

Differentiation in the Dartmoor Granite.

IN his presidential address to the Devonshire Association on June 24, Mr. R. Hansford Worth devotes a section to a brief survey of Dartmoor geology and states, *inter alia*, that he cannot accept the idea of differentiated types of varied age for this granite mass.

As Mr. Worth points out, the granite as a whole is remarkably uniform in type, despite textural contrasts. But variants from the standard type are numerous, and their time-relationship to this type is often demonstrable.

Classified according to the C.I.P.W. system (based on detailed chemical analyses), these variants range from "II. 4. (2)3 . 3(4) to I . 4 . 1 . 2", with extreme types represented on one hand by highly biotitic vein-occurrences and, on the other, by considerable masses of quartz-felspar eutectic and pegmatite. The great bulk of the granite varies little from the type I . 4 . 2 . 3 which may be conveniently adopted as the standard. But the symbols for a suite of thirty granites representative of East Dartmoor, for example, reveal a graded and significant variation, which is more clearly shown in the following table:

	SiO_2. Per cent.	K_2O. Per cent.	Na_2O. Per cent.	Total Alkalies. Per cent.	CaO. Per cent.	MgO. Per cent.	Total Iron Oxides. Per cent.
Coarse granitoid inclusion in tor-granite "II . 4 . (2)3 . 3(4). . .	57·4	3·98	1·89	5·87	3·68	3·63	9·23
Tor-granite (Saddle Tor) I . (3)4 . "2 . 3.	71·69	4·59	3·03	7·62	1·49	0·66	2·50
A quarry-granite intrusive into tor-granite (Haytor) I . 3(4) . 1 . 3.	73·66	5·02	2·89	7·91	0·67	0·45	1·72
A typical aplite (Jordan) I . (3)4 . 1 . 2".	76·32	7·51	2·00	9·51	0·40	0·02	0·41

(Analyses by H. F. Harwood.)

In West Dartmoor, variation is still more striking. Notwithstanding this wide range of mass-composition, biotites separated and analysed prove to be varietally identical, and are associated with the same characteristic accessory minerals.

Essentially the same variation-trend is displayed by many granite complexes, both British and foreign, in which the mass-relation between differentiates and standard types also varies. As applied to such composite granite masses, 'stages of intrusion' imply nothing more than brief local pauses in the intrusion process.

The variation briefly indicated above is closely concerned with the tectonic history of the Dartmoor granite, its anatomy, and its space-form in relation to the country rocks and to the granites farther west. These problems are complex indeed, and admit of amicable and stimulating exchanges of opinion.

A. BRAMMALL.

Geology Department,
Royal School of Mines, S.W.7,
July 2.

Influence of Nitrogen Dioxide upon the Ignition Temperature of Hydrogen-Oxygen Mixtures.

H. B. DIXON has observed that the ignition temperature of hydrogen-oxygen mixtures may be lowered so much as 200° C. by small quantities of nitrogen dioxide. Hinshelwood[1,2] and his co-workers, who investigated this reaction afresh, found that the nitrogen dioxide concentration must lie between two definite limits to give the observed effect, and when the nitrogen dioxide concentration is above or below these limits, only a slow combination of hydrogen and oxygen ensues. Up to the present, it has not been possible to give a satisfactory explanation of the phenomenon.

Now, according to Mecke,[3,4] one of the oxygen atoms in nitrogen dioxide is relatively weakly bound (77 Cal.). On the other hand, in the chain mechanism proposed by Bonhoeffer[5] and Haber[6] for the hydrogen-oxygen combination, reactions are involved which are considerably more exothermic than 77 Cal.

It is legitimate to assume that the nitrogen dioxide is especially fitted to take up the energy of the 'hot' molecules produced in these reactions and then dissociates thus: $NO_2 \rightarrow NO + O$. The oxygen atom formed in this manner can then cause further reaction to take place. When the nitrogen dioxide concentration is great enough to form sufficient oxygen atoms, explosion takes place at a lower temperature.[7] (This is the lower limit of nitrogen dioxide concentration.)

Again, it has been shown[8] that the reaction I.,

$$O + NO_2 \rightarrow NO + O_2,$$

takes place more frequently than the reaction II.,

$$O + H_2 \rightarrow OH + H,$$

when it is assumed that the oxygen atom is not very strongly excited, which is, however, scarcely the case in these examples. The three body collision reaction, $O + H_2 \rightarrow H_2O$, which yields very 'hot' molecules, is likewise slower than reaction I.

Hence it follows that when the nitrogen dioxide concentration rises, the probability of the oxygen atom disappearing through reaction I. becomes greater and greater, until eventually the nitrogen dioxide concentration reaches a point where no explosion due to oxygen atoms develops. (This is the upper limit.) Taking suitable values for the velocity and the mechanism of an individual reaction, it is possible to derive the sharp limiting values of the nitrogen dioxide concentration observed by Hinshelwood (loc. cit.). The influence of nitrogen dioxide upon the ignition temperature of $CO - O_2$ mixtures found by

Sagulin and Semenoff[9] likewise finds a similar explanation.

HANS JOACHIM SCHUMACHER
(International Research Fellow).

Princeton University,
Princeton, May 16.

[1] Gibson and Hinshelwood: *Trans. Faraday Soc.*, **24**, 559; 1928.
[2] Thompson and Hinshelwood: *Proc. Roy. Soc.*, A **124**, 219; 1929.
[3] R. Mecke: *Z. phys. Chem.*, B **7**, 108; 1930.
[4] *Die Naturwiss.*, Dec. 20, 1929.
[5] Bonhoeffer and Haber: *Z. phys. Chem.*, **137**, 263; 1928.
[6] Haber: *Z. angew. Chem.*, 745; 1929.
[7] Farkas, Goldfinger, and Haber: *Die Naturwiss.*, **34**, 674; 1929.
[8] H. J. Schumacher: *J. Am. C. S.*, in press, 1930. G. B. Kistiakowky: *J. Am. C. S.*, **52**, 1868; 1930.
[9] Semenoff: *Chem. Rev.*, 350, September 1929.

Photography on Copper.

DURING a metallographic examination of some copper alloys it was observed that certain etching reagents produced a surface which was light sensitive, to such a degree that the illuminated area of the specimen turned black during a few seconds' examination under the microscope. The phenomenon has been investigated, and found to depend upon the well-known light-sensitivity of cuprous chloride. The process affords a simple and rapid method of obtaining a sharp photographic image on the surface of plates of copper and copper alloys, including white alloys like German silver. It appears, however, to have escaped observation, and a brief description may therefore be of interest. It seems possible that the process may have some technical application, although I do not know of any, and I should be glad to give further information to anyone interested.

The copper or brass surface is polished and cleaned as for engraving, and dipped for ten seconds into a ten per cent solution of cupric chloride or copper ammonium chloride. A very thin white film, which X-ray examination shows to be cuprous chloride, forms on the surface of the plate. The plate is washed in running water, rinsed in methylated spirit, and dried in the air. The methylated spirit not only accelerates drying, but also makes the film much more adherent, and the wet plate can be wiped with a cloth without the film being destroyed. The plate is now light sensitive. On exposure for a few seconds to the direct light from an arc lamp the surface turns black, owing to the conversion of cuprous chloride into cuprous oxide. For contact prints from ordinary negatives an exposure of about one minute to the light of an arc lamp is required. The image (positive) so obtained is about equal in definition and contrast to that obtained in the ordinary three-colour and photogravure processes. The image can be 'fixed' by washing in dilute hypo or salt solution, but since this also reduces the intensity of the image the plate should be over-exposed during printing. For many purposes, such as engraving, fogging by diffuse daylight is so slow that fixing is unnecessary.

C. J. SMITHELLS.

Research Laboratories of the
General Electric Company,
Wembley, July 2.

Absorption Band Spectrum of Chlorine.

As a mistake which I made in a paper under the above title appearing in the June issue of the *Proceedings of the Royal Society* has been repeated on p. 989 of NATURE of June 28, I should like to direct attention to it and to correct it. In the publication first referred to, I refer to "Aston's figure for the relative abundance of Cl_{35} and Cl_{37}". Dr. Aston informs me that he has never made a direct measurement of the isotope ratio of chlorine, or published a value for it calculated from his work.

The value 1·67 which I gave as the calculated ratio of $Cl^{35}Cl^{35}$ to $Cl^{35}Cl^{37}$ was derived by using the figure 3·35 : 1 for the ratio Cl^{35} to Cl^{37} calculated by F. W. Loomis (*Astrophysical Journal*, 52, 248; 1920), and quoted on p. 156 of "Isotopes" (F. W. Aston, second edition). Dr. Aston has kindly pointed out to me that the masses of the chlorine atoms (correcting for O^{17} and O^{18}) are 34·980 and 36·976 ± 0·006 for Cl^{35} and Cl^{37} respectively. Using the atomic weight 35·457 and these figures, the ratio Cl^{35} : Cl^{37} becomes 3·185 : 1, giving the calculated ratio $Cl^{35}Cl^{35}$: $Cl^{35}Cl^{37}$ = 1·59 : 1. This value agrees slightly better with that found from the band spectrum intensities, namely 1·35 : 1 (this is incorrectly given on the first line of p. 656 of the publication first referred to as 1·45 : 1; Table VII. of the same paper gives the correct value).

A. ELLIOTT.

Physical Laboratory,
University of Utrecht.

Effect of Magnetic Fields on Dielectrics.

PROF. BURNS in his letter in NATURE of July 12, p. 59, observes that he has found a decrease of power factor when a magnetic field is superimposed on a dielectric, normal to the alternating electric field, and refers to my paper on dipoles (*Phil. Mag.*, May 1930). The view that such effects may arise from the existence of a magnetic as well as a dipolar moment is tempting, although cursory consideration of magnitudes suggests that such an effect is likely to be small.

Smouroff, however, has investigated the effect of magnetic fields upon dielectrics from atomic and ionic considerations ("Int. Congress of Math." (Bologna), Sept. 1928, *Arch. El.* p. 31, 1929). On his theory a decrease of power factor appears possible in some cases, but it would seem more usual to expect an increase in power factor. Monkhouse (*Proc. Phys. Soc.*, vol. 31, p. 83) has made experiments upon the electrical breakdown of dielectrics in magnetic fields and also mentions that large increases of power factor have been observed in agreement with Smouroff's theories.

With solids a longitudinal field appeared to have much more effect than a transverse field. In absence of experimental details it cannot be concluded that these results are contradictory, but a further examination might give interesting information upon the limitations of Smouroff's theory and the applicability of an extension of the dipole theory.

S. WHITEHEAD.

The British Electrical and Allied Industries
Research Association,
36 and 38 Kingsway, London, W.C.2,
July 15.

Palæolithic Man in North-East Ireland.

DURING our present survey, unavoidably postponed last year, of existing exposures of the glacial series in Northern Ireland, we have found a palæolithic flake industry in flint, *in situ*, within undisturbed gravel beneath 21 feet of what appear to be fluvio-glacial deposits. We make this preliminary record in view of the significance of the discovery, which will form the subject of the presidential address to the Prehistoric Society of East Anglia in 1931.

J. P. T. BURCHELL.
C. BLAKE WHELAN.

July 12.

A Study of the Phenomenon of Spin in Airplanes.*

By H. E. WIMPERIS, C.B.E.

THE spin is a mode of motion of which we know very little. The general public are inclined to look upon it as necessarily dangerous, but this we do know it is not. It is only in rare circumstances and under fortunately rare conditions that danger arises. Nevertheless there is ample warrant for its study and for that study to be treated as one of high importance. New conditions of airplane operation are continually arising; the very increase of speed itself would ensure an entry into regions never before penetrated. Hence it is ever necessary to seek for remedies even before serious difficulty has arisen. This anticipating action always seems to me to be absolutely essential, and I am comforted by support in this view from no less an authority than Francis Bacon, who, in his essay "On Innovations", wrote: "Time is the greatest innovator; and if time in course alters things to the worse, and wisdom and counsel shall not alter them to the better, what shall be the end"?

So we have ahead of us the difficult task of diagnosing not so much actual diseases as mere symptoms, and of devising in anticipation suitable remedies. Spins from which recovery is difficult may be rare, but since from time to time they are reported, a vigorous investigation becomes necessary. Though that investigation is far from having been completed—indeed in some ways it is little more than begun—the interest taken by everyone in flying makes some account of our present efforts worth attempting, whilst the very complexity of the phenomenon is in itself a challenge.

THE SPIN.

The first step will be to describe what constitutes a spin, why certain forms of spin present difficulty, why the obvious remedies fail, and the form which the studies now in hand have taken.

Almost all airplanes are built nowadays to be stable in flight; if any small disturbance to their normal attitude occurs the craft tends by its own virtue to return to its previous attitude. The naval architect has always aimed so to design ships that they have this great quality. Indeed, a ship the stability of which depended upon the clever balancing action of its steersman would be decidedly unpopular.

Now, how does an airplane achieve stability? If one suspends a model airplane from a point above its centre of gravity it hangs in stable equilibrium. If slightly displaced it returns. When gliding in flight the upward pull of the string has to be replaced by the resultant of all the upward air forces on the wings and tail plane. If stability is to be obtained, this vertical resultant must pass through the centre of gravity of the craft. The usual way of ensuring this is to give an upward tilt to each wing (the dihedral angle), so that the air forces on the two sides are inclined and meet at a point in the vertical plane of symmetry. The relative inclinations of wing and tail plane can be adjusted in just the same way, and thus the resultant of all the vertical air forces is made to pass through the centre of gravity so that the airplane behaves as though suspended at an imaginary point above the airplane.

This is the condition of ordinary straight flight: centrifugal force does not come into the picture. With circular motion, however, it does. The airplane banks as it turns, the air forces bank with it, and their resultant force balances gravity by its vertical component and the centrifugal force due to the turn by its horizontal one. Hence motion in circles can be just as steady and just as normal as in straight flight. Inconvenient and even dangerous as the actual spin may sometimes be, the spinning airplane is not, so to speak, conscious of doing anything wrong. Its behaviour is purely normal and quite virtuous. There is nothing in it to suggest the vicious circle. When the radius of the turn is made gradually less and less, the angle of bank grows greater and greater until the vertical component of the air forces can no longer balance gravity and the nose drops; the motion then becomes a kind of tight corkscrew. The motion is still steady and is quite safe. It is safe because the pilot can convert the motion into ordinary straight level flight whenever he wishes to do so. If, however, the corkscrew is made tighter and tighter the motion of the airplane may suddenly change to one in which the air forces on the machine will automatically tend to make it tighter still. This is the spin.

Before the essential features of the phenomenon of spin can be grasped, it is necessary to consider in slightly more detail the nature of the forces which act on the wings of an airplane.

AUTOROTATION.

Airplane wings are of various shapes—some have concave undersurfaces and some convex—but all alike when inclined at an angle to the wind (the angle of incidence) give rise to an upward lift force and a small rearward drag. It is important to notice the manner in which the lift force changes as the angle of incidence increases. To begin with, the lift force doubles for each doubling of this angle, but once the latter has reached a certain amount, the lift force increases less rapidly until at a particular angle (known as the angle of stall and usually about 20°) the lift force ceases to increase at all, and instead falls off rapidly as the angle is still further increased. When this happens there is produced a new phenomenon altogether. For if any sudden 'bump' in the atmosphere causes the right wing (let us say) to drop and therefore to meet the air at a steeper angle, the lift force on that wing will *ipso facto* become less and the wing will tend to drop still further. In fact, the whole wing will tend to go on turning. This is the phenomenon of autorotation. It can easily be exhibited in a wind

* Discourse delivered at the Royal Institution on Friday, May 2.

tunnel by so mounting an aerofoil about a suitable axis as to give it a large angle of incidence; once the air stream is turned on the aerofoil will be found to be quite ready to rotate in either direction once some external cause has given it an initial push in that direction. (An experimental demonstration of autorotation was given at this point.)

The speed of autorotation depends upon the aerofoil section and the angle of incidence. In the case of a complete airplane it depends also on the disposition of the wings particularly in relation to each other and upon the arrangement of parts in the tail of the machine. It is the existence of the many factors which govern the occurrence and speed of autorotation which makes the study of the spin so complicated, that unless the problem is reducible to a few bare essentials a purely theoretical solution is scarcely to be anticipated.

When describing the tight corkscrew as a mode of motion I mentioned that this motion might suddenly change to the spin. This will happen if the angle of incidence should rise to the value at which for that particular wing section, and aerodynamic arrangement, autorotation sets in. Thereupon the forces acting on the airplane speed up the rotation and tend generally to take charge. Sometimes the machine is said to be 'locked into' the spin, but this language though understandable is really over strong, since the pilot by putting down the nose of the craft can bring the angle of incidence below that of autorotation; at once the autorotation couple dies away and the spin ceases.

How is a true mental picture of this complicated motion to be made? There are the resultant air force, the centrifugal force, and the gravitational attraction all acting on the airplane. We know that the last-named always acts vertically downwards, whilst the centrifugal force acts at right angles to the axis of spin. For equilibrium these forces must be balanced by the air forces, hence the resultant of these latter must have a vertical component equal to the weight, a horizontal and radial component equal to the centrifugal force, and a horizontal and tangential component of zero. This last has to be zero, since in steady motion there can be no acceleration in that direction, and any force necessary to drag the tail round must be supplied by a suitable component of the air forces which act on the aerodynamic surfaces. The resulting motions are known, but no disentanglement of the various air forces due to lift, drag, and sideslip has yet been made.

It was Bairstow who first suggested that the phenomenon of spinning could be imitated in a wind channel by setting an aerofoil at such an angle that self-rotation must occur. This is made clear in an Aeronautical Research Committee report dated October 1918. In this report Relf and Lavender showed not only why autorotation took place, but also how to calculate the rate of spin. Model tests showed excellent agreement with their prediction. The rate of spin was found to increase with the angle of incidence, and in a chosen example the rotational speed rose from about $1\frac{1}{2}$ spins per second to 2 spins per second when the incidence was increased from 20° to 30°.

It is clear from what has already been said, that a lift curve which did not drop after the stalling point would be much less likely to lead to autorotation, or would in any case delay it to so large an angle of incidence that it would be very rare for an airplane to be in the attitude at which spinning could occur. The so-called 'flat-topped lift curve' has this virtue in varying measure, as also have airplanes with slotted wings, for then the stalling angle is very large and could usually only be reached, if at all, by a deliberate jerk to the whole machine. Getting into a spin would then be a piece of voluntary acrobatics and not a pitfall awaiting the unwary. 'Pitfall' may seem a strong word, especially as the phrase of 'locking into' a spin has been deprecated on the ground that, after all, the pilot holds the key of the motion in the right use of his control levers. It seems, however, that certain forms of airplane have so high an autorotation couple that, given time to attain the full corresponding rate of spin, the centrifugal forces due to the unsymmetrical distribution of mass in the airplane may oppose and overcome the control force exerted by the pilot's actions, and this may happen the more readily on account of the spin having become so flat (the airplane being less inclined to the horizontal plane than the vertical) that the control organs in the tail, in the fin, and rudder, are shielded from effective action by the tail plane. At the same time the physiological action of the rotational forces on the pilot may hinder his actions. If one casts a kind of air-stream 'shadow' at 45° behind the tail plane, it will be seen that but little of the fin and rudder area can be effective in slowing up the undesired rotation or indeed in affecting it in any way.

The most elementary way of preventing this rapid spin from developing is to increase the size of the vertical tail surfaces, the fin and rudder, and to lengthen the fuselage so that a greater leverage is available. This leads to an increase of weight in the tail, and puts the centre of that weight still farther aft—both these actions lead to an increase in what are called the inertia couples due to the centrifugal force. The effect of these inertia couples is, as I will describe in a moment, to oppose the pilot's control of the machine, and so neutralise wholly or partly the good effect, from another point of view, of the larger tail surfaces and greater leverage. Nevertheless, there is sometimes an advantage on balance to be gained in this way, and for some time a ready criterion of spinning tendencies was used in America which depended principally upon whether or not the tail organs were inside a semicircle based on the wing span.

INERTIA COUPLES.

The effect of an inertia couple can be illustrated by taking the simple case of a rod having equal heavy masses at each end and pivoted at its centre of gravity. If one holds such a system at arm's length and turns round rapidly the rod takes up a horizontal position. This happens because the

centrifugal force on each mass is proportional to its radius of rotation, hence the mass which starts farthest out tends to go still farther out, and stability is only reached when the rod is at right angles to the axis of rotation. If a second similar rod were fastened at right angles, the forces upon it would balance those on the first rod. The combination would be neutral and would take up a neutral position. Hence an airplane with its masses symmetrically disposed would be free from such couples and free therefore from the peculiar difficulties of a flat spin. In practice, however, airplanes cannot be so made, and as a fair example of what occurs in practice the case of the well-known Bristol Fighter airplane may be cited. Here the moments of inertia about the longitudinal axis and the transverse axis are found to be about equal, whilst that about a vertical axis is half as much again.

A simple calculation shows that for any given rate of rotation this disturbing couple reaches a maximum when the fore and aft line of the airplane is inclined downwards at 45°. Once that angle is exceeded the couple grows less. When, therefore, an airplane is being brought out of a very flat spin the pilot has to exert a control not merely large enough to balance the inertia couple at the moment, but also large enough to overbalance this growing couple as the barrier angle is reached. The barrier angle will come at exactly 45° if the rate of spin remains constant, if it does not it may be somewhat above or below this angle. But a barrier there will in general always be, and recovery from any flat spin must depend on its being satisfactorily surmounted. (An experimental demonstration was given to show the effect of the inertia couple in raising the nose of the fuselage.)

A typical pilot's impression of the change from the ordinary spin to the flat spin appeared in one report as follows: "After the first two or three turns, which were relatively steep, the nose came up and the machine settled down to an exceptionally steady spin at moderately large incidence and a quick rate of rotation. There was no noticeable jerkiness during the turn."

(*To be continued.*)

The Bristol Meeting of the British Association.

Programmes of Sections.

Mathematical and Physical Sciences.

THE presidential address of Section A (Mathematical and Physical Sciences) will be delivered on Monday, Sept. 8, by Dr. F. E. Smith, who has chosen as his subject "The Theories of Terrestrial Magnetism." On each of the other days a considerable portion of the available time will be taken up by a series of related papers. Thus on Thursday, Sept. 4, there will be a discussion on "The Meteorological Relations of Atmospherics," in which Dr. R. A. Watson Watt, Prof. E. V. Appleton, M. R. Bureau, Dr. F. Schindlehauer, and Mr. M. A. Giblett will participate. On the following day there will be a series of papers dealing with aspects of the solid state, the contributors being Prof. J. E. Lennard-Jones, Prof. W. L. Bragg, Dr. J. D. Bernal, and Dr. F. Bloch. These will be followed by a brief discussion, opened by Prof. Heisenberg. On Tuesday, Sept. 9, there will be a discussion on flow in gases, and the aerodynamical and meteorological aspects of this subject will be dealt with by Mr. E. Ower, Mr. F. C. Johannsen, Mr. G. Bilham, and Mr. M. A. Giblett. The programme contains also the usual papers on particular investigations.

Many distinguished foreign visitors are contributing to the proceedings. In addition to those mentioned above, Prof. M. Siegbahn will present a paper on "The Highly Ionised Spectra in the Extreme Ultra-Violet," and the section will probably listen to other eminent visitors.

There will be a strong Sub-Section of Mathematics, and twenty papers appear on its programme. Several of these will be of interest to physicists and others. Thus Prof. S. Brodetsky will read a paper on "The Einstein Field-Theory," and Prof. A. C. Dixon will discuss integral equations, a subject which is rapidly becoming important in physical investigations. There will also be a paper on modern Babbage calculating machines by Dr. L. J. Comrie.

Chemistry.

For his presidential address to Section B (Chemistry) Prof. G. T. Morgan, director of chemical research in the Department of Scientific and Industrial Research, has chosen the title "A State Experiment in Chemical Research". He will discuss the development of the Chemical Research Laboratory at Teddington since its beginning five years ago. His account of the investigations now in progress at that institution will be illustrated by an exhibit of preparations, apparatus, and models of chemical plant.

On Friday, Sept. 5, a discussion will be held on the present position of the British dyestuff industry—a topic which is particularly opportune in view of the impending lapse of the Dyestuffs (Import Regulations) Act in January 1931. In opening the discussion, Prof. A. G. Green will review the development of the British industry since 1901, when he gave an account of the position at the Glasgow meeting of the Association. Subsequent speakers will be Prof. J. F. Thorpe, president of the Chemical Society and a member of the Dyestuffs Industry Development Committee, Sir William Pope, and the following members of the Dyestuffs Industry Development Committee: Messrs. C. J. T. Cronshaw, G. Holden, J. Morton, and Major L. B. Holliday. Mr. W. J. U. Woolcock will sum up the debate.

Another important discussion will be opened on Monday, Sept. 8, by Dr. F. L. Pyman, on "Chemo-

therapy". This is the first time that this important subject has been discussed, and those taking part include Prof. G. Barger, Prof. R. Robinson, Dr. A. J. Ewins, Dr. T. A. Henry, Dr. H. King, Prof. G. T. Morgan, and Prof. C. S. Gibson (Recorder).

Amongst other important individual communications are those by Prof. M. W. Travers, and Prof. N. Semenoff, of Leningrad. Prof. Travers will give an account of "New Experimental Methods for the Study of Gas Reactions". Although Prof. Semenoff is unable to attend the meeting, his paper on "The Initiation of Combustion" will be summarised by Prof. W. E. Garner, and it is hoped that this will lead to a discussion in which Prof. Garner and Mr. A. C. G. Egerton will take part.

GEOLOGY.

Prof. O. T. Jones's presidential address to Section C (Geology) will deal with "Some Episodes in the Geological History of the Bristol Channel Region", a subject that seems particularly appropriate to the place of meeting. Two of the items on the agenda arise out of the meeting in South Africa last year. Dr. G. Slater spent the greater part of his stay there in studying the earlier glacial deposits and will read a paper entitled "The Dwyka Tillite of Griqualand West". The question of the correlation of past pluvial and glacial periods is to be discussed jointly by Sections C, E, and H (geology, geography, and anthropology). It is perhaps doubtful if any geologist thinks this is possible at present, but a summation of the present position and a consideration of the difficulties in view may indicate lines for future work.

Perhaps of greater interest will be the sectional discussion on "The Validity of the Permian as a System". Since Murchison in 1841 divided the New Red Rocks into two systems, the Permian and the Trias, the status of the former division has been the subject of much controversy. Whilst abroad much greater thicknesses of rocks have been placed in that division, in England the system has been whittled down by the placing of the lower beds in the Carboniferous System. No doubt the exceptional British position will be thoroughly explored, and it is hoped that the wider aspects of the problem will receive due attention.

Both Upper and Lower Carboniferous Rocks come under review, for Prof. G. Delépine (of Lille) will describe "The Dinantian Zones of Goniatites in North France and Belgium", and Dr. D. A. Wray will discuss the sequence of non-marine lamellibranchs in the Upper Carboniferous of Yorkshire. Two papers on classification by Dr. A. E. Trueman and W. S. Bisat may prove somewhat controversial.

Of wide general interest should be Prof. J. W. Gregory's account of the recent cable fractures due to an earthquake in the Western Atlantic. The first description of a liverwort-like plant from the lower Downtonian of the Llandovery District will be made by Dr. A. Heard and Mr. J. F. Jones.

GEOGRAPHY.

The president of Section E (Geography) will be Prof. P. M. Roxby, of the University of Liverpool, whose address will be devoted to a review of "The Scope and Aims of Human Geography". Since one of the most fruitful local applications of the work of modern human geographers has been in connexion with the development of regional survey and regional planning, it is opportune that this aspect should receive particular attention at this meeting. Thus the main principles of the South-West Lancashire regional plan are to be analysed by Mr. Peirson Frank, while Prof. P. Abercrombie will deal with the problems of satellite towns. A discussion on these papers will be opened by Dr. Vaughan Cornish.

Various aspects of the Bristol region will be dealt with by Mr. W. W. Jervis and others, while the contribution made by Bristol to English exploration will be reviewed by Col. E. W. Lennard.

Problems concerning past changes in climate will occupy an important place in the work of the Section at the Bristol meeting, since in addition to the joint discussion with Sections C and H on the relations between past pluvial and glacial periods, the Section of Geography is to have papers dealing with climatic changes in historic times in parts of both the Old World and the New. The former will be dealt with by Dr. C. E. P. Brooks and the latter by Prof. A. E. Douglass (of the University of Arizona), who will be the foreign guest of the Section.

One morning is being devoted to papers dealing with various parts of Africa, and another will be occupied by a series of detailed physical and economic studies of parts of Great Britain.

ENGINEERING.

The subjects to be dealt with by Section G (Engineering) are somewhat broad in their scope. The president, Sir Ernest Moir, Bt., an authority on tunnelling and other operations at great depth, will speak on that subject in his address. Section G will afterwards join with Section I (Physiology) to discuss the physiological effects of the high pressures to which those working in these operations are subjected. This discussion is important, since these effects set a limit to what may be undertaken.

Of more general interest, perhaps, are three papers on "The Trend of Airship Development" to be given respectively by Col. V. C. Richmond, the designer of *R101*; Mr. B. N. Wallis, of *R100*; and Herr Direktor Doerr, of the Zeppelin Company. These papers will be followed by films illustrating the construction and operation of the British and German airships.

The question of the economical production of power, so important to us as a nation, is to be considered from various points of view. Mr. George A. Orrok, of New York, on "High Pressure and Temperature Steam"; Sir Henry Fowler, on "Fuel Consumption in Locomotive Practice";

and Messrs. A. L. Stanton and T. Stevens, on the "Distribution of Electrical Power", will lead the discussion.

The importance of Bristol as a centre of the aircraft industry is reflected in the paper on "Recent Developments in Air-cooled Aero-engines" by Mr. C. F. Abell, of the Bristol Aeroplane Co. Messrs. T. F. Hurley and R. Cook, of H.M. Fuel Research Station, Greenwich, will describe some of their researches on petrol engines; while Dr. S. J. Davies and Mr. Edmund Giffen will review the present position of the high-speed heavy-oil engine.

Section G will conclude the meeting with a discussion on steel for structural purposes and its standardisation. The degree of standardisation of steel sections can naturally exert a great influence upon costs of production, and the subject is to be treated from the points of view of the consulting engineer, the manufacturer, and the technician by Mr. J. S. Wilson, Mr. J. S. Lewis, and Prof. C. Bath respectively. Reports of the special research committees will also be presented.

Anthropology.

Anthropology (Section H) at the Bristol meeting will be under the chairmanship of Dr. H. S. Harrison, whose work has made the Horniman Museum a centre of study of the evolution of the arts and crafts. His address will appropriately be followed by a discussion of the project of a National Folk Museum, in which Dr. R. E. Mortimer Wheeler and Prof. J. L. Myres will take part, while the officers of the interesting museum of the City of Norwich will give an account of their valuable work. On Tuesday, Sept. 9, geologists, meteorologists, archæologists, and geographers will gather to discuss the sequence of phases of the Pleistocene ice age. Agassiz gave an early account of views on this subject at the British Association in 1840, while, about the end of that century, James Geikie in Britain and Penck and Brückner in Central Europe were trying to correlate phases in different regions. This difficult task is entering on a new phase in which study of maritime and river terraces is being brought into the question and dynamic considerations concerning growth and decline of ice sheets are playing an increasing part. The field work of Misses Caton-Thompson and Gardner in the Faiyum, of Messrs. Sandford and Arkell in Egypt, Leakey and Solomon in Kenya, Cammiade in South India, and Armstrong at Bambata in Rhodesia, will be brought into the scheme, and the discussion is likely to make a definite advance.

The University and city of Bristol have played a great part in anthropological studies, and a memorial lecture by Sir Arthur Keith will offer a tribute to the pioneer, Dr. John Beddoe, the chair being taken by Sir Evan Jones, an old student of Bristol and of Dr. Beddoe. The memory of Dr. Czaplička, at one time lecturer at Bristol, is cherished in anthropological circles, and the Spelæological Society of the University has made itself a place in the history of the science. It is, therefore, specially interesting that an unusual number of papers on local archæology and anthropology are being presented to the section after an introductory study of the area by Mrs. D. P. Dobson. The interesting discussion of the ruins at Zimbabwe in Rhodesia, which was a main feature of last year's meeting, will be continued by Miss Caton-Thompson, with Dr. Randall MacIver in the chair, an appropriate choice, as his book on medieval Rhodesia twenty years ago first made a serious attempt to combat fanciful speculations on this subject.

Physiology.

In Section I (Physiology) the work of the meeting will open with the presidential address by Prof. H. S. Raper on "The Synthetic Activities of the Cell". It is expected that this address will be characterised by vigorous thought and that it will provide material for lively expressions of opinion in the discussion to which the president has consented. Among the remaining items, in all probability the foremost in the breadth of its appeal is the joint discussion with Section G (Engineering), somewhat heavily entitled "Air Pressure Variations encountered in Engineering Works, and their Physiological Effects". The speakers from Section I will be (1) Capt. G. C. C. Damant, R.N., qualified not only by reason of his work with J. S. Haldane and Boycott, and his share in the preparation of the Admiralty tables regulating the decompression of deep-sea divers, but also by a personal experience of such work lasting over twenty years and including the recovery of £5,000,000 of bullion sunk in the *Laurentic*; and (2) Sir Leonard Hill, whose experience of air pressure and movement effects on the physiological side is well known and whose katathermometers (and their modifications) have proved of enormous value in the accurate recording of conditions calculated to promote the comfort of workers in unusual surroundings.

The remainder of the programme includes papers covering a very wide range. On one side, the section has a contribution from Dr. F. W. Edridge-Green of the Board of Trade, on the detection of certain forms of colour-blindness especially important in the mercantile marine and a discussion with Section J (Psychology) on primary colours which, one fears, is likely to prove interesting rather than conclusive. On another part of the wide field over which this section extends, Prof. Ruggles Gates is speaking on "The Blood Groups and their Inheritance". Again, Prof. A. Stanley Kent, well known for his discovery of the auriculo-ventricular bundle, is returning to the laboratory which he designed to communicate some of his hitherto unpublished work.

Psychology.

Section J (Psychology) this year meets under the presidency of Prof. C. W. Valentine, who in his presidential address will review the present position of child psychology. The proceedings will open with an intra-sectional discussion on "The Psychology of Adolescence". A joint discussion

has also been arranged with Section I (Physiology) on the question, "In what Sense can we Speak of Primary Colours?" The various branches of psychology are well represented, experimental perhaps more strongly than usual. A visit has been arranged to Stoke Park Colony, where the director of medical services, Dr. R. J. A. Berry, will give a demonstration of scientific and clinical methods of diagnosis of mental deficiency and will discuss their applicability to child guidance and normal children.

BOTANY.

Dr. A. W. Hill, of the Royal Botanic Gardens, Kew, is president of Section K (Botany) of the Association for the Bristol meeting. The emphasis at present being laid upon original investigation in mycology and plant physiology is reflected in Section K by the preponderance of papers dealing with these aspects of botany, Monday morning being devoted to the former and Tuesday morning to the latter.

A joint discussion (with Section M) on "Mineral Nutrition in Plants" will occupy the major portion of Friday morning. The various aspects of the subject dealt with during the discussion will be summarised by Sir John Russell. An excursion to Long Ashton to study material illustrating some features of the problem will be made during the afternoon.

Among the distinguished foreign botanists proposing to attend are Prof. F. A. F. C. Went, of Utrecht, who is to read a paper on "Wegener's Theory and the Distribution of the Podostemaceæ"; Dr. W. V. J. Osterhout, of the Rockefeller Institute, who is to contribute to the discussion on mineral nutrition; and Prof. W. Goodspeed, of Berkeley, Cal., who is outlining the results of his experiments with X-rays and radium on the species of the genus *Nicotiana*—a choice of subject which should have a particular appeal to the citizens of Bristol.

A number of attractive excursions have been arranged by local botanists, these including a visit to Mr. C. Hiatt Baker's garden at Almondesbury, and to the Somerset peat moors.

EDUCATIONAL SCIENCE.

The president of Section L (Educational Science) is the Right Hon. Lord Eustace Percy, whose presidential address will be entitled "A Policy of Higher Education". At the opening session of the section on Thursday, Sept. 4, papers will be given on "The Pre-School Child", by Miss Margaret Drummond (representing the Nursery School Association), Dr. J. A. Hadfield, and Dr. W. E. Blatz (Director of St. George's School of Child Study, Toronto).

Almost all one session will be devoted to "The Curricula of Central Modern and Senior Schools". Mr. W. A. Brockington will open with a general survey; Mr. J. A. White, Mr. H. T. Morgan, and Miss V. E. Carr Gordon will follow with papers dealing with the subject from the selective central school, the non-selective schools, and the modern girls' school points of view respectively. An interesting discussion will no doubt follow. The session will conclude with reports from sub-committees of the section dealing with training for overseas, the production and distribution of educational and documentary films, and the teaching of general science in schools, with special reference to the teaching of biology.

Another session will deal with formal training and disciplinary values in education. Dr. C. W. Kimmins will present the report of a sub-committee on formal training, and Sir Percy Nunn will read the first paper on "Disciplinary Value in Education", and will speak particularly with reference to "The Conception of Mental Discipline". Miss H. M. Wodehouse and Prof. F. A. Cavanagh will follow with papers on "Discernment of Disciplinary Values apart from Experiment" and "Some Further Practical Considerations". A final paper will be read by Dr. W. G. Sleight, and the discussion will be opened by Sir Richard Gregory.

For the final session the subject will be English and foreign ideas on method of education in relation to industry and commerce. Mr. Henderson Pringle and Sir Francis Goodenough are to deal with the subject mainly with reference to commerce; Dr. A. W. Richardson and Miss E. Webb Samuel will give papers dealing with the industrial aspect, and Mr. A. Abbott will conclude with a general paper on the whole question.

Afternoon visits to the local schools and the new Hospital School for Cripples at Winford are being arranged, and also a full day motor trip for the Saturday, during which Dauntsey School will be visited.

News and Views.

VERY hearty congratulations are extended to Sir Howard Grubb, who celebrates his eighty-sixth birthday on Monday next, having been born on July 28, 1844. Sir Howard was educated privately and at Trinity College, Dublin. In most parts of the world where observatories exist one may be sure that he has had a leading and expert part in the preparation of their equipment of mirrors, objectives, and all the varied apparatus and machinery of the modern astronomical observatory. Particularly is this the case as regards many of the great astronomical observatories of America; here his resourceful ingenuity has long been acclaimed. He has published many memoirs, chiefly through the medium of the Royal Dublin Society—among the earliest, "The Great Melbourne Telescope" (1870) and "On Clocks for Equatorial Telescopes" (1875). In 1896 he read a paper at the Royal Institution on "The Development of the Astronomical Telescope". In 1881 Sir Howard was the recipient of the Cunningham gold medal of the Royal Irish Academy, in recognition of work in the service of astronomers; in 1912 he received the Boyle medal of the Royal Dublin Society, awarded for scientific labours of outstanding merit carried out by Irishmen or in Ireland. Holding the honorary degree of master of engineering in the University of Dublin,

Sir Howard is also an honorary member of the Institution of Civil Engineers of Ireland. He was elected into the fellowship of the Royal Society of London so long ago as 1883.

DR. HERBERT LEVINSTEIN went fairly to the root of things in his presidential address to the Society of Chemical Industry delivered at Birmingham on July 15. "How we govern ourselves," he said, "how we arrange the exchange of our labour for goods or services, how we arrange our quarrels and our hates, social, racial, or international, all are merging into or depend on the greater problem of how we shall make the earth supply us with what we must have; how we can make the sun and the air do the maximum for us. This we may regard as one of the two great tasks of science. . . . The other problem of science is how to decrease human suffering by the conquest of disease." Hence the title of his address, "But an Apprentice in Nature's Workshop", and his remark that Aristotle's elements—earth, air, fire, and water—are the real raw materials of our organic chemical industries; hence also his statement that a striking weakness of Great Britain to-day as a manufacturing country is its dependence on coal as a source of power. We reckon wealth in terms of our store of fossils, but the age of coal is passing, and Dr. Levinstein suspects that the age of coal will take up but little space when the history of the world is written a few generations hence. "It will have lasted, when it is over, for a shorter period than the Moorish occupation of Spain." Other countries are developing the use of water power; we have little, but the problem of finding sources of energy alternative to a diminishing store of fossilised energy is none the less, rather the more, urgent.

AN industrial nation must have cheap power; although the exhaustion of our coal supplies will concern our descendants more acutely than ourselves, we of the present generation are faced with the alarming fact that coal is now no longer the cheapest source of power, and consequently it is no longer suitable for the new and large, cheap power industries. One such industry, that which produces aluminium, possesses the only outstanding hydro-electric installation in Great Britain; this will eventually represent about 840,000 tons of coal annually. We must therefore look for some other source of power. Politics must of necessity enter into the examination of such questions as are discussed by Dr. Levinstein. They can scarcely be considered along traditional lines, for tradition is a poor weapon with which to slay new and unmistakably fiery dragons. Familiar points of view may indeed prove sufficiently well placed to envisage the new domain of industry, but probably they will not, and the whole political side of the matter will have to be examined anew and 'without prejudice'. It is therefore only just that we should refer briefly to some considerations which Dr. Levinstein lays before our legislators.

THE business of Great Britain, as seen by the 'Manchester school' of economists, is to import raw material and food and to export manufactures; the main principle is to buy in the cheapest and sell in the dearest market. This, said Dr. Levinstein, is the "principle of the cheapjack"; to buy in the most trustworthy and sell in the most permanent market is a better maxim. He would therefore buy food and timber from those who buy our manufactures. There is at present a world over-production of manufactured articles which is likely to be permanent, whilst the over-production of food and wood is certainly temporary; when it passes, the opportunity for making arrangements for mutual interest between Great Britain and those sparsely populated nations which own wide areas of food and forest lands may pass with it. Further, Dr. Levinstein stresses the fundamental importance of the proper utilisation of the land in a densely populated country where land is relatively scarce. Let us decide, he urges, what proportion we should have under grass and then ensure that every acre, whether grassland or arable land, is compelled to yield the maximum of nourishment for the people. By the application to pasture of intensive methods, seventy million pounds could be added to the annual value of our milk and meat production; this is more than double the value of imported American cotton, and its magnitude indicates both that the grass-manufacturing industry is of national proportions, and that our present lack of a consistent agricultural policy demands attention.

MANUFACTURERS of chemical products in Great Britain have shown that they are able not only to produce efficiently the numerous chemical materials demanded in every avenue of modern life, but also to display their goods attractively, to stimulate interest and inquiry into their fields of activity, and to organise effective means for the interchange of opinion and the promotion of common interests. Speaking at the fourteenth annual general meeting of the Association of British Chemical Manufacturers, the chairman, Dr. G. C. Clayton, said that as regards chemical exhibitions Great Britain is far ahead of any other country. In none of the big foreign fairs is there a chemical exhibit comparable in magnitude, variety, or interest with that at the British Industries Fair. It is evident, therefore, that the principle that progress must be built on knowledge—a principle lying at the very foundation of the chemical, as of every other, industry—has been applied in the selling branch as well as in the manufacturing branch; the policy is wise and necessary, and should go far in maintaining and advancing the position which British scientific and commercial men have together won for a young, but vital, industry. At the same meeting, Dr. Clayton referred to agreements with the corresponding French and German associations to collaborate in work having in view the greater safety of workpeople. The study of risks of fire and explosion has already been completed, and the results of this inquiry will shortly be submitted to members for their information and criticism. It is satisfactory to find that it has been agreed to regard safety in industry as a matter on which there shall be the fullest and freest exchange of information, subject only to the limitations imposed by the need for safeguarding confidential details of methods of manufacture. Dr. Clayton included in his

address an expression of sympathy with the proposal for the establishment of Chemistry House; the ultimate industrial advantage is, he said, likely to be so great that everyone should do what he can to further the success of the scheme.

AT a recent meeting of the trustees of the Beit Memorial Fellowships for Medical Research, Sir James K. Fowler, trustee and honorary secretary, presented the annual report, reviewing the work of the twenty years of the existence of the fund. The Beit Fellowships were founded in 1909 by means of a gift of £230,000 by Sir Otto Beit. The total number of those who have held fellowships to date is 138, a considerable number of whom now hold or have held important posts on the scientific staffs of universities, colleges, and institutes. It is not possible to review the researches which have been carried out by Beit Memorial fellows, but those of Sir Thomas Lewis on the heart and of Prof. Edward Mellanby on rickets have been of outstanding importance. In 1927 a senior fellowship, value £1000 per annum, for research in tropical medicine was created and Dr. Edward Hindle appointed. His work on yellow fever has yielded important results. A vaccine has been prepared from the organs of certain monkeys infected with yellow fever which gives protection to other animals of the same species against a dose of virus a million times as great as that which is fatal to the unprotected. It has also been shown that Europeans may suffer from a mild disease scarcely recognisable as yellow fever, and if this is also true of natives, this may be the means by which the continued existence of the disease is maintained in endemic areas in the intervals between epidemics.

THE following elections have been made to Beit Memorial Fellowships for Medical Research, the proposed subject of the research to be undertaken by Junior Fellows and the place where it is to be carried out being given in brackets: *Senior Fellowship* (value £700 p.a.), Mr. R. J. Lythgoe. *Fourth Year Fellowships* (value £500 p.a.), Mr. P. Eggleton and Dr. F. R. Winton. *Junior Fellowships* (value £400 p.a.), Dr. F. H. Smirk (to study the functional pathology and physiology of diuresis from a biochemical point of view, and to study the functional pathology of plethoras, anæmias, and œdemas—Medical Unit of University College Hospital, London); Dr. G. R. Cameron (to complete work on the histological identification of calcium salts in pathological deposits and to commence study of inflammation in invertebrates—Graham Laboratory, Department of Pathology, University College Hospital School); Mr. J. McMichael (to continue present studies on the interrelationships of liver and splenic disease, mainly by clinical and pathological methods and animal experiments—Department of Medicine, University of Aberdeen); Dr. R. P. Cook (to study bacterial metabolism and its relation to the specific action between host and bacterial parasite—Sir William Dunn Institute of Biochemistry, Cambridge); Mr. N. U. Meldrum (to study the so-called reversible denaturation of hæmaglobin—Sir William Dunn Institute of Biochemistry, University of Cambridge); Mr. D. R. P. Murray (to make a comparison of the two types of proteolytic enzymes characteristic of the tissues and organs and of the digestive tract—Sir William Dunn Institute of Biochemistry, Cambridge); Mr. G. N. Myers (to study the curative action of digitalis, its glucosides, and allies, in general toxæmia and in conditions of shock—Pharmacological Laboratory, Cambridge); Mr. C. A. Ashford (for studies on the (*a*) metabolism of nervous tissue; and (*b*) mode of action of vitamin D with special reference to hyper-vitaminosis D—Sir William Dunn Institute of Biochemistry, Cambridge).

THE valuable work which has already been accomplished in Great Britain by the various research associations is well known to workers in pure science and technology. The wide dissemination of the results of their researches and the task of securing adequate appreciation of those results amongst the ranks of industrial workers are, however, matters of considerable difficulty. The British Cotton Industry Research Association attempted in part to meet these points some two years ago by the publication of a report on research in the cotton industry, which gave an account, as free from scientific terms as possible, of the main topics of the published research work of that Association. The British Research Association for the Woollen and Worsted Industries, in its recent publication, "Scientific Aid for the Wool Industries", has supplied a similar summary which should prove valuable to workers in the many branches of the woollen and worsted industries. Reference is made in the report to fundamental researches which are in progress, particularly on the physical, chemical, and biological sides. The textile technologist will appreciate the attempt which has been made to improve existing methods of testing. In this connexion the development of methods for the reeling of yarn, for the testing of yarn levelness, and for the autographic recording of strength and elasticity, deserve special mention. The report offers abundant evidence of the progress of the Association. Its success in its relationship with industry may be judged by the fact that a scheme for the support of the Association by means of a voluntary levy upon imported wool has recently been conditionally adopted by the industry.

WE are glad to learn that, after delay since August 1928, the Cultural Society of Peking and the Government of Nanking have jointly given permission for the renewal of Central Asiatic expeditions of the American Museum of Natural History. Dr. Roy Andrews is now in the field north-east of Kalgan, with a very strong party, including Messrs. Granger, Thomson, and Young of the American Museum staff, Père Teilhard de Chardin as associate palæontologist, two Chinese zoologists and palæontologists trained by Dr. Abel of Vienna, Dr. C. C. Young, and Dr. H. Chang. Lieut. W. G. Wyman, U.S.A., accompanies the party as topographer. The present survey is to the eastward of the Kalgan-Urga Trail where important Pliocene discoveries were made during the 1928 expedition, and the season's work will be chiefly in Pliocene horizons not represented in previous explorations west of the Kalgan-Urga Trail. Dr. Andrews' volume on the

narrative of the Expedition, Vol. 1 of the quarto series, is nearly ready for the press; Dr. Amadeus Grabau's volume entitled "The Permian of Mongolia" is now in press.

IN a recent issue we published a summary of, and commented upon, Sir Arthur Keith's lectures on recent discoveries of early man and their bearing upon our knowledge of his origin, development, and distribution (see NATURE, June 21, p. 935). How these discoveries have stimulated fresh interest in the discussion of man's place of origin may be gathered from an article by Prof. Elliot Smith which appears in the June issue of *Scientia*. As is well known, Charles Darwin in 1871 suggested that the survival in Africa of the two great apes most nearly allied to man pointed to that continent as the dwelling-place of our early progenitors. Many authorities have since taken the same view. On the other hand, the discovery of fossil apes in the Himalayas and of *Pithecanthropus* in Java has been held to point to Asia as the probable home of the human family. The evidence is reviewed, and carefully weighed, by Prof. Elliot Smith in his article. Notwithstanding the occurrence of a fossil ape in southern France, and setting aside the view of Schoetensack in favour of Australia and Ameghino's claim for South America owing to the absence in each of any possible ancestor of man, he concludes that the balance of probability is in favour of Africa. In arriving at this view he attaches considerable weight to the evidence afforded by the Taungs skull, now determined to be of Lower Pliocene age. He holds that while the Taungs skull cannot be mistaken for the gorilla or chimpanzee, and in the absence of prominent eyebrow ridges and in its upright forehead it resembles the orang, it affords definite though slight indications of the beginning of the process of refinement of the features that is an essential part of the transformation of the ape into a human being.

IN October next a pageant entitled "Heart of Empire" will be held at the Royal Albert Hall. The date opportunely coincides with the meeting of the Imperial Conference which is to be held in London during that month. The pageant is to be taken from the book "Hyde Park: its History and Romance" by Mrs. Alec Tweedie, of which a new and abridged edition recently published is noticed in another column. It will last from Oct. 13 to 25 inclusive, and the proceeds will be given to charities. Each evening will have a special character—Oct. 14 the Lord Mayor, Oct. 15 Canada, Oct. 16 Australia, and so forth, the last evening being given to the United Services. It is gratifying to note that what may be called the imperial function of science is not to be overlooked, and one night, that of Oct. 22, is to be devoted to learned societies. Among the list of patrons, which includes the Maharajah of Kapurthala, the Dowager Maharanee of Cooch Behar, the Maharajah of Burdwan, the Duke of Sutherland, the Marquis of Londonderry, the Marquis of Aberdeen, Lord Jellicoe, Lord Meston, Lord Irwin, Viceroy of India, and a distinguished array of ministers, ex-ministers, and administrators, are also a number of prominent men of science. Among these are Sir John Rose Bradford, president of the Royal College of Physicians; Sir William Bragg, director of the Royal Institution; Sir Charles Close, president of the Royal Geographical Society; Sir Frank Dyson, Astronomer-Royal; Sir Arthur Keith; Sir Ronald Ross; Sir Ernest Rutherford, president of the Royal Society; and Prof. J. F. Thorpe, president of the Chemical Society. The organisers of the conference are to be congratulated on their far-seeing policy, which will bring home to a wide public the vital interest of science in, and its close connexion with, the problems of a world-wide empire such as ours.

MR. J. L. BAIRD has recently made further progress in perfecting the applications of television for theatrical purposes. We see from the *Times* that a demonstration of this new art will form part of the programme of the London Coliseum in the week beginning July 28 and onwards. A disadvantage of the home television sets which are now on the market and receive broadcast television at certain hours of the day is the small size of the televised images. This makes it possible for only two or three people to see the screen properly. In the new apparatus for use in a theatre, the receiving screen is divided into 2100 elements. Each element consists of a cubicle which contains a tiny metal filament lamp, the front of the cubicle being covered with ground glass. The lamps are in circuit with bars on a large commutator. As the commutator revolves, each of the lamps is switched on in succession. The whole of the 2100 lamps are switched on and off in one-twelfth of a second. When operating, the incoming television signal is first of all amplified. The amplified current then flows through the revolving commutator. The current is strong at a bright part of the picture and weak at a dark part, and the picture is built up of a mosaic of bright and dark lamps. The lamps are not instantaneous in their action, and in this respect they differ from those used in other television devices. Great brilliancy, however, is attained by this means, and the flickering is much reduced. Experiments have been made at the Baird laboratories on the transmission of images showing considerable detail. It seems quite feasible to broadcast these pictures to distant cinemas by means of land lines.

A CIVIC WEEK lecture on "Science and the Fishing Industry", delivered at the University College, Hull, on Oct. 16, 1929, by Prof. A. C. Hardy, has been recently published as a pamphlet by Messrs. A. Brown and Sons, Ltd., Hull, price 6*d*. Prof. Hardy, who was chief zoologist to the *Discovery* expedition, discusses at some length the bearing of marine biological research upon the problems which confront the fishing industry. The men of science, he points out, by patiently investigating the many factors, some known, many yet unknown, which influence marine life, are gradually piecing together the story of what is going on below the surface of the sea. The work is laborious, disappointments are many, and progress is slow. Nevertheless, much has already been done, and last year,

for the first time in history, it became possible to forecast the prospects of certain fisheries. This is a great achievement, and Prof. Hardy is confident that, with more knowledge, this work can be extended and perfected so as to be of immense practical value. To bring immediate financial benefit to the trade, however, is not the only function of marine investigation. Much of its efforts must of necessity be directed towards the accumulation of knowledge which will result in no immediate gain to the industry, but is absolutely necessary as a basis for intelligent legislation in future, should occasion demand it. A strong plea is made for more co-operation between science and the industry—between the research worker and the fisherman. Each has much to learn from the other. Stress is also laid upon the paucity of financial support for scientific research. The trade, says Prof. Hardy, pays but a few hundred pounds a year to research institutions, and that more as a kind of charity than as an economic investment. To be of real benefit, research must be carried out on a scale bearing a reasonable relation to the magnitude of the industry. For this to be done, ample funds are essential.

AT the recent World Power Conference, Dr. Oskar Oliven gave a remarkable address on a "European Grid Power System". He pointed out the gradual growth of small power plants to huge power stations, the voltages of which were ever increasing. Interconnexions were being made between these stations, resulting in important economies being effected. Exchange of energy and compensation of load were now taking place over political frontiers, and the question had now become one which had to be considered by the whole of Europe. The problem could be solved if the visible and invisible boundaries which separated nations could be freely opened to the passage of electric energy for their mutual benefit. The idea of the peaceful co-operation of nations was gaining ground. The approximate length of the European super power system he suggested was 6000 miles. It included Calais, Rome, Constantinople, and Oslo. Britain and the northern part of Russia are left out for economical reasons. He assumes that capital can be obtained at 4½ per cent interest, and that the total cost would be about £100,000,000. He calculated that the average cost per unit would be reduced to about the fifth of a penny. He proposes to use a supply pressure of 400 kilovolts. There are now no technical difficulties in the way. He considers that the utilisation and application of electricity has become one of the strongest factors in international economy. A map of the proposed European grid is published in the *Electrician* for July 4.

AT the ninth annual general meeting of the Empire Cotton Growing Corporation, held in Manchester, with Lord Derby in the chair, on May 29, his son, Lord Stanley, made some very interesting comments upon the possibilities of agricultural development in India as affected by the coming completion of the Sukkar Barrage on the River Indus. With the completion of this barrage, which is anticipated for 1932, it is estimated that the irrigated area in India will increase from 2,035,000 acres to 5,394,000 acres, and much of the new land is thought to be of very good quality, capable of producing a better class of cotton than is at present grown in any cotton district. Lord Stanley made two very important and suggestive criticisms in connexion with this vast scheme. He pointed out that if full use is to be made of this new area under irrigation, the advisory research services which must guide in technical matters should be created *now*; Lord Stanley is emphatic that progress should be speeded up in this direction. He also pointed out that it is essential that some large estates be created in the new irrigation area, with the necessary capital and equipment in men and materials to enable new methods of cultivation, adapted to the changed conditions, to receive a thorough trial. The small cultivator is too conservative and too poorly equipped to make the necessary trials of new methods, and unless some large estates are organised in good time, much time may be lost after irrigation commences in learning how to make full use of the new potential sources of agricultural fertility.

THE first report of the Museum of Science and Industry, Chicago, founded by Mr. Julius Rosenwald in 1926, covers the period July 1928 to December 1929, and is a record of very active progress which, if maintained, will place the Museum in the forefront of such institutions in the United States. The provision of a building is always a serious matter, but it appears that from the first the founder had in view the utilisation of the much-admired Fine Arts Building erected for the World's Fair in Jackson Park in 1893. It is more than doubtful whether it would not have been wiser to have had a new building. Facts go to show that the cost of reconditioning this old building is going to be as great as the cost of a new one without any corresponding advantages. The Director, Mr. Waldemar Kaempffert, was appointed in 1928, and he has studied the older institutions of the same kind in Europe, particularly the Deutsches Museum at Munich. It is evident that he has been strongly influenced by what he has seen and no radical departure from them appears to be in view. He is alive to the necessity of drawing up beforehand schemes of what ought to be shown, and he is avoiding the pitfalls of accepting objects not strictly within the scheme; he is obtaining, too, the co-operation of individuals and firms. In fact, the idea of the industrial museum at last seems to have gripped the American imagination. We wish the institution much and early success.

IN the annual report of the Geophysical Laboratory of the Carnegie Institution of Washington for 1928–29 (*Year Book* No. 28 of the Institution), the director (Dr. A. L. Day) describes two important scientific expeditions in which the laboratory has participated. The first was for the study of volcanoes in the Dutch East Indies, where many active volcanoes are found within a small area; Dr. Zies, who undertook this work, went provided with spectrographic apparatus for the investigation of volcanic flames. This part

of the programme was unsuccessful, but valuable experience was obtained which it is hoped to utilise later; and gases, incrustations, and lavas were collected which have provided interesting material for laboratory studies. The other expedition was a gravity-measuring cruise in a United States submarine, using the methods and apparatus of Dr. Vening Meinesz, who accompanied the expedition; the U.S. Navy and the National Academy of Science co-operated with the Geophysical Laboratory in this work. A cruise of 45 days was undertaken in October and November 1928, in the Gulf of Mexico and the Caribbean Sea. Measurements of gravity were made at 46 sea stations, as well as others in various harbours. It was found that isostatic compensation in the Mississipi Delta is practically complete, despite the deposition of nearly 12 billion tons of matter there each year. But anomalies indicate that the Nares Deep is a recent uncompensated geological feature in which there must be large shearing stresses (see NATURE, Mar. 23, 1929, p. 473).

THE University of Melbourne has recently issued in bound form several volumes of "Collected Papers from the Science Laboratories". Vol. 5 consists of separata that have appeared during the years 1910–1928 and come from the following departments: Anatomy, 9 papers; zoology, 19 papers; and veterinary science, 14 papers. The papers cover a wide range of subjects, and in all departments deal with matters not only of local interest or rather concerning local material, but also of a more general nature. The former group contains anatomical investigations of Tasmanian aboriginals and Melbourne criminals; a number of descriptions of new Australian invertebrates, parasitic and otherwise, and studies on the parasites and diseases of Australian cattle. The second group include anatomical studies of man and other mammals; investigations into the development of the fowl, and parasites and diseases of cattle not limited to Australia. Altogether the papers show a commendable recognition of the importance of research as an essential function of University activity. From the personal point of view we are glad to see the name of Baldwin Spencer as part author of one of the papers in the zoological section, as it is probably the last paper by one whose recent death has deprived the University of an outstanding personality.

THE Report of the Secretary of the Smithsonian Institution for 1929 records a year "gratifyingly and unexpectedly rich in progress". One of the most important ventures has been the addition to the research laboratories of a new department, the Division of Radiation and Organism, the object of which will be to investigate the relationship between radiation and the growth and health of plants and animals. During the year twenty-nine expeditions, fitted for anthropological, geological, biological, or astrophysical investigation, sought knowledge and materials in distant parts, from Alaska to China, Cuba, and Haiti. As material has flowed in publications have flowed out, including, in addition to the usual monographs and articles, four volumes of the 12-volume set entitled "Smithsonian Scientific Series". The National Zoological Park has obtained a new building for birds, believed to be the best for its purpose in the world, and provision has been made by Congress for a new reptile house equally well designed; and certainly not least, an extensive collection of paintings and art treasures, valued at several million dollars, has been given by Mr. John Gellatly to the Smithsonian for eventual exhibition in the National Gallery.

WITH reference to our remark (June 14, p. 901) on the lack of a serious policy for the encouragement of children in the national museums, Dr. G. H. Carpenter sends us an account of the school work conducted in the Manchester Museum. Five trained teachers specially appointed by the City Education Authority take five classes a day, and each class, paying a weekly visit, gets a systematic course of lessons, with the advantage of illustrative specimens and objects freely placed at the teachers' disposal. Such an arrangement is excellent; it is the best possible plan under the passive system where the museum allows the fullest use to be made of its treasures. Our notion was that, if the system of the Peabody Museum were adopted, the national museums by means of their own staffs—specially appointed for the purpose, of course, but responsible to the museum authority—would become active agents in spreading knowledge of their treasures inside and outside the museum. We look forward to a time when it will be recognised that education is as much the duty of a museum as is the care of specimens.

ETON COLLEGE has followed excellent precedents in having formed a Natural History Society, the threefold purpose of which is to observe and collect local plants and animals, to make and listen to lectures, and to keep a log-book of all observations. The first annual report (1930) records a creditable number of these original faunistic observations, which concentrate upon the stock lists of birds and Lepidoptera; but there are many little problems of local distribution and numbers, of life-habits, and seasonal changes, which the members could tackle with advantage to their own powers of observation and reasoning, and to the advance of scientific knowledge. There is evidence in the report of abundance of enthusiasm, and we wish the new Society a long life and a busy one.

IN the General Report of the Survey of India 1928–1929 one of the most notable achievements recorded is the completion of the survey of Chitral on the 1-inch and ½-inch scales. This was one of the most difficult pieces of work in the survey of India. Another achievement was the survey of about 800 miles of previously unexplored country in Bhutan by permission of the Bhutanese Durbar. A summary of topographical surveys shows that about forty-eight thousand square miles was surveyed during the year, an area rather in excess of the average of recent years. So steady is the progress of the work that rather more than half the total area of the Indian Empire has now been surveyed, mainly on a 1-inch scale, but in places

on a ½-inch or ¼-inch scale. The report contains a key sheet to all maps of the survey of India.

THE North-West Territories Branch of Canada's Department of the Interior has issued a finely illustrated handbook entitled "The North-West Territories, 1930". This gives besides a general account of an area which embraces over a third of Canada, many valuable notes on the forests, other vegetation, and wild life. Particular attention is paid to the Eskimo, who, according to a census made in 1927, number little more than 7100. The Department of the Interior has also published a revised map of the North-West Territories on a scale of 60 miles to an inch. It has no orographical detail but there are a wealth of names and indications of all the police and trading posts and the position of the game preserves. From the Natural Resources Intelligence Service of the same department comes a finely illustrated volume on the province of New Brunswick with several maps and much statistical information. Copies can be obtained free of charge from the National Development Bureau, Ottawa.

ALTHOUGH the present buildings of the Mellon Institute of Industrial Research were completed only in 1915, for practically ten years the Institute has had a waiting list of companies with problems for investigation. A new building is therefore to be erected and work on it will start this year. In addition to providing a greatly increased number of laboratories, the new building will give more commodious quarters for the general departments. The present library contains 11,000 volumes; the new library is planned to accommodate 250,000 volumes. The present Department of Research in Pure Chemistry will be expanded and facilities for pure research in other branches of science will be provided. Much more elaborate chemical engineering laboratories are to be available, and the fellowships in each specific field of industrial research are to be grouped in suites of rooms so that they can best make use of general apparatus adapted to their needs. Certain rooms will be equipped for specialised phases of experimental technique, such as electrochemistry, spectroscopy, low-temperature studies, radiations, high-pressure experimentation, etc. Other special features to be included are a large lecture hall, a dining hall, an industrial fellowship museum, and an underground garage. The new laboratory will be seven stories high, with monolithic columns along all four sides, and approximately 300 feet by 400 feet. The laboratories are to face on interior courts, and additional laboratory suites can be constructed in the interior courts without interfering with the original laboratory units.

THE Messel medal of the Society of Chemical Industry was presented to Lord Brotherton of Wakefield during the forty-ninth annual meeting of the Society, for his services to chemical industry.

THE Minister of Agriculture and Fisheries, with the approval of the Army Council, has appointed Brigadier H. St. J. L. Winterbotham to be Director-General of the Ordnance Survey, in succession to Brigadier E. M. Jack, who retires on July 31 next. Brigadier Jack was president of Section E (Geography) of the British Association for the South Africa meeting last year.

A PROGRAMME has now been issued of the Southampton meeting of the Institute of Metals, to be held on Sept. 9-12. The proceedings will be opened on Sept. 9, when the ninth autumn lecture will be given by Prof. D. Hanson, on "The Use of Non-Ferrous Metals in the Aeronautical Industry". The mornings of Sept. 10 and 11 will be devoted to the reading and discussion of metallurgical papers, several of which are being contributed by distinguished metallurgists from abroad. Some attractive visits and excursions, including a trip to Cherbourg during the following week-end, have been arranged in connexion with the meeting.

A CONFERENCE on Soil Science Problems, to be opened by the Right Hon. W. G. A. Ormsby-Gore, will be held at the Rothamsted Experimental Station on Sept. 16-18 under the auspices of the Imperial Bureau of Soil Science. The discussions will cover soil analysis, surveys, field experimentation, and similar topics. The Conference will be the occasion of the annual visit of Empire agricultural officers.

A FURTHER step to encourage co-operative marketing in Great Britain is seen in the modification of the terms under which loans to marketing enterprises are issued. The Ministry of Agriculture's Advisory Committee on Co-operation and Credit has recommended that the initial period of remission of interest on a loan may be extended from two up to five years. Full particulars are published in Marketing Leaflet No. 19, which may be obtained post free from the Secretary, Ministry of Agriculture and Fisheries, 10 Whitehall Place, London, S.W.1.

A CORRESPONDENT has directed our attention to the fact that recently two tubes of anhydrous aluminium chloride supplied to a school laboratory exploded on opening. It should be kept in mind that these tubes frequently contain a considerable pressure of hydrogen chloride gas and are liable to burst if any attempt is made to open them with a file. The tubes are perhaps best opened by wrapping in a thick duster and softening the drawn out end with a blowpipe flame. When the rush of gas ceases, the tube may be cut open. We think it would be advisable for the dealers to attach some such information as a label on the tube, but in any case those teachers who are not aware of the danger would do well to take note of it and should never allow pupils to open such tubes.

AN International Illumination Congress will be held in Great Britain in 1931 under the auspices of the International Commission on Illumination (which succeeded the International Photometric Commission) and is being organised by the National Illumination Committee of Great Britain and the Illuminating Engineering Society. The first week of the Congress, Sept. 3–12, will consist of a tour starting from London and visiting Glasgow, Edinburgh, Sheffield, and Birmingham; technical sessions will be held at each city. The second part of the Congress, Sept. 13–19,

will be at Cambridge. The subjects for discussion include factory lighting, street lighting, museum lighting, laboratory technique, and so on. The countries represented by National Committees on the International Commission on Illumination include most of the European powers, Japan and the United States; the president (1927–31) is Mr. C. C. Paterson, honorary secretary Dr. J. W. T. Walsh, and central bureau the National Physical Laboratory, Teddington. The honorary general secretary of the 1931 Congress is Col. C. H. S. Evans, c/o Illuminating Engineering Society, 32 Victoria Street, London, S.W.1.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—Assistant entomologists under the Division of Economic Entomology of the Australian Commonwealth Council for Scientific and Industrial Research, for research work on buffalo fly and blowfly problems—F. L. McDougall, Australia House, Strand, W.C.2 (July 30). A lecturer and demonstrator in plant pathology at the Swanley Horticultural College—The Principal, Horticultural College, Swanley, Kent (July 30). An evening teacher in electrical engineering at Goldsmiths' College—The Warden, Goldsmiths' College, New Cross, S.E.14 (Aug. 2). A lecturer in charge of the mining department of the Walker Technical College, Hartshill, Wellington, Shropshire—The Principal, Walker Technical College, Hartshill, Wellington, Shropshire (Aug. 9). A curator of the natural history department of the Kelvingrove Art Galleries and Museums, Glasgow—The Town Clerk, City Chambers, Glasgow (Aug. 15). A cotton classer, a cotton entomologist, and an assistant pathologist, each under the Department of Agriculture and Stock, Brisbane—The Official Secretary, Queensland Government Offices, 409 Strand, W.C.2 (Aug. 20). A lecturer in chemistry at the Leicester College of Technology—The Registrar, Colleges of Art and Technology, Leicester (Aug. 25). A demonstrator in chemistry in the University of Aberdeen—The Secretary, The University, Aberdeen (Aug. 30). An expert hydrobiologist for fisheries investigations in Turkey—The Expert-Adviser of Fisheries—Mr. E. C. Weberman—Beyoglu, Sira Servi 4, Istanbul, Turkey (Sept. 15). A George Herdman professor of geology in the University of Liverpool—The Registrar, The University, Liverpool (Sept. 30).

ERRATUM.—In NATURE for July 19, p. 109: Paragraph "The Planet Saturn", line 7, for 838,500 read 838,500,000.

Our Astronomical Column.

Recent Solar Activity.—During the last few months there has been a noticeable absence of large sunspots and a steady diminution each month since January in the average daily number of groups. Although the solar cycle is progressing towards minimum, the very active period (Nov. 1929–Jan. 1930) and the present one of decline (Mar.–June 1930) would seem to be merely one of the many 'ups and downs' shown by the sunspot curves of preceding cycles when plotted from means taken over periods of a month or of a solar synodic rotation. Unless the present cycle is abnormal, the minimum is to be anticipated about 1934. During the last fortnight there have been signs of a revival of activity. On July 13–14 two large prominences were seen at the sun's east limb, and they could be followed as dark absorption markings in hydrogen or calcium light as the sun's rotation brought them across the disc. The larger and more massive prominence, in latitude about 25° N., was seen with the spectrohelioscope at Greenwich on July 18 as a strongly defined marking nearly 6′ in length, although still somewhat foreshortened, and inclined about 30° to the sun's equator.

The Approaching Opposition of Eros.—Eros will be nearest to the earth at the end of January 1931, when its parallax will be 50·3″. Dr. H. Spencer Jones contributes a paper with useful hints to observers which is published in *Astr. Nach.* 5715.

The rapid motion of Eros makes short exposure times and rapid plates desirable. The relative advantages of guiding on Eros or on the stars are discussed. It is thought that a suitable plan may be to follow Eros in R.A., but allow it to trail in declination. It will be brighter than most of the comparison stars, and its light should be reduced by a rotating sector. No photographs should be used in which the conditions of seeing have not been constant, as this may involve an error in the effective mean time of mid-exposure.

The light of Eros is sometimes subject to rapid variations; this also may affect the mean time of mid-exposure. The times of beginning and end of exposure must be accurately noted, on account of the rapid motion.

One of the useful by-products of the campaign will be an improved mass of the moon. Photographs for this purpose should be taken at the times when the difference of the R.A. of Eros and the moon is near 0^h, 6^h, 12^h, 18^h. These photographs may be taken near the meridian, whereas those for parallax in R.A. are taken at large hour-angles.

It is recommended that stars of extreme colour (types *B* and *K5* to *M*) should not be used as comparison stars. *Harvard Bulletin* No. 871 gives the spectral types of the primary reference stars that are not in the Henry Draper Catalogue.

Meteors connected with Comet 1930 *d* (Schwassmann-Wachmann).—It was noticed soon after the discovery of this comet that its orbit approached that of the earth fairly closely. A watch for possible meteors was kept at the Kwasan Observatory, Kyoto, Japan. *Bulletin* No. 172 of the Observatory reports that Mr. T. Miyasawa observed numerous meteors on May 21 and the following nights. Mr. S. Sibata has derived the following orbit for the comet, by Miss Hayford and Mr. Anderson, is given for comparison:

	Meteors.	Comet 1930 *d*.	
T	—	1930 June 14·21981 U.T.	
ω	212° 24′	192° 19′·4	1930·0
Ω	60 10	76 45·2	1930·0
i	18 50	17 17·9	1930·0
log q	9·965	0·004934	
Period	—	5·2668 years.	

Mr. H. E. Wood has pointed out that there is a general resemblance between the orbit of this comet and that of comet Pons-Winnecke, suggesting that the two comets may have had a common origin.

Research Items.

Melanesian Shell-Money.—In No. 1 of vol. 1 of the *Anthropological Series of the Publications of the Field Museum, Chicago*, Mr. Albert B. Lewis describes the Melanesian shell-money in the museum collections. Many different kinds of shell-money are in use in Melanesia, but each is confined to a small area, outside which it has little or no value. Usually it takes the form of small discs on varying lengths of string; but in some places, such as the central Solomons, large shell-rings were manufactured which had a high value. Tanga arm rings in New Zealand would each buy a wife or one or two pigs. In the Gazelle Peninsula, New Britain, the *dwarra* currency was strung on rattan which could be broken to any length to make change. The Duke of York Islands was an important centre for the manufacture of the broad-shell variety of money called *pele*. It was put up in short strings tied in bunches. Though it had a standard value it was not actually used as money, but was traded to New Ireland and New Britain. The chief centre of manufacture of shell-money was the small islands around New Ireland, and the great number of these islands must be held to account for the great number of varieties. The value depended on colour and workmanship, the most valuable being the small red discs. The most elaborate and valuable variety of New Ireland money was that known as 'pig money', which was used for the purchase of pigs for use in ceremonial. Its value was so great that only very wealthy people could acquire it. It has long disappeared from use. Shell disc money, though not so common as in New Ireland, was also in general use throughout the Solomons, Santa Cruz, Banks, Northern New Hebrides, and New Caledonia.

Urn-Burials in Alabama.—Among papers submitted to a Conference on Mid-Western Archæology held in St. Louis, U.S.A., in 1929, of which a report is issued as *Bull. No. 74* of the National Research Council, Washington, was an account of recent discoveries made along the Tallapoosa and Alabama Rivers by Mr. P. A. Brennan. Among them a large number of urn-burials were found. This custom is said to be an indication of Choctaw cultural influence. The Choctaw are said to have placed their dead on racks until the flesh had decayed before burying them. Articles associated with these burials indicate that they had a much higher cultural level than their descendants. Their pottery is of heavy earthenware, shell-tempered, glazed with charred grease, and sometimes the vessels are of a capacity of eight gallons. At Montgomery a cache of twelve urns, each covered with a bowl, all contained skeletons—adults, children, and babes. Several contained remains of more than one individual. The largest was 26 inches in diameter and the smallest 8 inches. Yet the latter contained the complete skeleton of a baby. The urns were close to the surface and the arrangement may have been intended to represent a constellation. A similar find made a few years ago consisted of nine urns arranged around a central urn. A vault-like placing had been attempted in a hole 25 feet in diameter which had been cut in red clay. Into this was poured quartzy gravel, periwinkle and mussel shells from the kitchen middens, and then ashes. After the vessels had been placed in position, they were surrounded with layers of gravel, shells and ashes, and then covered with clay. This was then hardened by fire. Interments in the earth and apparently contemporary accompanied them. Shell objects, though not numerous, are indications of a high civilisation, while the shell pictures, especially that of a figure with its protruding tongue transfixed by a sword, suggest contact with Mexico.

Economic Standing of Members of the Crow Family.—Having already discussed the food of the rook and jackdaw, Dr. Walter E. Collinge (*Jour. Ministry Agr.*, May 1930, p. 151) turns to four other members of the family, the carrion crow, the hooded crow, the magpie, and the jay, all of which have been condemned from one point of view or another. His conclusions do not support the almost universal views of game-preservers, and they are of great interest to a more important group of economic workers, the farmers. It was found that 36 per cent of the food of these birds was of direct benefit to the farmer and fruit-grower, since it consisted of injurious insects, mice and voles, slugs and snails. On the other hand, 18 per cent was injurious, but of this, half represented the destruction of the eggs and young of wood-pigeon, blackbird, gulls and ducks. Evidently any destruction of these 'crows' is prejudicial to the interests of the farming community. Even so far as game-preserving is concerned, Dr. Collinge finds that the injuries are not excessive, and thinks that they have been generally over-estimated.

Birds of Buru.—In 1921–22 L. J. Toxopeus made a collection of the birds of Buru, in the Moluccas, which has added considerably to the list of species and to our knowledge of the differentiation of races in that area. Stresemann in 1914 recorded 135 species from Buru; now H. C. Siebers brings the number to 167 (*Treubia*, vol. 7, suppl., May 1930). His work is of more than ordinary faunistic interest on account of its careful descriptions of racial characters, of the habits of some of the native birds, and of the detail with which the breeding areas have been worked out.

Coleoptera of Italy.—In *Memorie della Pont. Accademia delle Scienze Nuovi Lincei*, ser. 11, vol. 13, 1929, there is to be found an important contribution entitled "I coleotteri d' Italia", by Paolo Luigioni, S.O., which will interest coleopterists and students of insect distribution. This extensive compilation amounts to 1135 pages and consists of a catalogue of the beetles of Italy together with the literature dealing with them. The area embraced in this work includes continental Italy, and also Corsica, Sardinia, Sicily, and the Maltese Islands. Altogether 1169 genera and 9979 species of Coleoptera are enumerated as occurring in the area under consideration. In an appendix a number of additional species are listed provisionally owing to their identity being doubtful. As might be expected, the families most numerous in species are the Curculionidæ, Staphylinidæ, and Carabidæ, with 1610, 1595, and 1059 species respectively. As compared with the paucity of the British fauna, it is interesting to note that the Buprestidæ comprise 188 species, the Cerambycidæ 267 species, and the Meloidæ 57 species. The enterprise which prompted the compilation and actual publication of this bulky work deserves special commendation, and it is likely to remain the standard reference catalogue on its subject for many years to come.

Egg-killing Insecticide Washes.—During the winter, when vegetation upon the fruit tree is dormant, it is possible to use insecticide washes of considerable strength with the view of controlling insect pests then present on the bark in the form of eggs. During recent years there have been indications that the researches into the preparation of a successful egg-

killing wash, carried on at the experiment station at Long Ashton under the auspices of the Ministry of Agriculture, had met with considerable success. In a paper in the *Journal of Pomology*, vol. 8, pp. 129-152, May 1930, Messrs. Staniland, F. Tutin, and C. L. Wilson give an account of the progress of these investigations and show very clearly that the ovicidal powers of the successful tar distillate washes are due to the asphyxiating action of a uniform, oily film deposited over the eggs by the spraying operations. Direct toxic action of the active chemical constituents is relatively unimportant; experimentally, the eggs can be killed equally well by heavy medicinal paraffin. Paraffin wax and neutral tar products boiling above 360° C. were less successful ovicides, because, on drying, they did not yield a uniform film, but an irregular granular deposit. The control of capsid bug and the winter moth by the new 'high neutral' tar distillate washes, when a suitable emulsifier is used, seems to be exceedingly efficient on apple trees. On black currants capsid bugs are less easily controlled. The authors point out this may be because the egg protruded further into the air, out of the bark, and is therefore less readily covered by the drying film of oil. The destruction of *Aphis* and *Psylla* eggs by these washes, on the other hand, is not brought about by their asphyxiation, but by the directly toxic action on the eggs of certain chemical constituents in the washes. This paper, of great practical importance, is also of very considerable scientific interest, the practical results of field spraying trials being controlled by numerous laboratory experiments with the various constituents of the insecticide washes upon different types of insect eggs.

Grasses of Central America.—In his monograph of the grasses of Central America, Prof. A. S. Hitchcock (*Cont. U.S. Nat. Herb.*, Smithsonian Institution, vol. 24, part 9, 1930) brings together for the first time much scattered information relating to the grasses of the whole area between Colombia and Mexico. Native and introduced species are both included, and the paper gives descriptions of 115 genera and 460 species, including one new species, *Ichnanthus standleyi* Hitchc. from Honduras. The best represented genera are *Paspalum* and *Panicum*, each with more than 60 species. The grass flora falls into three types. In the tropical rain forests bordering the Atlantic coast the flora is similar to that of the other tropical American coastal lowlands bordering the Atlantic. The coastal region on the Pacific side is much drier and possesses a well-marked dry season, as a result of which there are extensive savannas extending from Panama to Mexico. The flora of elevated interior is high temperate rather than alpine, and the grass flora represents a southern extension of that of the Mexican plateau.

Hybrid Poplars for Pulp Production.—Throughout the world research work is now being undertaken, having for its object the increase in the production of paper, chiefly pulp, for the news sheets and cheaper forms of publications. During the past few years Dr. Ralph H. McKee and others have been carrying on research with the object of attempting to find means by which the steadily diminishing supplies of wood in the United States of America might be supplemented. Amongst other experiments entertained, attempts were made with hybrid poplars, the object aimed at being to obtain an increased rapidity of growth. Several hundred acres of waste land in the eastern parts of the United States have been planted with hybrid poplar trees (the species are not mentioned), which it is said will yield a crop of pulp wood for the paper industry comparable in value to the financial return from flaxstraw and cotton. Dr. McKee recently described this work before the Franklin Institute, a notice of which is given in *Daily Science News Bulletin*, No. 469 C (Washington, 1930). The new hybrids will produce, it is said, from 10 to 14 times as much wood per year as wild poplars growing under similar conditions. It was pointed out that in 60 years natural reforestation yields about six cords of useful wood per acre, or 125 pounds of cellulose a year from each acre. The yield per acre-year for cotton is 150 pounds of cellulose, for flaxstraw 100 pounds, and cornstalks nearly 500 pounds. "Well managed reforestation plantations of pulp wood using wild species produce about 2000 pounds of cellulose per acre-year," said Dr. McKee. "From the new hybrid poplar plantations we have every reason to expect 80 cords of pulp wood per acre in 12 years; that is, an average of about 16,000 pounds of merchantable wood per acre-year, equivalent to 8000 pounds of cellulose." The development of this interesting experiment will merit the most careful watching.

Carboniferous Fossils from Nova Scotia.—A collection of Carboniferous fossils from the Mississippian beds at Windsor, Nova Scotia, formed by the late Miss Eleanor Long in 1914, has been worked over by W. A. Bell (*Proc. Acad. Nat. Sci. Philad.*, vol. 81). The author, who has already prepared a paper on the district for the Geological Survey of Canada (*Memoir 155*), gives a summary of the general geology of the Windsor area, accompanied by a map, and enumerates the forty-six species of fossils in Miss Long's collection with special notes and figures of three. The Windsor fauna as a whole exhibits close affinity to the Viséen of western Europe, more especially the *Seminula* zone of England, and differs from the faunas of like age in the Mississippian basin of America, as early noted by Dawson and others.

Earth Pressure Experiments.—In connexion with the construction of a big retaining wall, 900 ft. long and 160 ft. high at mid-length, for a power scheme in New England, a series of large-scale experiments on earth pressure have been carried out in a laboratory especially erected for the tests, and an account of the investigation is given in *Engineering* for May 30 and June 13. The laboratory was erected on a site provided by the Massachusetts Institute of Technology, and the tests were made by Dr. C. Terzaghi, now professor in the Technical High School, Vienna. The testing machine employed consisted of a ferro-concrete bin 14 feet square, one side of which had a movable stiffened slab, the thrust against which could be measured by weighing machines. Boulder clay and till—the latter a geological term applied to a deposit of clay, sand, and gravel—were used in the experiments, the results of which are given in the articles. Experiments were also made on the internal frictions of sands and clays under different pressures, when it was found that, with identical materials and low pressures, the coefficient of friction was far greater with densely packed than with loose materials, but as the pressures increased the margin between the two values tended to disappear.

Structure of the Electron.—In a series of papers published since 1929 in the *Proceedings of the Physico-Mathematical Society of Japan*, Mr. U. Kakinuma endeavours to develop a new theory of the structure of the electron which shall combine the theory of relativity with wave mechanics. He starts by replacing the ordinary relativity electromagnetic energy-tensor by another energy-tensor which involves velocity components as well as electromagnetic terms, and is analogous to the usual energy-tensor of a perfect fluid.

From this assumption are derived the fundamental field-equations, which admit of a remarkable solution, with one factor such as appears in Einstein's cosmological theory, and a second factor which is periodic. Thus with every electron there is associated a wave of a definite frequency. Moreover, the solution leads directly to the fundamental equation of wave mechanics, connecting the mass of the electron with the frequency of the associated wave. It might be thought that Mr. Kakinuma's work is a development of Einstein's unitary field theory, but this is not so. It is more on the lines of the theory of gauges due to Weyl, of which little has been heard for several years, but it uses Riemannian geometry, which both Weyl and Einstein have now discarded.

X-Ray Crystal Analysis.—In the *Engineer* for July 4, Mr. V. E. Pullin, director of radiological research at Woolwich, in a well-illustrated article on X-ray crystal analysis in engineering gives a broad outline of the object, the methods, and the results of the application of the X-ray spectrometer to various metals and alloys used in engineering. Starting with a brief note on the discoveries of Von Laue and other investigators, he says that the important facts which render X-ray crystal analysis of use to engineers are first, that metals are crystalline, and second, that the working of metals either by tools or by heat always tends to alter or modify the crystal structure. This being so, it is the function of X-rays to show the manner in which individual atoms are normally arranged, and how they are modified by mechanical or heat treatment or by alloying with other metals. After a short explanation of the types of crystals of importance to engineers, (1) face-centred cubic crystals, (2) body-centred cubic crystals, and (3) hexagonal crystals, Mr. Pullin goes on to describe the apparatus and the technique, and then gives a series of examples of the information that can be obtained. He gives some forty or more characteristic diagrams which are published in a special supplement.

Compressibilities of Gases.—The April number of the *Journal of the American Chemical Society* contains three papers dealing with the compressibility of hydrogen and nitrogen and of a 3 : 1 mixture of these gases at temperatures of −70°, −50°, −25°, and +20°, and at pressures up to 1000 atm.; of carbon monoxide at temperatures from −70° to +200°, and at pressures to 1000 atm.; and on a characteristic equation with relation to nitrogen. In the case of nitrogen, a curious phenomenon appeared at about 380 atm., when the deviation from the ideal gas was nearly constant through the temperature range −70° to +100°. Carbon monoxide was found to undergo decomposition under pressure at atmospheric temperature when stored in iron vessels. Carbon and carbon dioxide are formed, and at 100 atm. the gas contained more than 1 per cent of carbon dioxide after three weeks. Formation of iron carbonyl also occurred. The compressibility curves of carbon monoxide are similar to those of nitrogen: carbon monoxide is slightly more compressible than nitrogen in the low-pressure range and slightly less compressible in the high-pressure range, the difference becoming smaller with increasing temperature. The results are to be expected from the fact that carbon monoxide has a slightly higher critical temperature (−139·0°) than nitrogen (−147·1°). Carbon monoxide exhibits the same peculiar behaviour as nitrogen, but over an even wider range of temperature, namely, from −70° to +200° at 375 atm.

Chemistry of Coal.—A paper on the benzenoid constitution of coal (Part 6 of a series on the chemistry of this substance) has been contributed to the June number of the *Proceedings of the Royal Society* by Prof. Bone, Dr. L. Horton, and Mr. S. G. Ward. The elaborate series of experiments performed, mainly on the oxidation by permanganate of the residues from the 'benzene-pressure-extraction' of various coals, have lead to results of much importance. All the coal residues examined gave much the same weight-yields of crystalline organic acids, chiefly benzene carboxylic acids, the proportion of which did not vary materially from one coal to another, and smaller amounts of oxalic and acetic acids, indicating that "a considerable part of the organic débris originally deposited in the incipient coalfields either had or soon acquired a cyclic, and probably benzenoid, structure which has been preserved during the subsequent maturing process". Evidence has also been obtained that in the oxidation of the coal substance by alkaline permanganate, complex colloidal 'humic acids' are formed intermediately, the crystalline benzenoid acids, and probably also oxalic and acetic acids, arising simultaneously from their further oxidation. These results, and others obtained in earlier work, "revealing as they do that in great part the coal substance—no matter what its geological age or chemical maturity, or whether or not it is extractable by boiling benzene under pressure—has an essentially 'benzenoid' structure, suggest the possibility of its having arisen through condensations of phenolic- and amino- with aldehydic-bodies, much as 'bakelite' is synthesised nowadays from phenols and formaldehyde". The experimental exploration of the many questions opened up by this investigation—which have been necessarily referred to only in certain salient points in the present note—is being continued, but it is evident that the researches already performed have led to a considerable advance in knowledge of the properties of coal.

Radio Communication with Aeroplanes.—Mr. Hoover, the radio engineer of the Western Air Express, read a paper on radio communication with aeroplanes to the Society of Automotive Engineers in the United States on Feb. 20. The difficulties to be overcome are mainly due to the radio waves emitted by the engine every time a spark occurs in any of the sparking plugs—the ignition wires, magneto, and low tension wires forming an antenna system. The highly sensitive receivers on the aeroplanes have to pick up feeble signals from stations more than a hundred miles away. It will be seen, therefore, how difficult it is to shield from the receiver the waves coming from strong spark transmitters only ten feet away. The only possible solution is to put a continuous metallic shield round all the radiating apparatus. The Airways Division of the U.S. Department of Commerce has initiated the building of earth stations for aeronautical use. About forty stations have already been installed. They are spaced along the airways at distances apart of about 200 miles. They cover the whole country from New York to San Francisco and from Seattle to Key West. The stations use the voice and have a carrier output of two kilowatts. On a conservative estimate this would give a day range of about 150 miles and a night range of double as much. The 1927 international convention set aside a band of wave-lengths between 800 metres and 1200 metres exclusively for aeronautical purposes, and the Government stations work between these limits. A new branch of the U.S. Weather Bureau has been inaugurated to make hourly collections and forecasts of the weather. The reports are collected and broadcast over the airways every hour and it is hoped shortly to broadcast them every half-hour.

The Third Imperial Entomological Conference.

THE Third Imperial Entomological Conference was held in London, under the auspices of the Imperial Institute of Entomology, on June 15–27. Through the courtesy of the officers and council of the Entomological Society of London the meetings of the Conference were held at the headquarters of the Society at 41 Queen's Gate. About forty delegates, representing twenty-four different States of the British Empire, attended in an official capacity. Lord Buxton, the chairman of the managing committee of the Imperial Institute of Entomology, was unfortunately unable to be present owing to illness, and was represented at the opening meeting by Sir Sidney Harmer. The morning of the first day of the Conference was devoted to the reception of delegates and the appointment of sub-committees to deal with business matters. At this meeting it was announced that the Managing Committee had decided to alter the name of the Imperial Bureau of Entomology to the Imperial Institute of Entomology, in view of the growth and expansion of its work since it was first founded. In the afternoon the delegates were shown a very remarkable film brought from Canada by Mr. A. Gibson, Dominion Entomologist, representing the mass production of the parasites of the European corn borer, as carried on in the laboratory of the Dominion Entomological Department at Chatham, Ontario. In this film the various phases of the mass production work and the behaviour of the principal parasites of the pest studied were shown with extraordinary clearness and accuracy. The film was exhibited at the Imperial Institute through the courtesy of the Director, Lieut.-Gen. Sir W. T. Furse, and was again shown by request on Friday, June 20. The exhibition of the film was followed by a reception of the delegates at the Natural History Museum.

The meetings of June 18, under the chairmanship of Mr. F. A. Stockdale, were devoted to discussions on the organisation of entomological departments, opened by Mr. H. H. King, of the Sudan, and on entomological work among backward races, opened by Mr. A. H. Ritchie, of Tanganyika. In the evening there was a meeting of the Entomological Society of London, which was largely attended by the delegates.

On Thursday, June 19, the delegates visited the Parasite Laboratory at Farnham Royal, where they were entertained by the Imperial Institute of Entomology to luncheon and tea, and shown in detail the various methods in use in the work of the laboratory.

The morning meeting of June 20, held under the chairmanship of Dr. T. Drummond Shiels, M.P., was devoted to the extremely important subject of tsetse control. The discussion on this subject was opened by Mr. C. F. M. Swynnerton, whose excellent work in areas infested by the tsetse in Tanganyika Territory is, of course, well known. Mr. Swynnerton gave a detailed and most interesting account of the work which is now being carried on in Tanganyika, where the practice of grass burning, carried out under skilled direction and combined with the breaking up of the infested zones into areas of a size convenient for burning, has given excellent results. A very important phase of this work has consisted in the production of live fences or hedges designed to prevent the passage of game, and produced by the planting of cuttings or live poles of certain species of indigenous trees which are used by the natives to fence their villages. Another important development in this work is the use of moving baits smeared with tanglefoot for the capture of individual flies, and the introduction of the aeroplane for scouting work. The importance of aeroplane surveys in entomological work is now widely recognised, and it is to be hoped that every facility for their use will be granted by the authorities, in order that this work may be carried on in the infested areas in a thorough and satisfactory manner. Mr. Swynnerton's paper was followed by a very interesting discussion on various phases of the tsetse problem, including the important matter of game preservation. The afternoon meeting, under the chairmanship of Mr. A. Gibson, Dominion Entomologist for Canada, was devoted to the control of insects by cultural methods, and was opened by Mr. F. A. Stockdale. It gave rise to a number of very important comments in regard to the value of cultural methods, particularly against sucking insects, in various parts of the world.

Saturday, June 21, was devoted to a visit to the University of Cambridge, where the delegates were entertained by Prof. J. Stanley Gardiner, and shown the work conducted by the Department of Entomology and the important investigations in progress on virus diseases of plants. The delegates were entertained to tea at Messrs. Chivers' fruit farm.

The morning of Monday, June 23, was devoted to the meetings of committees and the afternoon meeting to the important subject of locusts, under the chairmanship of Major E. E. Austen. The discussion was opened by Mr. B. P. Uvarov, of the Imperial Institute of Entomology, one of the foremost living authorities on this subject. Unanimous agreement was expressed by all the speakers as to the necessity for further investigations on the permanent breeding-grounds of the migratory locusts and the underlying causes of the phenomenon of migration.

On the following day the meetings, which were held under the chairmanship of Sir Sidney Harmer owing to the unavoidable absence of Dr. R. Stewart MacDougall, were devoted to the subject of biological control, which is now of especial interest owing to the fact that since the previous Conference the Imperial Institute of Entomology has founded, with the aid of a grant from the Empire Marketing Board, its laboratory at Farnham Royal as an Imperial centre for work on biological control of insect and plant pests. In the morning meeting the biological control of insects was considered. It was opened by Mr. A. Gibson, who gave an interesting and detailed account of the work in progress on these lines in the Dominion of Canada. In the discussion that followed, many points of interest were brought up concerning the practice of biological control of insect pests in various parts of the world, and general satisfaction was expressed by all the delegates in regard to the initiative which Sir Guy Marshall, director of the Imperial Institute of Entomology, had taken in the creation of a special institution for work of this type within the Empire. The afternoon meeting was devoted to the control of weeds by insects. Dr. Miller, of the Cawthron Institute of New Zealand, who opened the discussion, gave an account of the work which is being carried on in New Zealand in collaboration with the Imperial Institute of Entomology at Farnham Royal on the biological control of some of the most important weeds of New Zealand, including particularly blackberry, gorse, ragwort, and bracken. He was followed by Dr. A. Nicholson, deputy chief of the Entomological Division of the Commonwealth Council for Scientific and Industrial Research of Australia, who described to the delegates the extraordinarily successful and interesting experiments carried on by the Commonwealth Prickly Pear Board against the various species

of prickly pear in Australia. He showed that the initial successes obtained in this work have now been very greatly extended, and that large areas formerly rendered uninhabitable and useless for agricultural purposes by the invasion of the prickly pear have now been freed completely from this pest and are being brought under cultivation.

The morning of June 25 was devoted to meetings of committees, and the afternoon to a discussion, opened by Dr. W. J. Hall, of orchard pests in various parts of the world. In the evening an official dinner was given to the delegates by His Majesty's Government at Lancaster House, St. James's, under the chairmanship of Lord Passfield, Secretary of State for the Colonies.

The final meeting of the Conference was held on June 26, and was followed on Friday, June 27, by a visit to the Rothamsted Experimental Station and Pathological Laboratory of the Ministry of Agriculture at Harpenden. W. R. THOMPSON.

Cellulose and Sodium Hydroxide.

THE British Cotton Industry Research Association has recently issued two memoirs (reprinted in the *Journal of the Textile Institute*, vol. 20, T. 373, 1929; and vol. 21, T. 225, 1930) in which S. M. Neale describes some work on the physical chemistry of cellulose. Regarding cellulose as a linked series of glucose residues with -OH and -O- groups as reacting points, it is shown that the behaviour in alkaline solutions can be explained by treating the -OH groups as sources of potential acidity, with their capacity for liberating hydrion governed by the law of mass action, so that an average dissociation constant can be assumed for the primary acid ionisation of cellulose in any state of complexity. In developing this idea it is necessary to employ the Donnan equation of membrane equilibrium to allow for the fact that the assumed cellulose ion is coherent and unable to diffuse. By assuming an approximate value of 2×10^{-14} for the dissociation constant it is possible to calculate approximately the osmotic swelling pressure of cellulose in solutions of caustic soda of any concentration. The calculated osmotic pressure curve is strikingly similar to the curve obtained by plotting the imbibition of water by regenerated cellulose (cellophane sheet) against the concentration of alkali in which it is placed, while the amounts of alkali taken up are shown to be consistent with the stoichiometric conversion of cellulose into the mono-sodium salt at high alkali concentrations, when allowance is made for the alkali imbibed in accordance with the Donnan equation.

The peculiar effect of temperature on the swelling curve of cellulose in sodium hydroxide solution is a consequence of the theory and arises essentially from the increasing hydrolysis of the cellulose salt at high temperatures. The amount of heat developed in the reaction between cellulose and sodium hydroxide has been determined and is found to rise continuously with the concentration of the alkali. The heat effects at all concentrations are in fair agreement with values calculated on the assumption that the heat of ionisation of cellulose is comparable with that of the monosaccharides. Allowance is made in these calculations for the very large additional heat effects arising from the higher energy content of alkali in concentrated as compared with dilute solution, and from the dilution of the bulk alkali by the water molecules set free and those formed as a result of the postulated chemical reaction.

When cellulose in equilibrium with any given solution is immersed in a solution of widely different concentration, striking transient volume changes are observed. These are explained in terms of the osmotic theory which is put forward, and arise from the fact that the water diffuses more rapidly than the alkali. The data presented in the second paper describe the behaviour of regenerated cellulose in solutions of sodium hydroxide more dilute than half-normal, and it is shown that in this region the absorption of alkali and the swelling of the gel are quantitatively explained by assigning to the ionisation constant of cellulose the value $1{\cdot}84 \times 10^{-14}$ at 25° C.

The considerations of these papers are largely applicable to the behaviour of cotton hairs in caustic alkali, and go far towards making clear the chemical and physical mechanism of the process of mercerisation.

Geology of Ceylon.

IN the little pamphlet referred to below [1] Dr. Adams brings together the work of former investigators in Ceylon, savouring his account with important conclusions derived from observations of his own. The geological structure of the island is outlined for the first time, analyses of rocks are given and, above all, there is an admirable geological map, the first of the whole island to be produced. A list comprising seventy references is provided.

The historical side is touched on briefly in an "Introduction", wherein it is stated that man had not reached the Palæolithic stage, when probably "by means of a then existing land bridge" he arrived on the island. The successive invasions from Neolithic time to the occupation by the British in 1796 are summarised in a few paragraphs. After a review of earlier publications, Dr. Adams deals with the topography and brings out clearly the three peneplanations to which the land has been subjected, illustrating his explanation with four admirable plates, two being reproductions of sheets of official maps.

Investigators in Ceylon are fortunate in having such a sound basis for their work as this topographical survey produces. To these three peneplains, clearly visible, must be added a fourth, the submarine plateau. The subaerial surfaces of erosion, representing stationary conditions in a periodically renewed upward movement, are respectively 100 feet (the coastal plain), 1600 feet and 6000 feet above sea-level and are of more than local interest. Whether they are or are not due to marine erosion is left an open question—the author inclines to subaerial denudation—one notes in passing that Wayland assigns the first and second to the former cause. Dr. Adams suggests that the Deccan Plateau is perhaps a continuation of the second, possibly the uplands of the Nilgiris represents the third planation, making the comment that so well defined a series of erosion surfaces may yet be recognised in other fragments of 'disrupted' Gondwana Land. He suggests Madagascar in this connexion. The present writer would add the Northern Frontier Province of Kenya; the type of country, a wide stretching plain with suddenly rising 'buttes' or residual hills, is essentially the same as that shown by Dr. Adams in Plate II.

As it must be, the topography is influenced by the strike of the foliation of the crystalline rocks, but in Ceylon ("an admirable relief map of the island" exists in Colombo) the strike ridges swing in successive loops resembling, as Dr. Adams has it, "a series of garlands pendent from the northerly extremity of the Island";

they follow approximately the outline of the coast. The island, in fact, is a portion of a much eroded syncline, the axis in general trending north and south a short distance east of Kandy and Nuwara Eliya. Altogether, this is a stimulating portion of the book.

For the Pleistocene, the Miocene at the extreme north of the island and the very small area of non-marine Jurassic beds at Tabbowa, the author relies principally on data collected by Wayland; for the Archaean, which constitutes so very large a proportion of the whole, Coomáraswámy is a noteworthy contributor. Acknowledgment for information received, especially concerning the gem deposits, is made to Mr. J. S. Coates, the Principal Mineral Surveyor. The crystalline rocks present many interesting features, and the resemblances they bear to those of other lands attract Dr. Adams's attention. He points out the essential identity of the dominant quartzose biotite-gneisses with "hundreds of occurrences in the Laurentian of Canada" and the "striking resemblance" of the limestones to those of the Grenville Series of the Canadian Shield. Doubtless the island is the southward extension of the Bengal gneiss with which, in Ceylon as in India, khondalites are associated. Of these analyses are given. Nine analyses of charnockites and four of allied rocks, together with a table of norms, increase our knowledge of that interesting series. Much petrographical detail is provided, but a few photomicrographs would have added to the value of the work.

The geological map, with an east and west section through the island, shows the limestones, quartzites, and khondalites differentiated from the huge expanse of biotite-gneiss, the distribution of the charnockites in the southern part of the island and in addition the Galle Series of Coomáraswámy, a group distinguished by the occurrence of scapolite and wollastonite. The strike of the foliation is made clear by broken lines. Doubtless, as Dr. Adams comments, there is yet room for additional study in Ceylon, but in this work we have the most valuable contribution to the geology and physiography of the island produced for many years.

JOHN PARKINSON.

[1] *Canadian Journal of Research.* "The Geology of Ceylon." By Frank Dawson Adams. (Ottawa: National Research Council of Canada, 1929.)

University and Educational Intelligence.

BIRMINGHAM.—At the recent degree congregation the degree of D.Sc. was conferred on Mr. Edward Tyler for published work on liquid jets, vortices behind aerofoil sections and rotating cylinders, eddy flow from annular nozzles, and other aerodynamic investigations.

Dr. H. B. Keene is resigning his post as lecturer in physics on being appointed head of the Physics Department of the Birmingham Municipal Technical College.

The fiftieth anniversary of the opening of Mason College and the thirtieth anniversary of the granting of the charter to the University of Birmingham are to be celebrated in October, the programme including a special degree congregation at which honorary degrees will be conferred on, among others: Sir William Hardy, Prof. R. Robinson, Dr. F. E. Smith, and Sir Thomas Lewis.

EDINBURGH.—At a meeting on July 14, the University Court accepted the resignation of Mr. J. G. Semple, lecturer in mathematics, on his appointment to the chair of mathematics at Queen's University, Belfast. Mr. Alexander Oppenheim was appointed lecturer in mathematics in place of Mr. Semple. The resignation of Mr. L. A. Harvey, lecturer in zoology, was intimated on his appointment as head of the department of zoology in the University College of the South-West at Exeter.

LONDON.—The following appointments have been made: Dr. Samson Wright, lecturer in physiology at King's College, to be University professor of physiology (Middlesex Hospital Medical School); Dr. Alexander Robertson, University reader in chemistry at East London College, to be University reader in biochemistry (London School of Hygiene and Tropical Medicine).

Mr. J. G. Thomson (medical protozoology) has been given the title of professor in respect of the post held by him at the London School of Hygiene and Tropical Medicine.

Dr. G. S. Wilson (bacteriology as applied to hygiene) has been given the title of professor in respect of the post held by him at the London School of Hygiene and Tropical Medicine.

The title of emeritus professor of physics in the University has been conferred on Prof. C. H. Lees on his retirement from East London College.

OXFORD.—Applications are invited from members of Magdalen College for the Edward Chapman research prize, value £20, for a published piece of original research in one of the following departments of natural science: physics or chemistry, including the sciences of astronomy, meteorology, and mineralogy or geology, or the biological sciences of zoology and botany, whether treated from the morphological, palæontological, physiological, or pathological point of view. Competing essays should be sent by, at latest, Oct. 11 next, to Prof. H. L. Bowman, Magdalen College.

THE Ramsay Memorial Fellowships Trustees have made the following awards of new fellowships for the session 1930–31: Mr. W. R. Angus, a fellowship of £300, tenable for two years, at University College, London; Dr. K. Krishnamurti, a fellowship of £300, tenable for one year, at University College, London; Dr. James Bell, a Glasgow fellowship of £300, tenable for two years, at University College, London; Dr. A. Girardet, a Swiss fellowship of £300, tenable for one year, at the University of Edinburgh. The Trustees have renewed the following fellowships: Dr. H. Erdtman (Swedish Fellow), University College, London; Dr. A. Klinkenberg (Netherland Fellow), University of Cambridge; Prof. Y. Nagai (Japanese Fellow), University College, London; Dr. Lloyd M. Pidgeon (Canadian Fellow), University of Oxford.

NOTICE is given by the President and Council of the Royal Society of forthcoming awards of Moseley, Mackinnon, and Lawrence research studentships. The first-named will be for "the furtherance of experimental research in pathology, physics, and chemistry, or other branches of science, but not in pure mathematics, astronomy, or any branch of science which aims merely at describing, cataloguing, or systematising", and the value £350 per year; the second will be for the purpose "of furthering (i) natural and physical science, including geology and astronomy, and (ii) original research and investigation in pathology", and the value £350 per year; the third will be of the value of not more than £200 for one year, for research in some subject related to the cause and cure of disease in man and animals. Forms of application, returnable not later than Oct. 11, may be obtained from the Assistant Secretary of the Royal Society, Burlington House, London, W.1.

Historic Natural Events.

July 28, 1883. Destructive Ischian Earthquake.—Casamicciola, the chief town in the island of Ischia (Italy), was destroyed by an earthquake and about 1800 out of 3963 inhabitants were killed. The area of complete destruction, however, contained only 3 square miles, and the whole disturbed area between 300 and 400 square miles, that is, less than the area of a slight British earthquake. This implies a very shallow focus, the depth of which was estimated from the directions of fissures to be one-third of a mile. The epicentral area lay on the northern slope of Epomeo, a volcano that was last in action in 1302, and its longer axis was directed towards the centre of the old crater. Thus, the earthquake may have been the result of an unsuccessful attempt to force a new eruption.

July 29, 1875. Shower of Hay near Dublin.—About 9.30 A.M. a quantity of hay fell from the sky at Monkstown near Dublin, over an area of more than a mile in diameter, the shower lasting five minutes. There was a dark cloud overhead and the hay was wet, but no rain was falling, and the air was very calm.

July 29, 1911. Thunderstorms over the British Isles.—A line-squall traversed the British Isles from south to north between 2 P.M. on July 29 and 9 A.M. on July 30, and in the southern half of the country it was associated with violent thunderstorms and strong squalls. At South Kensington 1¼ inches of rain fell in a short time. The storm caused remarkable tidal oscillations in the English Channel, the water rising suddenly 3 feet with the onset of the squall.

Aug. 1, 1785. Swarm of Aphides at Selbourne.—Gilbert White records that about 3 P.M. a shower of Aphides or smother-flies fell in Selborne, blackening all the plants and covering persons walking in the streets. They were observed at the same time in great clouds about Farnham, and all along the vale from Farnham to Alton, and were probably migrating from the hop-fields of Kent.

Aug. 1, 1798. Mirage at Ramsgate.—A remarkable mirage was observed by the Rev. S. Vince from Ramsgate from about 4.30 P.M. until between 7 and 8 P.M. The day had been extremely hot and the evening was very sultry. The masts and upper sails of a ship were seen through a telescope; above it was a perfect inverted image of the same ship and a part of the surface of the sea, and above that again, and joined on to it, a third image showing the ship erect, these two images having their hulls joined. Similar effects were seen with various other ships. Most of the observations were made from a height of 25 feet, others from 80 feet, the phenomena not being altered by the change of height.

Aug. 1, 1846. Hailstorm in London.—During a violent hailstorm the glass in the picture gallery at Buckingham Palace was totally destroyed and the gallery flooded. 7000 panes of glass were broken in the Houses of Parliament and 10,000 at Burford's Panorama in Leicester Square. The glass arcade then covering the side walks in Regent Street was destroyed and the Surrey Theatre was flooded.

Aug. 1–6, 1901. "De Witte" Typhoon.—One of the most violent typhoons which have been systematically studied approached China, travelling in a west-north-west direction, on Aug. 1, 1901, and struck the coast in lat. 27° N. on the afternoon of Aug. 2. Thereafter it travelled on a great curve through Fuhkien, east of Kiangsi and across the province of Chekiang, and continued across Asia towards the north-north-west, a very abnormal path. Off the coast the barometer in the central calm fell to 915 mb. (27·03 in.). The storm is known for the destruction of the Russian vessel *Finanzminster De Witte*, a powerfully engined and well-found steamer of 2000 tons, less than two years old, which was knocked to pieces by the heavy seas.

Aug. 1, 1907. Ball Lightning at Alpena, Michigan.—On Aug. 1, 1907, during a heavy shower with thunder and lightning, a ball of lightning about six to eight inches in diameter entered a house. It dropped lightly on to the floor, moved round the room in circles, then entering the wall, moved up inside it and came out a few feet above the window. A four-inch brace was splintered and much plaster was forced into the room. The ball then travelled across the room again and out of the other wall, making a ragged hole. It struck into the earth about 30 feet from the house, leaving a hole about 6 inches wide and a few inches deep.

Aug. 2, 1837. The Hurricane of Los Angeles.—This was probably the most severe hurricane ever experienced in Porto Rico; it lasted only five hours, but its violence was so excessive that all the ships in the harbour of San Juan were wrecked and great damage was done to property throughout the island.

Aug. 2, 1906. Guildford Storm.—After a very hot day violent thunderstorms broke over south-east England during the evening, the most violent occurring between Hindhead and Ripley, and especially at Guildford. At Grayshott 1·17 in. of rain fell in 15 minutes between 8·23 and 8·38 P.M., accompanied by a violent squall. At Guildford the low-lying parts of the town were flooded to a depth of several feet and a great deal of damage was done by the wind and hail. Many large trees were blown down and several buildings wrecked, while there was some loss of life.

Aug. 2–3, 1922. Swatow Typhoon.—This storm, one of the worst in history in the China Seas, was first observed as a slight disturbance near the Caroline Islands on July 27. It moved towards the west-north-west, gradually increasing in intensity. On July 31 it was over northern Luzon, where it turned more towards the north and crossed the Chinese coast on the night of Aug. 2–3, the centre passing directly over Swatow. The barometer fell to 938 mb. (27·70 in.), the wind was very violent and the rain torrential. Both foreign and native shipping suffered heavily, but the worst damage was done by an enormous sea wave, which crossed the mud-flats in front of the city early on the morning of Aug. 3, and washed away all the houses which had not been blown down. Out of a population of 65,000 persons, it is estimated that 50,000 lost their lives, and it was several days before the water drained off the countryside.

Societies and Academies.

DUBLIN.

Royal Irish Academy, June 23.—**J. I. Armstrong, J. Calvert, and C. T. Ingold**: The ecology of the mountains of Mourne, with special reference to Slieve Donard. The vegetation of the area is mostly *Callunetum* of various types, growing on peat covering granite rock. The peat is mostly retrogressive, especially at high altitudes; rarely a progressive peat formation was seen. Examination of the peat (one station, 518 metres) shows in a two-metre section an extraordinary increase of pollen-grain at 66 cm. from the surface. All the pollen is considered to be wind blown.—**J. M. White**: Re-colonisation after peat-cutting. Studies were made mainly in Co. Armagh, where peat-cutting is still carried on on a considerable scale. The depth to which peat-cutting is carried was found to be the most important factor in the re-colonisation of the cut areas, when combined with the time factor.—**Miss M. Duff**: The ecology of the Moss-

Lane region, Lough Neagh. Gives a detailed account of the vegetation around Portmore Lough, which is the home of many rarities of the Antrim flora, and of much interest ecologically.—**K. C. Bailey**: The kinetics of the formation of malonamide from ethyl malonate and ammonia in homogeneous solution. A reaction of the third order. The reaction between ethyl malonate and ammonia in aqueous alcoholic solution takes place in accordance with the equation $v = k\ a\ b^2$, where v is the velocity of reaction, and a and b are the concentrations of ethyl malonate and ammonia. The velocity is increased by increasing the proportion of water in the solvent.—**Elizabeth Mary Ryan and Hugh Ryan**: Studies in the diflavone group (5). Metamethoxybenzaldehyde and diacetoresorcinol. In the presence of alcoholic alkali m-methoxybenzaldehyde condenses with diacetoresorcinol-dimethylether to form di-m-methoxybenzylidene-diacetoresorcinol. Nearly colourless prisms. M.P. 157°-158° C. Its dibromo derivative consists of prisms M.P. 213° C. (decomp.) and its tetrabromide also melts with decomposition about 176° C. With diacetoresorcinol m-methoxybenzaldehyde forms two chromisomeric *unsaturated ketones*. Both melt at 157° C. but one is orange yellow and the other is light yellow in colour. They form the same diacetate. Cream-coloured prisms. M.P. 122° C. The tetrabromide of the last body did not crystallise but was converted by alcoholic potash into nearly colourless crystals melting at 277°-279° C. which consisted mainly if not entirely of 3′·3″-dimethoxydicourmaranone. The dipiperonylidene derivative of 3′·3″-dimethoxy-diflavanone was obtained as yellow prisms melting at 245° C. by the action of piperonal on di-m-methoxy-benzylidene-diacetoresorcinol in the presence of alcoholic hydrochloric acid. Under the same conditions benzaldehyde formed the dibenzylidene derivative of the diflavanone and this consisted of yellowish-white prisms melting at 249° C. —**L. B. Smyth**: The carboniferous rocks of Hook Head, Co. Wexford. The Lower Carboniferous of Hook Head is conformable with O.R.S. The finding of *Avonia* (*Productus*) *bassa* Vaughan at the very base of the calcareous series shows that no appreciable amount of the underlying sandstones and conglomerates can be of Carboniferous age. The *K.Z* and *C* zones of Vaughan are identified. The latter two form a continuous zaphrentid phase, as in south Pembrokeshire. C_2 is recognised but it is uncertain whether S_1 is present. It is now proved that there is only one dolomite band, repeated by faulting (not two as previously believed) and that it is of *laminosa* dolomite age. The total thickness of Carboniferous beds exposed is 1300 feet. At the top they disappear under the sea. Several new species are described, and '*Michelinea*' *antiqua* (M'Coy) is shown to be a degenerate tabulate coral with porous tissues.—**Brian Coffey and Hugh Ryan**: The constitution of certain compounds formed by the action of alcoholic hydrochloric acid on unsaturated ketones. In a previous paper Coffey and Ryan (Royal Irish Academy, 39, B. 3) showed that where alcoholic hydrochloric acid acts on alcoholic solutions of unsaturated ketones such as α-benzylidene methylethyl-ketone, dimerisation takes place and compounds of the type represented by the formula I are formed.

$$\begin{array}{lcl} C_6H_5\cdot CH & \text{——} & CH\cdot CO\cdot CH_2\cdot CH_3 \\ | & \text{I} & | \\ C_6H_5\cdot CH & \text{——} & CH\cdot CO\cdot CH_2\cdot CH_3 \end{array}$$

In the present communication an account is given of the monoxime of the compound I and of a compound formed by the action of phosphorus pentoxide on solutions in benzene of the monoxime. It appears that only monoxime is formed of the compound I and that by the action of phosphorus pentoxide internal rearrangement takes place with formation of the amide.

$$\begin{array}{lcl} C_6H_5\cdot CH & \text{——} & CH\cdot CO\cdot CH_2\cdot CH_3 \\ | & \text{II} & | \\ C_6H_5\cdot CH & \text{——} & CH\cdot CO\cdot NH\cdot CH_2\cdot CH_3 \end{array}$$

R. W. Ditchburn: The uncertainty principle in quantum mechanics. The theory of errors and uncertainties in physical measurements is discussed so as to distinguish clearly between possible error and probable error. The discussion is applied to the formulation of the uncertainty principle. It is shown that the term 'product of the possible errors' is meaningless and that discussions which relate solely to the probable errors are likely to be misleading. It is suggested that the real meaning of the principle is contained in Bohr's probability theorem (Birtwhistle, "Quantum Mechanics", p. 280), no more precise formulation being possible.

PARIS.

Academy of Sciences, May 26.—**Ch. Achard and A. Arcand**: The lipidic phosphorus accompanying the globulins in the blood serum and in serosities. After extraction with acetone and ether the remaining proteins still contain a lipidic residue, and this can be extracted by Kumagawa's method. It consists mainly of sterols, with a small proportion of lecithine. —**André Blondel**: The conditions of stability of a turbo-alternator connected with a network of mains, taking the governor into account.—**P. Vincensini**: A transformation of surfaces with total constant negative curvature.—**Georges Durand**: Local properties and ensemble of points without tangent plane of the envelopes of spheres.—**F. Marty**: Some properties of normal families of meromorph functions. —**Georges Valiron**: On the differential of a meromorph function and on certain functional equations.—**Émile Merlin**: Some properties of perfect fluids, with spiral striæ in rotation.—**Paul Bary**: The vapour pressure of jellies. A discussion of the reason why a fragment of jelly can, under certain conditions, partially dry in an atmosphere saturated with water vapour.—**Charles Dufraisse and Léon Enderlin**: Researches on structures susceptible of exhibiting reversible oxidation: study of the benzofurane group. In a search for the grouping which endows rubrene with the property of reversible oxidation diphenyl-benzofurane was examined, but it was found that the photo-oxidation of this compound did not give a dissociable oxide.—**Paul Gaubert**: The influence of foreign materials held in suspension in the mother liquor on the facies of crystals. Methylene blue, added to a solution of lead nitrate, may give, according to the conditions of crystallisation and the quantity of particles in suspension in the liquid, either crystals in cubes or crystals more or less flattened along the faces of the octahedron. The crystalline form of lead nitrate is also modified by the presence of rosolic acid in suspension.—**R. Fabre and H. Simonnet**: Contribution to the study of the oxido-reducing power of the tissues.—**Mme. L. Randoin and Mlle. A. Michaux**: The lipocytic coefficient of the red corpuscles and the globular resistance in the course of experimental scurvy.—**Mlle. Andrée Courtois**: The high proportion of non-proteid nitrogen in insects.—**H. Bierry and B. Gouzon**: The influence of the pH on a colour reaction of the adrenalines. A steel needle, placed in an aqueous solution of adrenaline hydrochloride, gives rise to a series of colours depending on the ionic acidity of the liquid.—**Henri Devaux**: The connexion between the organisation and the vital activity. The rôle of the plasmic membranes.—**Mme. Y. Khouvine, E. Aubel, and L. Chevillard**: The transformation of pyruvic acid into lactic acid in the liver.—**Paul Durand and Ernest Conseil**: The experi-

mental transmission of Marseilles exanthematic fever by *Rhipicephalus sanguineus*.

CAPE TOWN.

Royal Society of South Africa, April 16.—M. R. Drennan: On a ground stone axe from a Cape Rock shelter. Cultural and other remains found on excavating a small rock-shelter at Witsands, in the Cape Peninsula. The implements retrieved were practically all of the type usually met with in the Kitchen-midden culture of South Africa. The most important find was a ground stone axe with a large grooved slab on which the polishing might have been done. The special features of the stone axe are described, especially its unique hafting notch, only paralleled in the culture of the Australian aboriginal, which supplements the evidence we already have that some of the South African aborigines fixed handles to their stone implements.—**A. J. H. Goodwin**: (1) Some ground axes from Rhodesia and the Transvaal. A description of six specimens of ground axes, four from Rhodesia and two from the Transvaal. They are associated with a Neanthropic culture of known type, namely, the Smithfield.—(2) A new variation of the Smithfield culture from Natal. A hitherto undescribed industry showing marked similarity to certain phases of the Smithfield culture of the Free State and elsewhere. It is probably a Natal variation of the Smithfield, fed from the phase known as Smithfield *A*, and has been named Smithfield *N*.—**P. v. d. R. Copeman**: Changes in the composition of oranges during ripening (Pt. 1): Changes in weight. Weight of orange, skin and pulp increase, and the changes may be expressed by an autocatalytic equation. At the end of ripening transpiration becomes the dominating factor in growth and the respective weights decrease. Spraying with lead arsenate mixtures does not produce any significant effects upon these factors. The weight of residue per fruit in the sprayed oranges remains practically constant during ripening, while it decreases in the unsprayed oranges. It would appear that the arsenate spray exerts an internal physiological action, resulting in a reduction of the 'active mass' of the cell-wall material.—**A. J. H. Goodwin and W. E. Jones**: A new stone implement technique from Natal. A series of minute cuts occur along the edge of stone implements of a hardened shale, discovered at Mfongosi, Zululand, by Mr. Jones. If these are human in origin they constitute an entirely new technique, hitherto undescribed; if of non-human origin they may illustrate the gnawing habits of a rodent, probably a field-mouse.

SYDNEY.

Royal Society of New South Wales, May 7.—Leo A. Cotton: An outline and suggested correlation of the Pre-Cambrian formations of Australia (Presidential Address). The study of the distribution and structure of the Pre-Cambrian rocks in Australia discloses three great massifs, the largest of which forms the greater part of Western and South Australia, embracing marginal areas in the adjacent states. For this block the name 'Yilgarna' is suggested. A second block forms a broad zone about the Gulf of Carpentaria, extending from Darwin on the west to the east coast of Queensland, north of Mackay. This is called the Carpentaria massif. The third massif is the Tasmantis of David and Sussmilch: the fourth and smaller massif is recognised in the Kimberley district. Between Yilgarna on the south-west, and the Carpentaria massif and Tasmantis on the north and east, lies the great Nullagine geosyncline. The interaction of these elements of the Pre-Cambrian framework of the continent has been the chief cause controlling the later geological history of Australia.

Official Publications Received.

BRITISH.

Annual Report of the Auckland Institute and Museum for 1929–30, presented at the Annual General Meeting held on 28th May 1930. Pp. 56. (Auckland, N.Z.)

Memoirs and Proceedings of the Manchester Literary and Philosophical Society, 1928–29. Vol. 73. Pp. vii+134+xlvii+7 plates. (Manchester.) 12*s*.

City and Guilds of London Institute. Report of the Council to the Members of the Institute, 1930. Pp. liii+80. (London.)

Journal of the Indian Institute of Science. Vol. 13A, Part 6: Dibatometric Studies in Enzyme Action. By M. Sreenivasaya and B. N. Sastri. Pp. 57-62. 12 annas. Vol. 13A, Part 7: i. Studies in Neutral Salt Action, Part 1: Diastase, by D. Narayanamurti; ii. The Nature of Amylase, 2, by D. Narayanamurti. Pp. 63-72. 1.8 rupees. Vol. 13A, Part 8: i. Action of Sulphur Monochloride on Mercaptans, Part 2: Formation of Organic Trisulphides and Hexasulphides, by P. P. Patel, I. Sengupta and G. C. Chakravarti; ii. Action of Sulphur Monochloride on Mercaptans, Part 3: Oxidation of Unsymmetrically substituted Hydrazodithiodicarbonamides to Thiodiazoles, by P. P. Patel and G. C. Chakravarti. Pp. 73-92. 1 rupee. Vol. 13A, Part 9: i. Power Alcohol and Paper from Rice Straw, by D. D. Deshpande; ii. Estimation of Pentoses and Pentosans by different Methods, by D. D. Deshpande. Pp. 93-112. 1.4 rupees. (Bangalore).

Indian Central Cotton Committee: Technological Laboratory. Technological Bulletin, Series A, No. 14: Technological Reports on Standard Indian Cottons, 1930. By Dr. A. James Turner. Pp. iv+122. (Bombay.) 2 rupees.

Proceedings of the Royal Society. Series A, Vol. 128, No. A807, July 1. Pp. 360. (London: Harrison and Sons, Ltd.) 18*s*.

Annals of Eugenics: a Journal for the Scientific Study of Racial Problems. Vol. 4, Parts 1 and 2, April. Pp. 232. (London: Francis Galton Laboratory for National Eugenics, University College.) 35*s*. net.

Quarterly Journal of the Royal Meteorological Society. Vol. 56, No. 236, July. Pp. 271-358. (London: Edward Stanford, Ltd.) 7*s*. 6*d*.

Journal of the Royal Microscopical Society. Series 3, Vol. 50, Part 2, June. Pp. xvi+161-296. (London.) 10*s*. net.

Experimental and Research Station, Nursery and Market Garden Industries Development Society, Ltd., Turners' Hill, Cheshunt, Herts. Fifteenth Annual Report, 1929. Pp. 88. (Cheshunt.)

British Empire Cancer Campaign. Seventh Annual Report of the Grand Council, presented at the Meeting held at the House of Lords, 14.7.30. Edited by J. P. Lockhart-Mummery. Pp. 198. (London.)

Proceedings of the Royal Society of Edinburgh, Session 1929–1930. Vol. 50, Part 2, No. 15: Do the Wireless Echoes of Long Delay come from Space outside the Moon's Orbit? By Carl Störmer. Pp. 187-199. 1*s*. Vol. 50, Part 2, No. 16: A Simple Spectrum Comparator. By Dr. David Jack. Pp. 200-203. 9*d*. (Edinburgh: Robert Grant and Son; London: Williams and Norgate, Ltd.)

Transactions of the Royal Society of Edinburgh. Vol. 56, Part 2, No. 22: Studies on the Scottish Marine Fauna. Additional Observations on the Fauna of the Sandy and Muddy Areas of the Tidal Zone. By A. C. Stephen. Pp. 521-535+1 plate. (Edinburgh: Robert Grant and Son; London: Williams and Norgate, Ltd.) 2*s*.

Technical College, Bradford. Diploma and Special Day Courses, Session 1930–31. Pp. 230+26 plates. (Bradford.)

FOREIGN.

Bernice P. Bishop Museum. Special Publication 15: Proceedings, Hawaiian Academy of Science, Fourth Annual Meeting, May 9-11, 1929. Pp. 20. (Honolulu.)

Journal de la Société des Américanistes de Paris. Nouvelle Série, Tome 21. Fasc. 1. Pp. iii+306. Fasc. 2. Pp. xxxi+307-556. (Paris.)

Report of the Aeronautical Research Institute, Tôkyô Imperial University. No. 60: A new Ultra-Speed Kinematographic Camera taking 40,000 Photographs per Second. By Prof. Toyotarô Suhara, Naozô Satô and Sidutakə Kamei. Pp. 187-194+plates 18-24. 0.28 yen. No. 61: Action of Antioxydants in Oxidation of Unsaturated Fatty Oils. 1: Mechanism of Inhibitory Action of Diphenylhydrazine and α-naphthylamine. By Bunnosuke Yamaguchi. Pp. 195-229. 0.33 yen. (Tôkyô: Koseikai Publishing House.)

University of Illinois Engineering Experiment Station. Bulletin No. 208: A Study of Slip Lines, Strain Lines and Cracks in Metals under Repeated Stress. By Prof. Herbert F. Moore and Prof. Tibor Ver. Pp. 60. 35 cents. Bulletin No. 209: Heat Transfer in Ammonia Condensers, Part 3. By Prof. Alonzo P. Kratz, Prof. Horace J. Macintire and Richard E. Gould. Pp. 50. 35 cents. Bulletin No. 210: Tension Tests of Rivets. By Prof. Wilbur M. Wilson and William A. Oliver. Pp. 36. 25 cents. (Urbana, Ill.)

Bulletin of the American Museum of Natural History. Vol. 61, Art. 3: Notes on the West Indian Crabs of the Genus *Actæa*. By Lee Boone. Pp. 117-127. (New York City.)

Publications of the American Association of Museums. New Series, No. 10: Nature Trails in Cleveland. By Edmund Cooke. Pp. 18. (Washington, D.C.)

U.S. Department of Agriculture. Farmers' Bulletin No. 1627: The Hessian Fly and how Losses from it can be Avoided. By W. R. Walton and C. M. Packard. Pp. ii+14. 5 cents. Technical Bulletin No. 183: Life History of the Oriental Peach Moth at Riverton, N.J., in relation to Temperature. By Alvah Peterson and G. J. Haeussler. Pp. 38. 10 cents. (Washington, D.C.: Government Printing Office.)

Cornell University Agricultural Experiment Station. Bulletin 501: Social Relationships of Slaterville Springs — Brooktondale Area, Tompkins County, New York. By Glenn A. Bakkum and Bruce L. Melvin. Pp. 55. Memoir 127: The Bacterial Diseases of the Bean; a Comparative Study. By Walter H. Burkholder. Pp. 88+6 plates. (Ithaca, N.Y.)

The Carnegie Foundation for the Advancement of Teaching. Twenty-fourth Annual Report of the President and of the Treasurer. Pp. vii+204. (New York City.) Free.

Conseil Permanent International pour l'Exploration de la Mer. Faune ichthyologique de l'Atlantique nord. Publiée sous la direction de Prof. Joubin. No. 4. 24 planches. 4.00 kr. Bulletin statistique des pêches maritimes des pays du nord et de l'ouest de l'Europe. Vol. 18, pour l'Année 1928. Pp. 80. 3.25 kr. (Copenhague: Andr. Fred. Høst et fils.)

The Memoirs of the Imperial Marine Observatory, Kobe, Japan. Vol. 4, No. 1, May. Pp. 51. (Kobe.)

Ministry of Agriculture, Egypt: Technical and Scientific Service. Bulletin No. 88: Cattle Plague in Egypt. By Dr. I. F. Salem. Pp. 32. (Cairo: Government Publications Office.) 5 P.T.

CATALOGUES.

A Catalogue of Books on Hunting, Horsemanship, Deer-Stalking, Shooting, Angling, Cricket, Golf, Big Game, etc. (Catalogue 527.) Pp. 40. (London: Francis Edwards, Ltd.)

Catalogue of X-ray Accessories. Pp. 48. (London: Watson and Sons (Electro-Medical), Ltd.)

Diary of Societies.

FRIDAY, JULY 25, TO *THURSDAY*, AUGUST 7.

GEOLOGISTS' ASSOCIATION.—Summer Field Meeting in the St. David's District, Pembrokeshire.

SATURDAY, AUGUST 2, TO *TUESDAY*, AUGUST 12.

INSTITUTION OF ELECTRICAL ENGINEERS (London Students' Section).—Summer Meeting in the Ruhr area and Switzerland.

CONGRESSES.

AUGUST 3 TO 9.

INTERNATIONAL CONGRESS FOR SEX RESEARCH (at House of British Medical Association).

Monday, Aug. 4.—Prof. F. A. E. Crew: Puberty and Maturity (Address). Papers relating to Puberty and Maturity.

Tuesday, Aug. 5.—Papers on the Biology of Testicular and Ovarian Function.

Wednesday, Aug. 6.—Papers on Hormone Therapy.

Thursday, Aug. 7.—Discussion on Psychology and Biology.

Friday, Aug. 8.—Papers on the Biological and Therapeutical Aspects of the Control of Human Fertility.

Among the papers to be communicated to the Sectional Meetings are The Aschheim-Zondek Test for Pregnancy (Prof. Aschheim); The Corpus Luteum Hormone (Dr. Clauberg); Biological Tests of the Female Hormone (Menformone) (Assistants from Prof. Laqueur's Institute); The Channels and Significance of Excretion of the Female Sex Hormone (Prof. R. T. Frank); The Male Sex Hormone (Prof. S. Loewe); Evidence for the Metabolic Basis of Sexuality (Dr. O. Riddle); Human Hybrids (Prof. C. G. Seligman).

AUGUST 4 TO 9.

INTERNATIONAL CONGRESS OF EXPERIMENTAL CYTOLOGY (in conjunction with the Anatomical Congress) (at Amsterdam).

AUGUST 5 TO 7.

IMPERIAL HORTICULTURAL CONFERENCE (to discuss the best methods of approach to horticultural problems and the technique involved) (at Royal Society of Arts).

Tuesday, Aug. 5, at 10 A.M.—Sir Robert Greig: Bureaux and their Work. The Director and Chief Officer of the Bureau: Discussion of the Work of the Imperial Bureau of Fruit Production and Future Lines of Development. This will be prefaced by a précis of the work already done.

At 11.30 A.M.—F. L. McDougall: Possible Development of Fruit Growing in the Empire from an Economic Point of View.

At 12.15.—J. L. Brown: The Evolution of the New Zealand Fruit Board.

Experiences of Horticultural Research—

At 2.30.—Dr. W. T. Macoun: In Canada:—(*a*) Centralised.
E. F. Palmer: (*b*) At an Unattached Station.

At 3.10.—Prof. A. C. D. Rivett: In Australia.

At 3.30.—Dr. B. Hahne: Horticultural Research in the Union of South Africa.

At 3.40.—W. G. Freeman: Tropical and Sub-tropical Fruit Industry. Difficulties Encountered and Lines of Attack.

At 4.15.—Sir Frederick Keeble: An Industrial Research Station.

Wednesday, Aug. 6, at 10 A.M.—Sir Daniel Hall: The Directions in which Experimentation is likely to be Valuable in Horticulture.

Field Experiments:—

At 10.45 A.M.—T. N. Hoblyn: The Adaptation of Modern Statistical Methods to Horticultural Conditions.

At 11.30 A.M.—Prof. E. E. Cheesman: Practicability of the Application of Statistical Method in the Case of Tropical and Sub-tropical and other Crops.

At 12.15.—F. J. Martin: Field Experiments in certain Tropical and Sub-tropical Crops in West Africa.

Application of Pure Sciences to Horticultural Problems under—Temperate Conditions:—

At 2.30.—Prof. B. T. P. Barker: Fruit Products and Associated Problems.

At 3.—Prof. V. H. Blackman: Some Physiological Considerations in Horticulture.

Tropical and Sub-tropical Conditions:—

At 3.30.—Dr. E. J. Maskell and Dr. T. G. Mason: Physiological Work in the Tropics. Some of the Problems with special reference to Cocoa, and some Possible Lines of Attack.

Soil and Climate Survey as a Basis for Fruit Research:—

At 4.—T. Wallace: Soil and Climate Survey as a Basis for Fruit Research.

T. Rigg: Soil Type and Manuring in Relation to Yield and Quality of Nelson Apples.

A. J. Prescott: Soil and Survey Work as a Basis for Fruit Production in Irrigated Areas.

At 4.30.—H. V. Taylor: Meteorology and Fruit Production: The British Scheme of Research.

Thursday, Aug. 7.—Progress of Fruit Storage Methods:—

At 9.30 A.M.—Dr. F. Kidd: A Survey of the Principal Fruit Storage and Transport Problems of the Empire to-day.

At 9.50 A.M.—T. Wallace: Factors influencing Storage Qualities of Fruits.

At 10.10 A.M.—Dr. A. J. Smith: Problems of Biological Engineering in the Cold Storage of Fruit.

At 10.30 A.M.—Dr. A. Horne: The Infection and Invasion of the Apple Fruit by Fungi in Relation to the Problem of Storage.

At 10.50 A.M.—Dr. D. Haynes: Chemical Change in Stored Apples: The Relation of the Time of Picking to the Chemical Composition and Storage-life of the Apple.

At 11.10 A.M.—Dr. L. P. McGuire and Dr. C. W. Wardlaw: Investigations of the Storage Behaviour of Bananas at the Low Temperature Station of the Imperial College of Tropical Agriculture, Trinidad.

At 11.30 A.M.—W. T. Hunter: Recent Progress in the Study of Johnathan Breakdown in U.S.A. and Canada.

At 11.50 A.M.—R. G. Tomkins: Biological Effects of Atmospheric Humidity.

At 12.10.—Meirion Thomas: Biochemical Study of Functional Diseases in Fruits.

Dr. B. T. Dickson and W. M. Carne: The Present Position of the Bitter Pit Problem in Australia.

R. Wheeler: Fruit Transport Problems in Canada.

E. A. Griffiths: Problems of Storage and Transport.

Prof. J. Young: Citrus Storage Investigations in Australia.

At 12.30.—F. A. Stockdale: Sources and Training of Future Horticultural Research Workers.

AUGUST 7 TO 15.

INTERNATIONAL HORTICULTURAL CONGRESS (in London).—*Papers to be read on Aug.* 8, 11, *and* 13:—

Prof. Priestley: Vegetative Reproduction from the Standpoint of Plant Anatomy.

Dr. Van der Lek: Anatomical Structure of Woody Plants in Relation to Vegetative Propagation.

Dr. R. Salaman: Vegetative Mutations.

Prof. E. Baur: Production of Mutations by External Stimulus.

Dr. F. E. Denny: The Excitation of Dormant Buds under External Influence.

John Innes Horticultural Institution: Graft Hybrids.

John Innes Horticultural Institution: Vegetative Production of Polyploids.

John Innes Horticultural Institution: Sterility.

G. E. Yerkes: Raising Root Stocks from Seed.

Dr. C. G. Dahl: Root Stocks from Seeds of known Parents.

Dr. R. J. D. Graham and L. B. Stewart: Special Methods of Practical Utility in the Vegetative Propagation of Plants.

Miss Mary E. Reid: The Influence of the Nutrient Conditions of Seeds and Cuttings upon the Development of Roots.

Prof. P. W. Zimmerman: Factors influencing Root Growth of Cuttings.

Dr. A. B. Stout: The Inter-relations between Vegetative Propagation and Seed Reproduction.

N. Esbjerg: Varieties grown on own Roots.

Prof. N. I. Vavilov: The Wild Progenitors of Fruit Trees in Turkestan and in the Caucasus.

R. G. Hatton: The Development of a Research Programme around the 'Build Up' of a Fruit Plant.

Dr. H. Faes: Vine Propagation.

L. Ravaz: The Influence of American Stock on French Vines.

W. G. Freeman: Vegetative Propagation of Cacao and the West Indies Citrus.

Prof. T. Tanaka and Y. Tanaka: Propagation of Citrus Fruits in Japan.

Prof. H. J. Webber: Studies on Rootstock Reactions in Citrus.

Dr. F. F. Halma: The Propagation of Citrus by Cuttings.

Dr. H. P. Traub: The Ripening Process in Fruits, with special reference to the Fig and the Grapefruit.

Prof. B. T. P. Barker: The Fruit Tree Complex in Relation to Environment: Some current Investigations at Long Ashton.

Prof. N. E. Hansen: Fruit Stocks where Mercury Freezes.

Prof. E. C. Auchter: American Experiments in Propagating Deciduous Fruit Trees by Stem and Root Cuttings.

W. T. Macoun: National Tastes in Apples.

Dr. L. Filewicz: The Frost Injuries of Fruit Trees in Poland in 1928–29, with special reference to the Influence of the Stock and Scion upon the Resistance of the Apple-trees against the Frost.

Dr. P. J. S. Cramer: Rubber Budding.

W. A. Orton: Propagation in Tropical Countries.

Prof. P. Work: Some Scientific Problems in connexion with Vegetable Seeds.

Eng. G. Jacobsen: Electric Heating of Soil in Hotbeds and Hothouses.

Prof. B. Fedtschenko: The Horticultural Work of Russian Botanical Gardens.

Prof. C. Regel: The Botanical Garden of the Present Day.

H. J. Rumsey: Horticultural Progress in Australia.