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Avebury—the Nation's Responsibility

AN interest in the preservation of areas of natural beauty or historic interest, now widely diffused among the public, affords hope of the success of an attempt which is being made to secure the famous site of Avebury and its immediate neighbourhood in Wiltshire from vandalism once and for all, and to promote its further archaeological exploration.

Of the importance to the prehistorian of the site at Avebury there can be no question. Even in the unlikely contingency that future excavation should bring no additional monuments to light, Avebury as it stands, with its satellites, constitutes one of the most imposing assemblages of the work of prehistoric man, not in Britain alone, but in the whole of Europe. The circle itself, with its three rings, is the largest known to exist. It covers twenty-nine acres of ground and is surrounded by a rampart and a fosse, now mostly silted up, three quarters of a mile in length. An avenue a mile long leads from one side to the remarkable sanctuary on Overton Hill. This avenue was marked by standing stones, but many are missing or fallen. The missing members are being sought underground by Mr. Alexander Keiller, and as they are found are being replaced. Even this work of exploratory repair has thrown fresh light on the cultural history of the settlement. A similar avenue of like length may have led from the circle in almost exactly the opposite direction. This too may prove a guide to future discovery.

The remains directly linked with the circle by no means exhaust its archaeological context. At a distance of a mile to the north-west lies the camp on Windmill Hill, which Mr. Keiller's recent excavations have made a *locus classicus* in the annals of archaeology; and at the same distance to the south is Silbury Hill, of which the bare statement that it is the largest artificial circular mound in Europe gives little idea of the impressiveness of its height and mass. Nearby are the East and West Kennet barrows, the largest long barrows in Britain. Both long and round barrows are numerous in the area; and not far away stands Stonehenge.

The mere enumeration of the monuments of the area is a sufficient indication of its pre-eminence in early cultural development, while their size and construction, necessitating the preparation, transport and erection of these great blocks of stone, as well as excavation on a grand scale,

must have involved an organisation of labour and an engineering skill such as could have been possible only at a point of concentration of a relatively large population over a considerable period of time. It requires little exercise of the imagination and no straining of the facts to see in Avebury a great centre of early tribal and religious activity. Lying on the periphery of European prehistoric culture, it is the meeting place and the goal of lines of ethnic and cultural migration, of which the paths across Europe are now emerging as the result of recent archaeological research. Already at Avebury and in the neighbourhood, excavation has established a cultural succession in the neolithic and early bronze ages of the third and second millennia before our era, which eventually may afford a clue to the causes which led to this great efflorescence of cultural development and the reason why it should have taken place precisely at this point.

Mr. Ormsby-Gore's appeal on behalf of Avebury, in *The Times* of May 31, is an exceptional measure to meet a difficult situation. As a Minister of the Crown and the responsible head of the department which has been entrusted by Parliament with the protection of our ancient monuments, he presses urgently for the co-operation of the public in the preservation and further exploration of this centre of ancient civilisation. By his action, the future of Avebury has been raised to the status of a national problem. Normally, the Office of Works does not take action in such matters except on outside representation; nor do its powers to protect ancient monuments under schedule extend, except in certain conditions, to ensuring the preservation and systematic and scientific investigation of the evidence which lies beneath the surface of the ground. Hence in the conflict of private ownership and scientific and historic interests, the latter, even in the face of public protest, may go to the wall. It is with the object of averting this catastrophe at Avebury that Mr. Ormsby-Gore has intervened to urge the need for immediate powers to control the future of the site.

At present, exact and scientifically assured knowledge of Avebury and its surroundings covers only a small part of the field; and an intensive exploration of a considerable area is essential before anything like a comprehensive view of its development will be possible. Mr. Ormsby-Gore, indeed, holds that this investigation is of such

moment that it should take precedence of all other schemes; and he couples Avebury with the Roman Wall as being of international importance. Further, he stresses the danger which threatens the character and archaeological development of the site through the erection of "haphazard bungalows, petrol pumps, or other less desirable forms of our ephemeral twentieth-century 'development'".

The danger is acute. Mr. Ormsby-Gore points out that the Office of Works has effective 'guardianship' only over Silbury, the West Kennet Barrow and the sanctuary on Overton Hill, and although the stones now standing or lying above ground are 'protected' under schedule, the land which everywhere may cover precious evidence of this great neolithic civilisation is in the hands of small landowners, who not unnaturally are desirous of making the most of their opportunities.

What is the remedy? Mr. Ormsby-Gore is anxious that the urgent work of conservation and further exploration should proceed forthwith, and suggests the immediate application of a scheme under the Town and Country Planning Act. For this it would be necessary to secure joint action on the part of the local authorities of Wiltshire, the owners and the Office of Works itself, as well as the support of "the various public bodies interested in the progress of British archaeology". While local bodies in Wiltshire will no doubt be sufficiently public-spirited to lend the weight of their authority, private owners may be less ready to acquiesce if the scheme involves serious interference with their rights to deal with their own property.

Without details it is impossible to say how far this method of procedure is likely to attain adequate preservation of the antiquities in the area and ensure the facilities necessary for future research. Under existing legislation, archaeological exploration would seem to be a necessary precedent condition of effective protection, and this will be both a lengthy and a costly business. If Avebury is of international importance as Mr. Ormsby-Gore maintains—and no archaeologist would be prepared to deny this contention—its possession by Great Britain imposes upon the nation a duty not only of maintaining the area in a condition worthy of its character and history, but also the duty of making accessible its full evidential value in the history of European civilisation—in other words, of assuming the responsibility for its exploration. Avebury and its

surroundings should be made a national possession and a reserve under Act of Parliament, much as is the Yellowstone Park in the United States, and a sum should be set aside annually in the provision for the Office of Works for its archaeological investigation. As the system of farming in

Wiltshire is not such as need interfere with the character of the area as a setting of archaeological remains, rents under Crown holdings would reduce the cost of such a scheme. In such a way, but scarcely otherwise, would this generation carry out to the full its obligation to posterity.

Reviews

Vitamin Research

Methodik der Vitaminforschung. Von Dr. Christian Bomskov. Pp. xvi+301. (Leipzig: Georg Thieme, 1935.) 24 gold marks.

THIS is a book that can be recommended without any hesitation or qualification to all those who are concerned with biological, chemical or physical assay of the vitamins. So thoroughly has the ground been covered, including even those portions of contiguous territory with which too many vitamin assayists seem to be unacquainted, that it can be confidently recommended to all who are engaged in any kind of biological assay whatever. The introductory pages, being concerned with the rearing and maintenance of a healthy animal colony, emphasise, however briefly, matters of fundamental importance to every animal laboratory.

On this question of an animal colony, there is one sentence in the introductory chapter that almost deserves to be printed in letters of gold. The author is discussing the "spontaneous" appearance of diseases in an animal colony and tersely remarks: "Die beste Prophylaxe ist immer noch die Sauberkeit im Tierstall". He gives some interesting tables showing the different stock diets that have been proposed by different investigators, and his tables showing the composition of different constituents will save many workers time in looking up figures and making their own calculations. It is, however, curious that, when stating the average weight of young animals produced on different diets recorded, he makes no distinction between the pure albino rat and the pied or hooded animal, though it is well known to workers in this field that certain strains of the latter may have a growth rate and a final weight 50 per cent greater than those of the former. It would obviously be quite unfair, for example, to condemn diet *A* because it permits in pure albinos less vigorous growth than diet *B* permits in pied albinos.

Before directing attention to certain of the author's views and venturing to criticise some minor points, it is necessary to point out that this

is the only volume available on its subject, and has therefore to be judged on its merits, without odious comparisons. Of the standard books on vitamins we recognise the English survey, published by the Medical Research Council, and the American Chemical Society's monograph by Sherman and Smith, as authoritative and permanent. The former lays naturally rather more emphasis on the clinical aspect than the latter, which is written by and for chemists; between them they give a comprehensive account of known facts and suspicions. The vast monograph by Ethel Browning, marred by a number of inaccuracies, commands respect for its bibliographic completeness, as also does the more limited but also more accurate bibliographical "Survey of Vitamins" published by Wodlinger in 1932. Besides these we have certain specialised books—for example, Barnett Sure's "Vitamins in Health and Disease", Hess's monographs on rickets and scurvy, Blunt and Cowan's "Ultraviolet Light and Vitamin D in Nutrition"—and a number of semi-popular expositions, but nobody has so far gathered together in one place an account of all the varying techniques employed in vitamin research. The excellent series of papers by Jung, in the *Zeitschrift für Vitaminforschung*, only occupies 54 pages, and is confined to methods of assay in food and pharmaceutical products; in Dr. Bomskov's much more comprehensive publication, all methods proposed by workers of standing have been described in detail and made to some extent the subject of critical consideration. One can particularly admire the way Dr. Bomskov has managed to produce by September 1934 (the date of his preface) a book that actually takes cognisance of the recommendations made by the Vitamin Conference in June of that year.

We might, it is true, with advantage have had a rather more detailed discussion of the principles involved in vitamin assay. Had this been done, the curious understatement that "in certain circumstances pure bred animals are to be preferred" could have been made considerably clearer. The change in methodology implied by the introduction of standard preparations into

vitamin assay should have been discussed explicitly, particularly since some German workers in the field have been amongst the worst sinners in depending upon animal reactions for their units of measurement.

After a general section, occupying 25 pages, there follows the special section of the book, in which every known vitamin is discussed separately. In addition to A, D, E, B₁, B₂ and C, the author has thought fit to include a discussion of the "fat-soluble growth vitamin", by which he understands the "Coward factor", though his references also cover the work of Evans and Lepkovsky on the unsaturated fatty acid dietary factor, which is perhaps a rather unfortunate confusion. In the water-soluble group he has included, besides B₁ and B₂, the following factors: B₆ (anti-pellagra), extrinsic factor or anti-sprue factor, B₃, B₄, B₅, F (reported by Sure, Kik and Smith, and possibly identical with the flavine factor), Chick and Copping's Y factor, the insoluble factor R of Hunt and Lewis and vitamin H of Györgyi, as well as the vitamin C₂ of Bezssonoff and von Euler. Besides this miscellaneous collection of vitamins, some of them of distinctly dubious respectability, we find in the last two pages of the book a section entitled "Vitamins of Doubtful Nature", including such things as McCay's trout factor, the anti-paralytic factor of Keenan and colleagues, the growth factors of Mapson, Daggs, Seegers-Smith, Madsen, Norris, and Bethke, with a final allusion to Wesson and Murrell's carbohydrate-exchange regulating factor.

The book is throughout profusely exemplified with tables and illustrations, the latter reproduced from original publications in various countries. Dr. Bomskov has adopted a sound, but rather unusual, course in reproducing most of his tabular matter in its original language, and has been remarkably successful in avoiding printer's errors during the process. (A very few, such as "scaily tail", "Osteolin", and so on have been noticed.) He has also inserted a number of tables of his own, as for example, the comparative list of vitamin B₁-free diets (p. 170), which includes seventeen variants proposed by twelve different workers or groups of workers.

The book is, naturally, concerned predominantly with biological methods of assay, but the author has given an adequate account of such procedures as the chemical evaluation of reducing power, proposed by Tillmanns, Harris and others for assaying vitamin C, and has even included the Reichstein, Haworth and Micheel syntheses of ascorbic acid, for which he has used the configuration put forward by the Birmingham workers and now generally accepted. Again, he has given adequate

recognition, following the findings of the 1934 Vitamin Conference, to the spectrophotometric method of assaying vitamin A, and does not overlook Chevallier's ingenious adaptation of this method.

Towards the end of each section on a particular vitamin, short special sections give information as to the requirements and storage of the vitamin in various animals, including man. It is interesting to note that the author regards vitamin B₂ as consisting of a flavine growth factor, Györgyi's antipellagral B₆, and the extrinsic factor of Castle, a view that we do not think will find general acceptance at the present moment. In the general section he also remarks, in passing, that on a particular stock diet of his own, the young animals have such large reserves of vitamin B₂ that they cannot be used for its investigation. In view of current controversy, however, his discrimination between the flavines and the anti-pellagral factor seems to be more important than his assignation of the term "B₂" to the former.

The book is extremely well served with references; the author has elected to place them at the foot of the pages to which they apply, and to dispense with the usual author index. The subject index of twelve pages is perfectly adequate. The high quality of Dr. Bomskov's work has been ably backed by his publisher, though it is a pity that a book likely to be handled as often as this one should be published in paper covers.

A. L. BACHARACH.

The Works of Huygens

Œuvres complètes de Christiaan Huygens, publiées par la Société Hollandaise des Sciences. Tome 18 : L'Horloge à pendule ou à balancier de 1666 à 1695; anecdotes. Pp. iv+703. (La Haye: Martinus Nijhoff, 1934.) n.p.

THE eighteenth volume of the monumental edition of the works of Christiaan Huygens, in course of publication by the Dutch Society of Sciences, appears less interesting than many of its predecessors. The reason for this impression does not lie in the value of its contents. On the contrary, it is because the greater part of the volume is occupied by the classical work "Horologium Oscillatorium", which alone would have sufficed to establish the enduring fame of its author. But this was the mature outcome of years of earlier research; the polished work is not only more familiar, but also the phase of creative effort has an interest which cannot be altogether sustained in a formal textbook, however original.

Huygens went to Paris in 1666, and nearly the whole of the following fifteen years were spent in the French capital. He had been in intimate correspondence with some of the leading founders of the Royal Society, and he took a natural place, and soon a dominant place, in that group of men who, under the encouragement of Colbert and his royal master, founded the Paris Academy of Sciences. What constitutes the greatness of Huygens is the universal character of his outlook and method. His distinction lies at once in observational science, in his mastery of physical manipulation and in natural philosophy. The practical and the theoretical side of things shared his interest. Hence his persistent and fertile efforts to improve the construction of the clock conferred a recognised benefit on mankind. Yet the motive came from the recognition of the clock as a scientific instrument of fundamental importance, and this in turn led him from the contemplation of one type of mechanism to the profound study of the fundamental laws of dynamics.

At heart, Huygens was devoted to the cultivation of science as a purely intellectual pursuit. Geometry, which for him meant Euclidean geometry of course, was the key. But no man of science ever preserved a more harmonious balance between all those sources by which scientific truth can be revealed.

As an acknowledged masterpiece of the first order, the "Horologium Oscillatorium" needs no description. Published in 1673, it is cast in the classical mould in the true line of descent from the Greek geometers. Although the main results embodied in the work were already in the possession of Huygens before he left Holland, as previous volumes of the present edition of his works have shown in detail, they had in many cases not been published in any definite form, if at all. Hence the publication in the shape of a regular treatise constituted an event of capital importance in the history of science in general and rational mechanics in particular. Nothing else is needed to show the remarkable state of development which dynamical ideas had reached at the very moment from which we are accustomed to trace the Newtonian system of dynamics.

Huygens returned finally to Holland in 1681. The present volume, in addition to the capital treatise here presented in French and Latin versions, contains all the fragments of his work bearing on the perfection and performance of the clock between 1666 and 1695. Their interest is mainly of a controversial, or purely technical, kind rather than of a general character.

H. C. P.

British Marine Zoology

The British Sea Anemones. By Prof. T. A. Stephenson. Vol. 2. (Ray Society Vol. 121 for the Year 1934.) Pp. xii+426+16+plates 15-33. (London: Dulau and Co., Ltd., 1935.) 37s. 6d.

THE sea anemone fauna of Great Britain is now known much better than that of any other area in the world, largely as a result of the twenty years work that has been put into Prof. T. A. Stephenson's magnificent monograph, just completed by the appearance of the descriptive volume.

In addition to the very full accounts of anatomy and the references to all previous work, the author of this comprehensive monograph, although he was obliged to omit his contemplated review of actinian physiology and behaviour, has given many interesting descriptions of the animals' habits. This has been facilitated by the comparative ease with which anemones can be maintained for observation in aquaria, a fact that is proved by the pathetic story of Mr. Evans's *Actinia equina* during the War. Left in an aquarium without food or aeration, in water that was becoming increasingly more salt through slow evaporation, the anemones held on until their owner's return, very much reduced in size, but still recognisable. The palm for longevity under artificial conditions—seventy-three years—is held by the famous individuals of *Cereus pedunculatus* at present in the care of Prof. J. H. Ashworth at Edinburgh.

A few of the discussions of special interest that deserve notice are: parasitism and burrowing habits in *Peachia*; the range of variation and the viviparous reproduction of the well-known and widely distributed *Actinia equina*; the colouring, reproduction and commensal algae in *Anemonia sulcata*; autotomy of tentacles in *Bolocera*; apparent suppression of tentacular feeding in *Aureliania*; the unusual action of the *Fangtentakeln*, and laceration in *Diadumene cincta*; the puzzle of the distribution, relation to environment, and original home of *D. luciae*; dwarf races, laceration and planktonic feeding in *Metridium senile*; resorption of tentacles in *Calliactis*; commensalism in *Calliactis* and *Adamsia*; laceration in *Sagartia elegans* and *Actinothoe*; and what may be regarded as neoteny in *Metridium senile* and *Sagartia troglodytes*.

Lovers of the living things of the sea in particular will be grateful to Prof. Stephenson for the help he gives them in the identification of the British anemones. He provides not simply a key, the ends of which might be defeated by careless use, but a combination of a key and a summary

of the most important features. The volume is illustrated by numerous and beautifully executed text figures of anatomy and patterning, as well as by eight more exquisitely drawn plates in colour and eleven plates of photographs. Together with the charming and fanciful (if not strictly relevant) vignettes which terminate some of the chapters, they make the work one of artistic as well as

scientific importance. It is a critical and masterly account with a good bibliography of a difficult subject by one of the world's greatest experts who, although he has shown himself sympathetic with the demands of the modern schools of physiology and ecology, is not one of those who take lightly the responsibilities of the systematist.

A. K. TOTTON.

Short Notices

Methods of Air Analysis. By Prof. J. S. Haldane and J. Ivon Graham. (Griffin's Scientific Text-Books.) Fourth edition, revised throughout and enlarged. Pp. vii+176. (London: Charles Griffin and Co., Ltd., 1935.) 7s. 6d. net.

ALTHOUGH it is twenty-three years since Dr. Haldane's little book was first published, the methods and apparatus which he has described with such minute attention to detail are still in everyday use for the examination of air and mine gases. With the collaboration of Mr. J. Ivon Graham, the fourth edition has now been enlarged and admirably brought up to date without changing the general character of the book.

Owing to the toxicity of carbon monoxide, much attention has been directed of late years to the determination of very small quantities of this gas, for which purpose the portable and laboratory types of apparatus used in the Mining Research Laboratory, Birmingham, and capable of detecting 0.0005 per cent are recommended.

From the point of view of safety in mines, the new chapter dealing with the application of gas analysis to the detection of spontaneous combustion is of particular interest; the authors state that the analytical method is capable of greater sensitivity than the older one depending on smell.

Another trend in the technique of gas analysis has been the development of specialised instruments such as the Hartridge reversion spectroscope and the Katz recorder for carbon monoxide, the McLuckie apparatus for inflammable gases, and the Owens dust collector, to mention only a few of those described in the present volume.

F. R. E.

Handbook of Chemistry: a Reference Volume for all requiring Ready Access to Chemical and Physical Data used in Laboratory Work and Manufacturing. Compiled and edited by Prof. Norbert Adolph Lange, assisted by Gordon M. Forker. With an Appendix of Mathematical Tables and Formulas, by Prof. Richard Stevens Burington. Pp. xiv+1265-248+29. (Sandusky, Ohio: Handbook Publishers, Inc., 1934.) 6 dollars.

THE present reviewer has kept this handbook beside him for several months and has put it to the test repeatedly. It has met the requirements on every occasion, in chemical matters as well as in purely mathematical.

One of the best sections of the book comprises the 234 pages dealing with 4,452 organic compounds, for each of which is given a 'Beilstein' reference, in addition to the usual information. This reference is a particularly useful feature as it enables the reader to find at once the page in the enormous and unwieldy Beilstein where he can obtain further information. The section on inorganic compounds extending to 112 pages is also very useful.

In addition to the data given in the tables just mentioned, all the more important properties are given tables to themselves, and when only a limited list of substances is mentioned, the reader is directed where he can find a more complete list.

Among the interesting and novel features are: changes in atomic weights from 1894 until 1933; a large table of alloys (including heat- and corrosion-resisting alloys); classification of crystals; organic reagents for inorganic analysis; laboratory solutions; hazardous chemicals and their handling. There is a wealth of data covering not only a very wide field of pure chemistry (physical, inorganic and organic) but also every conceivable section of applied chemistry. The information is also brought well up to date.

It is impossible to give a complete catalogue of all the subjects treated in this valuable handbook, but great care seems to have been taken to make the information as complete and accurate as possible. Further, considerable attention has been paid to the arrangement of the details, which will be found very convenient.

The Complete Book of British Butterflies. By F. W. Frohawk. Pp. 384+32 plates. (London and Melbourne: Ward, Lock and Co., Ltd., 1934.) 10s. 6d. net.

It is now nearly thirty years since South's "Butterflies of the British Isles" was first published, and this, in its successive editions, has remained the best book on the subject both for the beginner and the more advanced collector. In 1929, Mr. Frohawk brought out his "Natural History of the British Butterflies", but the price of this was beyond most pockets. Mr. Frohawk has now challenged the supremacy of South's book by re-issuing, in a cheaper form, the essential illustrations from his larger book with good descriptions of all stages of the insects and excellent biological notes. All the illustrations and the greater part of the letterpress are the original work of the

author. This has many advantages but some drawbacks, as, for example, a rather sweepingly exact statement that in *Erebia epiphron* "The larval stage lasts 288 days".

References are made to variation, protective coloration and migration, sufficient at least to excite the interest; and, as one would expect from Mr. Frohawk, there is an excellent account of the relation of the larva of *L. arion* to ants. Only one misstatement has been noticed, and that not about a truly British insect; contrary to what is said on pp. 38 and 41, the Monarch butterfly has an adult life up to about ten months and has a definite period of semi-hibernation in the southern United States.

The classification and Latin names are the most up-to-date possible, that of the Royal Entomological Society's recent list, but the author shows either misapprehension or unbounded optimism where he refers to this as an "established International Rule" and a "permanent International Classification"; we wish that it were so! Among the English names we wonder if he is trying to introduce the law of priority when he replaces the well-known 'Gatekeeper' by the older 'Hedge Brown'.

On the whole an excellent book, particularly for the young naturalist in whom the desire for collecting can be replaced by wider biological interests.

C. B. W.

Structural Geology: with Special Reference to Economic Deposits. By Bohuslav Stočes and Charles Henry White. Pp. xv+460. (London: Macmillan and Co., Ltd., 1935.) 25s. net.

THE mining geologist who has a sound knowledge of the various types of crustal deformations and of the form, extent and position of mineral deposits of economic importance with their relationships to the host rocks, is well-equipped for one of the most important aspects of his work; and whilst experience in the field will always remain the best training ground, it is essential that he should be familiar with structural types of various kinds, particularly those encountered in certain mining areas in different parts of the world.

Hitherto, the mining geologist has been handicapped by the lack of a suitable treatise, for although it is true that a number of books on structural geology have been published, few of these appeal strongly to mining engineers and mining geologists, who prefer clear illustrations of dislocations and deformations as revealed by underground mining, to long and involved descriptions of structural types which are largely hypothetical and based only on surface indications. Dr. Stočes, professor of geology at the National School of Mines of Czechoslovakia, whose former work on this subject was published in both Czech and German, and Dr. White, who has had practical experience as a consulting mining geologist in many countries since his retirement from the professorship of mining and metallurgy at Harvard University, have rendered conspicuous service to mining engineers and mining geologists by the publication of this authoritative volume. It

differs from other books on structural geology in at least three important aspects: it is written specially for graduate and post-graduate students of applied geology; the reading matter has been wisely subordinated to remarkably clear and well-selected sketches, diagrams and photographs, numbering in all 663, almost two to every page; and the illustrations include a large number of the structural types encountered in mining areas in different parts of the world.

W. R. JONES.

Inorganic and Theoretical Chemistry. By Dr. F. Sherwood Taylor. Third edition. Pp. xiv+832+19 plates. (London: William Heinemann, Ltd., 1935.) 12s. 6d. net.

THE third edition of this book is only 14 pages longer than the first edition, but includes sections on most of the recent developments, such as *ortho-* and *para*-hydrogen, heavy hydrogen, neutrons and positrons, atomic transmutation and artificial radio-elements. The current view, that the nucleus is composed of protons and neutrons, is mentioned; but it is not adopted in the figure illustrating the isotopes of neon.

Certain weaknesses, which have persisted from the first edition, still call for comment. Thus, although a clear distinction is drawn between covalent and electrovalent links, salts are still occasionally formulated as covalent molecules, as when a fictitious ring-structure is assigned to barium peroxide (p. 600). Conversely, an ionic structure is incorrectly assigned to hydrogen bromide (p. 208), which is surely only ionised in presence of a 'base' or proton-acceptor. The student is also frequently misled by equations in which protons are shown instead of oxonium ions, as in the dissociation of water (p. 137), of acids (p. 186) and of hydrogen sulphide (p. 620). There is also a curious contradiction between the definition of a base (p. 186) and a subsequent statement that substances such as ammonia are "incorrectly called bases" (p. 194). These features, however, are only of minor importance in a book the merits of which have already been described in an earlier review (*NATURE*, 129, 919, June 25, 1932).

Technical Gas Analysis. By Dr. George Lunge. Revised and rewritten by Dr. H. R. Ambler. Pp. xvi+416. (London and Edinburgh: Gurney and Jackson, 1934.) 21s. net.

LUNGE'S book has held the field during twenty years, so that the new edition is overdue. The book has been largely rewritten; it aims at being comprehensive of all processes and types of method, as well as giving detailed working descriptions of the more noteworthy.

Gas analysis increases in importance as more industrial operations are brought under scientific control, the degree of accuracy required varying according to circumstances: time is often an important factor. Continuous recording instruments are coming into use when possible. The book follows well-known lines, and is illustrated by diagrammatic drawings of the apparatus. It should find a place in all technical and analytical laboratories.

40 metres—and consists of sand, often of a chalky nature. According to some geologists, this region represents a series of cemented quaternary dunes, which were hitherto the undisputed domain of the Mediterranean scrub and of tall forests, with only limited clear areas.

(3) *The true internal region*, lying between the preceding and the foot of the Lepines, constitutes the marsh proper and corresponds approximately with the deepest part of the ancient lagoon. The hydrographical conditions of this region were very irregular and variable. Abundant Carsic springs at the base of the Lepines—such as those of Ninfa—fed comparatively large water-courses, the natural flow of which was hindered by the slight slope of the ground, by the chain of dunes, by the vegetation, etc.

The soil varies in character throughout the region, being rich in humus and fertile in the lowest parts, where it is mixed with detritus of volcanic origin, mostly clayey and marly in the higher areas, and sandy and hence little suited to farming near the sea. The region is said to have been well cultivated and thickly populated in the Volscian age (twenty-four inhabited centres are spoken of, the largest being Pometia). The destruction of the Volscian State and its subjection to Rome, together with the abandonment of the drainage schemes, in which the Volscians must have been highly expert, and possibly also climatic changes, resulted in desolation. Actually, however, there is little exact knowledge of the conditions of the region in the pre-Roman epoch, but in early Roman times the marshy areas must have been very extensive. Attempts at reclamation date back to the end of the Roman Republic. Others were made during the Empire, in the Middle Ages by enterprising pontiffs like Martin the Fifth, and in modern times, under Leo the Tenth, Sixtus the Fifth and Urban the Eighth, who made appeal to the experience of Dutch engineers. The most impressive endeavour was that made at the end of the eighteenth century on the initiative of Pius the Sixth, but the main drainage canal, constructed over a length of about 30 km. parallel to the Apian Way, and fed by lateral channels, proved inadequate to drain the whole of the marshy area. This area, including land boggy only at times, amounted to 370 sq. km. Napoleon caused the problem to be studied again by well-known hydraulic engineers, such as Fossombroni, but failed to find time to give effect to the projects elaborated.

It is not possible to give here the history of the successive efforts made in the nineteenth century or of the earlier ones of the present century, which, like the splendid work of Pius the Sixth, led only to a partial and temporary solution. The more the problem was studied, the more complex it

appeared. The drainage question was, indeed, the first, but not the only one, demanding solution, as it led naturally to the sanitary problem—the struggle against malaria and the creation of the conditions for healthy existence. There was also the agrarian problem, comprising preparation of the soil for its immediate utilisation, population and colonisation, and installation of roads and other means of communication. All these issues required simultaneous resolution, and this was the aim of the law of Integral Reclamation (*Bonifica integrale*), which concerned Italy as a whole, but

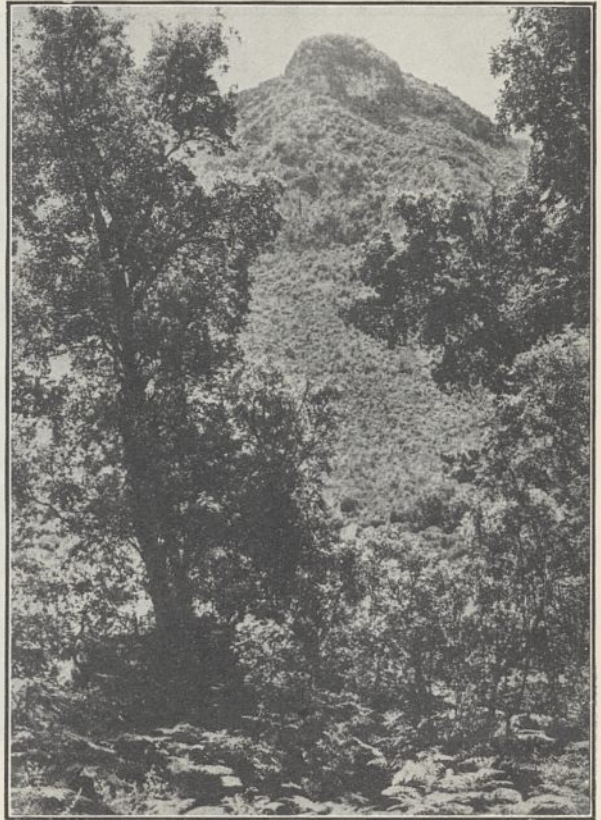


FIG. 2. Mount Circeo and scrub country.

found in this region its greatest and most complete application. The whole of the work involved was entrusted to the Opera Nazionale dei Combattenti.

The drainage problem was met by creating three systems of canals, which partly utilised existing water-courses. The waters of the more northern portion of the plain flowing from the Lepine Mountains—the so-called *high waters*—were conveyed to the sea by a direct route, mainly by an extensive collecting canal (the Mussolini Canal), which is 27 km. long and is the most important drainage work yet accomplished. This is able to deal with a flow of 450 cubic metres per second and flows, under suitable control, into the River Astura. *The middle waters* flow into another

large collector and pass to the sea through old water-courses, the principal of these being the Martino River (the work of Pope Martin the Fifth) and its tributaries the Cicerchian and Nocchian 'ditches', which have been re-organised. *The low waters* flow partly into the Pia water-course, which is still in good order, and partly are collected by a network of channels and led to the Fiume Sisto (named after Pope Sixtus the Fifth), the bed of which has been widened and deepened. In all, 1,756 km. of canal have been excavated and renovated. Other work has resulted in the drainage

and manuring, particularly with phosphates, have been necessary. Great difficulty has been encountered in the destruction of the thick Mediterranean scrub, consisting of deep-rooted trees, and both fire and dynamite have been employed to get rid of the roots. For tilling, use has been made of powerful multiple ploughs of the Fowler type. The so-called Terracina Forest, containing most of the tall trees, has been preserved for inclusion in a national park, which takes in also part of Monte Circeo.

The whole plan of reclamation outlined above

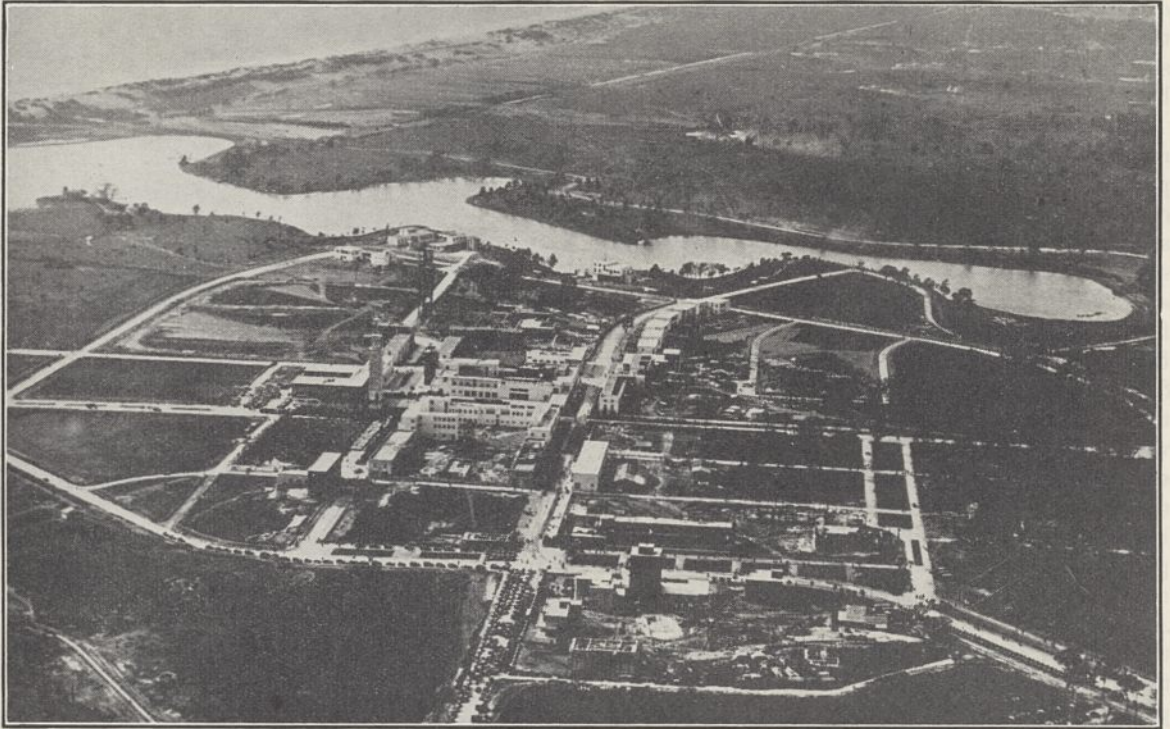


FIG. 3. The new city of Sabaudia.

of many wells and stagnant pools throughout the scrub zone—the so-called *Piscine*. Operations on a still larger scale are in progress with the object of keeping the coastal lakes within definite bounds. A number of difficult technical problems are here involved. Work on Lake Fogliano, which is well stocked with fish, is already well advanced; its bed is being deepened, its banks made up and the marshy margins dried, and permanent connexion with the sea is being established. Development of Lake Paola and of the district of Sabaudia on its shore is likewise proceeding. Work on the two smaller intermediate lakes is also under way; in the case of Lake Caprolace, certain areas around it are below sea-level, and have needed special means for drainage.

The reclaimed lands were not as a rule ready for immediate cultivation. In most cases deep tilling

was, as already mentioned, put into the hands of the Opera Nazionale dei Combattenti at the end of 1931. The average daily number of workmen employed was 13,500, board and lodging being provided for them by the creation of two large villages, as well as a number of smaller settlements.

During the first year—to October 1932—10,500 hectares were reclaimed and made ready for cultivation, in the second 14,100 and in the third about 17,000. The total agricultural land thus made available by the end of 1934 exceeded 41,500 hectares. In addition to the actual ploughing, etc., this necessitated the construction of houses and other buildings for the new colonies, and the creation of a network of roads, etc., so as to render the region fitted for permanent occupation.

All this has involved revolutionary changes,

since, until a few years ago, the Pontine region had no stable population. The section of coast from Nettuno to Terracina was, perhaps, one of the longest tracts of desert coast in the whole peninsula. A few hamlets (*casali*) existed along the Appian Way, and two or three in the remaining territory. From remote times the region had had a transitory population engaged in wood-cutting, production of charcoal, and raising cattle, sheep and pigs. This population lived in the most primitive huts, which contained only a single apartment and had a small, low door, with no other opening. The contents consisted of a hearth built of a few stones, beds, and a few essential articles of furniture. Such huts were found especially in the forest clearings (*lestre*), sometimes in groups of three or five or more, and occasionally in villages with a hundred or more inhabitants. This population came from the villages of sub-Apennine Latium (Filettino, Trevi, Veroli, Alatri, etc.) and spent eight or nine months in the region (October–June).

The huts have now almost entirely disappeared, and separate farmhouses, of two or three different types, are being built at regular intervals in the newly reclaimed area. As is natural in an agricultural district, the populace is a scattered one. On an average, 10–12 hectares of land, with house, are allotted to each family, the area being increased twofold on the poorer soils. Each farmhouse comprises living rooms, with stables below for the larger cattle. Small accessory buildings contain a furnace and accommodation for pigs and chickens, and a well and drinking troughs for the cattle are also supplied, together with implements, chemical fertilisers, etc. After a certain period of tenancy, the farms will pass into the possession of their occupiers. During the first three years, ending with the year 1934, about 2,450 farmsteads were built, the colonisation proceeding from north to south and from the coastal districts inland.

At certain points, chosen for ease of access, centres known as boroughs (bearing the names of battle-sites) have been instituted. Of these boroughs (*borghi*), which include a bureau of agricultural control, a health station, sometimes a school, a church, etc., twelve had been formed by the end of the year 1934. In view, however, of the vast extent of the area colonised, more important urban centres were also required to provide public services, business establishments, hotels, hospitals, places of entertainment, etc. The first of these, Littoria, was commenced on June 30, 1932, on the site of the former Quadrato, and was inaugurated on December 18 of the same year. The second, Sabaudia, situated in a magnificent position on the inner shore of Lake Paola, was begun on August 5,

1933, and officially opened on April 15, 1934. In October 1934, the first stone was laid of the third urban centre, Pontinia, in the farthest inland and lowest region, near the Appian Way, and in a zone where the work of reclamation has only just been begun; this was to be ready for occupation in April, 1935. Two further urban centres, Ausonia and Aprilia, are already projected.

Population of the agricultural districts of the Pontine region has been accompanied by that of the coasts, where seaside resorts have been developed. Among those already built are Foce Verde—to serve the Cisterna country—and Littoria. Under construction is Sabaudia Beach, which will be connected with the main centre by a bridge over Lake Paola at its narrowest point. During the past summer a seaside colony entertained 400 children from the families of the farmers of the Pontine region.

As regards the population of this region, it should be pointed out that the occupants of the new settlements are derived, not from the district that formerly supplied its temporary inhabitants, but from distant, over-populated parts of Italy: Friuli, Vicentino, Polesine, Ferrarese, etc. Admission to the colonies has been rigorously controlled, preference being given to the families of ex-service men and, among these, to the more numerous.

Whereas, in the past, the Pontine region had only a single road for wheeled traffic—the old Appian Way—and a few tracks and bye-ways, the whole of the colonised portion is now traversed by a fine network of roads (416 km. up to the end of 1934), adequate to meet the requirements of the new conditions and arranged according to a predetermined plan.

The mainstay of agriculture is corn, which has cropped well during the first three seasons in the Littoria district. Tree-fruit is also being grown and, in the south, horticultural produce—notably tomatoes, in the district between Terracina and Circeo. The lower slopes of Circeo and the environs of Terracina have been noted from ancient times for their vines. Beet-growing has commenced and the installation of a sugar factory at Littoria is projected. Attention will, however, probably be devoted mainly to corn, of which Italy is greatly in need.

The profound transformation brought about in Southern Latium by the Pontine reclamation is felt also in adjacent districts, especially in the Lepine towns, the relations of which with the plain below date from the earliest times. The new condition of things has also had an important consequence from the administrative point of view, as it has determined the creation of a new province—the ninety-third in Italy—which

embraces a vast region reaching, towards the south, to the River Garigliano and having Littoria as its capital.

The new province of Littoria has an area of 2,100.3 sq. km. and a population now approaching 200,000. The capital, Littoria, is a city constituted

almost exclusively of offices, business houses, places of assembly, scholastic establishments, hospitals and the like, etc. Its fixed population is only 2,500, but, like Sabaudia, it has been planned with a view to extensive development in the future.

To Sir Charles Vernon Boys on his Eightieth Birthday

Why does Sir C. V. Boys elect
To do the things we least expect,
And always choose a task that seems
More suited to the land of dreams:
A problem other men would shirk,
Yet solve the task, and make it work
By means that *no one* else employs?
The answer is: Boys will be Boys!

What made him buy an Otto bike—
Two wheels abreast—a thing to strike
Terror in any rider's soul,
Yet somehow manage to control
Its actions and avoid a spill,
And—using his uncanny skill—
Delight in a precarious poise?
Again we say: Boys will be Boys.

Why snatch a bullet in its flight,
Lit by a single spark so bright
That on a photographic plate
The fleeting shadow seemed to wait—
With wake and bow-wave primly set—
All posing for their silhouette—
And leave a picture of the *noise*?
Because, of course, Boys will be Boys!

Why did his bold, untrammelled thoughts
Conceive the scheme of fusing quartz,
Using an arrow, as it fled,
To draw a microscopic thread,
And from the fusion to "unreel"
A gossamer more true than steel,
Which every Physicist enjoys?
The fact is this: Boys will be Boys.

What made our friend so seeming rash
As to pursue a lightning flash
By lenses rapidly revolved,
And even get the problem solved—
Both of its speed and structure—by
A photograph "which cannot lie"?
That gave a thrill that never cloys,
And showed us still, Boys will be Boys.

To weigh the earth—to check the Therm—
Explain the logarithmic term—
To build with bubbles, and maintain
The opal colours in their train!
These are his pleasures, these his ploys
(Where skill with mind and Truth alloys)
For which, in Science, as in Toys,
We thank our stars, Boys *will* be Boys!

R. A. S. P.

Obituary

SIR GEORGE CORY

SIR GEORGE CORY, who died on May 7 at seventy-two years of age, had spent forty-four years of his life in South Africa. He received his scientific training at King's College, Cambridge, where he took honours in the Natural Sciences Tripos in 1888. After holding various academic appointments in the schools of Grahamstown, which is in the Eastern Province of Cape Colony, he was appointed professor of chemistry in Rhodes University College in 1904, and occupied the chair with great distinction until his retirement with the title of professor emeritus in 1925.

Cory was undoubtedly a good teacher and was beloved both by his colleagues and his students, whom he could, and did, inspire with his own enthusiasm. Indeed, some of his men have done extraordinarily well, but the truth is that though his heart was in his work, his real interest in life lay elsewhere. As a consequence of this, no scientific discoveries of any great value can be placed to his credit. He had neither the temperament nor the vision for chemical or physical research, and as

Rhodes College was off the beaten track, there were no chemical souls with whom he could commune.

Cory was really an antiquary. Very soon after his arrival at Grahamstown, where much of the early South African history was enacted, he realised, as indeed did others, that records of the doings of the 1820 settlers and of others would soon be lost if an attempt was not made to collect them. While others talked, Cory acted. He never took a holiday, but spent all his spare time in trudging over the country, covering great distances, enduring much physical discomfort, to carry on his self-imposed task. All interested in South Africa know that his "Rise of South Africa", in six volumes, was practically completed some little time ago. For his work in this and in other but similar directions, Cambridge awarded him the honorary degree of D.Litt. in 1921, and when he was knighted in 1922 he came to England, which he had not seen for more than thirty years, and did further historical research. He was awarded the gold medal of the Royal Empire Society in 1933.

MR. W. R. BUTTERFIELD

THE town of Hastings has suffered a grievous loss through the death of its museum curator and librarian. William Ruskin Butterfield came from Bradford in 1894 as a school teacher, and soon began to take a prominent part in the work of local scientific societies as a field naturalist. In 1905 he was appointed curator of the museum in the Brassey Institute, Hastings, and in 1909 librarian of its reference library, both of which under his care grew greatly in importance as centres for the study of the natural history, archaeology and arts of south-east Sussex. In 1929 the mansion of John's Place was purchased by the town as a home for the museum. This gave Butterfield his opportunity. In its new quarters under his skilful hands the museum became a live thing, each room the sanctuary of a particular science or art. Meanwhile, the reference library was rehoused in the old museum, and a lending library and reading rooms were added. The whole was a wonderful achievement for a man constitutionally unable to delegate responsibility; but a breakdown in health followed. From this, Butterfield recovered sufficiently to set up as an annexe to the museum the "Indian Durbar Hall" (from the Colonial and Indian Exhibition of 1886) which had been given to the town by the late Lord Brassey, and to arrange in it with his old skill the collections of "The Voyage of the Sunbeam", but he never regained complete health and died suddenly on March 24 at the age of sixty-two years.

Butterfield was a great Nature lover and an

accurate observer, and he contributed papers to the *Museums Journal*, of which he was for a time editor, and to local scientific periodicals. His knowledge of the locality embraced not only his favourite subjects of birds and insects, but also every branch of natural history and archaeology. This first-hand knowledge made him an excellent expositor, whether in the museum or on Nature rambles, and many hundreds of townfolk must owe their first interest in science to his inspiration. T. S. D.

WE regret to announce the following deaths:

Sir Robert Blair, education officer of the London County Council in 1904-24, on June 10, aged seventy-six years.

Mr. J. T. Cunningham, lecturer in zoology in Queen Mary (East London) College in 1917-26, on June 5, aged seventy-six years.

Mr. Daniel Nicol Dunlop, O.B.E., a director of the British Electrical and Allied Manufacturers' Association, and a founder of the World Power Conference, on May 30, aged sixty-seven years.

Prof. R. M. Holman, associate professor of botany in the University of California, an authority on the longevity and germination of pollen, and author of well-known botanical textbooks, on April 23, aged forty-nine years.

Prof. Alice Werner, C.B.E., emeritus professor of Swahili and the Bantu languages in the University of London, on June 9, aged seventy-five years.

News and Views

The Actonian Prize of the Royal Institution

THE Managers of the Royal Institution have awarded the Actonian Prize for 1935, of one hundred guineas, to Mr. W. T. Astbury, for his papers on "X-ray Studies of the Structure of Hair, Wool and Related Fibres". The Prize is awarded septennially, and is given, in the quaint phrasing of the deed of trust of the Acton Endowment, to the "author of the best essay illustrative of the wisdom and beneficence of the Almighty in such department of science as the said Committee of Managers for the time being of the said Institution shall in their discretion select". It is provided that the award may be made in respect of essays or papers already published. Mr. Astbury was for some years an assistant in the Davy Faraday Research Laboratory of the Royal Institution, working with Sir William Bragg on various problems in connexion with the X-ray analysis of crystal structure. He left the Laboratory in 1928, and is now lecturer in textile physics and director of the Textile Physics Research Laboratory of the University of Leeds. He has applied the X-ray technique acquired during his earlier work to textile problems, and the Actonian Prize is awarded to him in respect of the two valuable papers, under the general title given above, published in the *Philosophical Transactions of the Royal Society*.

Dewar Research Fellowship

THE bequest by Lady Dewar of a sum of money for the furtherance of research in the Royal Institution, in memory of the work of her husband, the late Sir James Dewar, has already been announced. The Managers of the Royal Institution have resolved, as the best method of giving effect to Lady Dewar's wishes, to establish a Dewar Research Fellowship, and conditions governing the award of the Fellowship have now been drawn up. The research must be carried on at the Royal Institution, in a branch of science at the discretion of the Managers. The appointment, which is open to persons of either sex, will be for a period of three years in the first instance, with a possible extension to five, and will carry with it a salary of £400 a year. It is hoped to appoint the first Dewar fellow later this year, and applications are being invited through the usual channels.

Award to Sir Frederick Banting

THE Society of Apothecaries of London at a Court-Dinner held in Apothecaries' Hall at Blackfriars on June 4 conferred upon the discoverer of insulin, Sir Frederick Banting, the Society's Gold Medal in Therapeutics, the highest honour which the Apothecaries' Company can bestow. After the presentation, Sir Frederick thanked the Society on behalf of those

who were associated with the early work on insulin, and referred to the desire of Canadians to be in touch with 'the old land'. He said that, as professor of medical research in the University of Toronto, he saw research students passing away from the University; in one year forty-five per cent of the graduates of the University went to the United States; nevertheless their bond with the British Empire was stronger than with America; their desire was to become more British. He asked that Canadian students should be made kindly welcome in Britain in order that their sentiments of kinship might be made stronger. In Canada they are endeavouring to send their students to Britain, for the great thing about British medicine is that it rests on a solid foundation. Traditions are only beginning in Canada; in this respect there is a great difference from Britain. The Canadian who comes over here takes back with him on his return some of the high traditions which guide men in Great Britain. The bonds of fellowship are stronger and more enduring than financial inducements, which are a source of weakness. Sir Frederick's great wish is that the ties with Britain should be strengthened.

The Quetta Earthquake

FEW details of scientific interest have as yet reached England from the Quetta district. Shocks of course continue to be felt, some of them strong enough to bring down walls left standing among the ruins. The destruction of Quetta City is almost complete. Landmarks of all kinds have disappeared, and the city is a widespread mass of debris. An official report gives the number of killed in it as 26,000 out of a population of 40,000. In addition to the towns of Kalat and Mastung, at least one hundred villages have been totally destroyed within a band 130 miles long and 20 miles wide, the number of killed in them being estimated as between 12,000 and 15,000, so that the total number of deaths is probably about 40,000. So impossible is it to excavate the dead bodies in Quetta City that all the survivors have been removed in fear of an outbreak of disease. The city has been surrounded by barbed-wire entanglements and will be protected by guards in order to save the property of survivors from marauding tribesmen; it is intended that the city shall remain so sealed for a whole year.

International Co-operation in Americanist Studies

AN important proposal for the promotion of studies in American ethnology and colonial history on an international basis is to be submitted to the next General Assembly of the League of Nations. It originated with M. Levillier, delegate of the Argentine, who proposed to the last General Assembly that arrangements should be made for the publication by international co-operation of a series of original and authoritative works dealing with the indigenous peoples and cultures of the Americas and with the history of the discovery, geographical exploration, conquest, settlement and colonial government of the continent in the sixteenth century. The proposal

was approved in principle and referred to the International Institute of Intellectual Co-operation for consideration and report on the organisation and financial arrangements necessary to give it effect. Such a scheme has now been prepared by a committee of Americanists appointed by the International Institute. The Committee is a strong body of distinguished diplomatists and historians; but as much stress is laid on the importance of the ethnology of America and the history of indigenous cultures, it is a little surprising to find that anthropology is represented on the Committee by one member only. Although that member, M. Paul Rivet, is a host in himself, it might, perhaps, have been expected that some, at least, of the numerous distinguished authorities on American ethnology and culture would have been included in the list of those consulted by correspondence, where Prof. Stolyhwo of Warsaw appears as the only anthropologist.

THE suggestions of the Committee provide for the publication of, approximately, fourteen volumes dealing with indigenous ethnology and culture, and fifty dealing with the historical side of Americanist studies. These volumes would be published over a period of years at the rate of, say, four a year, two in ethnology and two in history. In a comprehensive and detailed synopsis of topics, the subject-matter has been classified into six sections, of which the first covers the geology and natural history of America and the archaeology, physical anthropology, demography and culture of the Indians. The remaining five sections cover European relations with America before and after the Spanish discovery, the history of the discovery and exploration of the various parts of the continent, the conquest, the colonial period and administrative, social, religious and economic organisation during the sixteenth and down to the beginning of the seventeenth century from all points of view. The preparation of the volumes, which will appear in English or French, and will be in the nature both of monographs on specific points of research and treatises of a synoptic and general character, will be entrusted to scholars of admitted and international repute. The general aim of the Committee in preparing the scheme has been to promote the better mutual understanding of the peoples of the Americas and Europe and at the same time to remove popular misconceptions as to the methods and aims of the conquistadores and early colonists. While the Committee is unable to suggest precisely the price at which volumes should be published, as this must vary according to the amount of illustration, it mentions as an approximate figure 60 francs, with a subscription price of 40 francs, and invites advance promises to subscribe in order to facilitate consideration of its proposals.

Origin of Man Again

AT the Victoria Institute or Philosophical Society of Great Britain, on March 25, Mr. Douglas Dewar read a paper entitled "A Critical Examination of the supposed Fossil Links between Man and the Lower Animals". The paper contains no critical examination

of any of the fossils, but it shows how expert opinion has differed regarding the interpretation of the relationships of the relatively few specimens which have been found. The interpretation of fragmentary fossils is a ticklish business (witness the controversy regarding the significance of the Caithness fossil *Palaeospondylus*, notwithstanding that scores of complete specimens are known), so that no one need be unduly disturbed by different interpretations of anthropoid fragments. Nevertheless, Mr. Dewar correctly sums up the position when he states that "science can truthfully say that it knows not when, where or how, man originated"; but he understates the truth when he says that this is all that science knows, for although there is "no conclusive evidence that any Primate genus has been transformed into any other genus", there are resemblances in detail and gradings which require much explanation if transformism is to be rejected. To say that "each new type appears in the rocks having all its characteristics, as if it had migrated from some other locality", simply pushes the problem back to the 'other locality'. How did it originate there?

Special Creation or Evolution?

MR. DEWAR does not say so, but probably he would agree with the view of the president of the Victoria Institute, Sir Ambrose Fleming, that man and every other genus began as a special creation. In support of that thesis, Sir Ambrose regards the Java, Heidelberg, Piltdown and Pekin 'men', as biological abnormalities, passing over the probabilities against the disappearance of all the normal forms of their time, and the preservation of abnormalities only. He holds that "if nearly as many [human] individuals die as are born in a year, there can be no particular contest for food and one of the factors in the Darwinian causes of evolution is thereby removed" ("Modern Anthropology *versus* Biblical Statements on Human Origin". Second edition. London: Victoria Institute, 1935. 1s.) But this mortality rate is what actually happens in every stable species of plant and animal, and the enormous destruction has generally been regarded as affording just that opportunity for selection which Darwin postulated. These and other aspects of the anti-Darwin controversy are dealt with in a lively booklet by Sir Arthur Keith, "Darwinism and its Critics" (The Forum Series, No. 20. Pp. vii+56. London: Watts and Co., 1935. Paper, 7d. net; cloth, 1s. net), in which he defends the theory of evolution against the arguments of Sir Ambrose Fleming, and of other critics, some obviously ill-informed as to the facts. Sir Arthur clings to his hard-hitting style, but his punches are clean, and he swings a good knock-out. Also he adheres to the adage of a recent school grammar book—"explain clearly, as if to a Scotsman . . ."

London Television Station

THE Postmaster-General announces that the Television Advisory Committee has recommended the adoption of the Alexandra Palace for the London

Television Station. This recommendation has been approved by the Postmaster-General; and the British Broadcasting Corporation has made arrangements with the Alexandra Palace trustees for the use of a portion of the buildings for the station. The ground at the Alexandra Palace is 306 ft. above sea-level; and it is proposed to erect a 300 ft. mast on the site, thus providing an aerial height of 606 ft. above sea-level which, it is considered, should enable a high definition television service to be provided for the London area. The Baird Television Company and the Marconi-E.M.I. Television Company are being invited to tender for the supply of the necessary apparatus for the operation of their respective systems at the station. The Baird Company proposes the adoption of a standard of picture definition of 240 lines sequential scanning, 25 picture traversals a second, 25 complete frames a second; and the Marconi-E.M.I. Company propose a standard of 405 lines, 25 pictures a second, interlaced to give 50 frames a second, each of $202\frac{1}{2}$ lines. The Committee proposes that the vision signals shall be radiated on a wave-length of about 6.6 metres and the associated sound signals on a wave-length of about 7.2 metres.

Television in Germany

A REGULAR television transmission service has already been inaugurated in Berlin by the German Post Office authorities, and arrangements are made whereby the public can attend demonstrations so that they may see for themselves what the new service has to offer. An article describing the proposals for the further development of television in Germany was given in the *Wireless World* of May 24, as an abstract of a paper by W. Scholz, recently published in *Elektrische Nachrichten Technik*. The television transmissions are of the 180 line, 25 pictures per second type and are given on ultra-short waves of less than 8 metres. Both sound and vision transmissions take place on these wave-lengths, so that a single heterodyne oscillator may be used at the receiver for both portions of the programme. A total band-width of 2,400 kilocycles per second is allocated to each station for the combined programmes. In the scheme proposed, it is assumed that a minimum field-strength of 1 millivolt per metre has to be provided, and that the transmitters will have aerial powers of from 2 to 20 kilowatts on wave-lengths between 5.7 and 7.5 metres. The lower-power stations will be erected on mountain peaks at heights ranging up to 4,000 ft., and it is estimated that the effective range of these stations will be of the order of 85 miles. On this basis, it is considered that the whole of Germany can be provided with a television service by means of twenty to thirty stations, the wave-lengths being distributed geographically so as to avoid mutual interference.

Progress in the Gas Industry

THE seventy-second annual general meeting of the Institution of Gas Engineers was held in London on June 4-7 under the presidency of Mr. C. Valon Bennett of Rochester. He reviewed the present

position and general trends in the industry as a supplier of solid, liquid and gaseous fuels. There is a movement for gas works to pass into the control of holding companies, a process which has led at times to increased efficiency and a reduction in prices to the consumer. Mr. Bennett indicated the dangers to be feared where undertakings were bought at inflated prices, owing to the availability of cheap money, and where the motive force was financial opportunism irrespective of public good. In some countries, organisations have been established for the official testing and certification of gas appliances. Mr. S. Lacey and Mr. C. A. Masterman contended that such a movement could bring no advantage in Great Britain, where the safety and efficiency of gas apparatus already exceeds that current in other countries. Mr. W. L. Boon described the rapid advance of gas coke in public favour for domestic purposes. The development of the gravity feed boiler has resulted in coke displacing oil firing of central heating installations. With these boilers, uniform conditions can be maintained automatically, with attendance once in 24 hours, at a very low fuel cost. Open coke grates are increasing in popularity and already some 70,000 have been installed in London alone.

Flock of Birds Mistaken for Sea-Serpent

LIEUT. A. J. COBHAM, R.N., sends us an account of a flock of low-flying birds being mistaken for a sea-serpent. Similar observations have been made before, but it is worth while to put Lieut. Cobham's notes on record. On March 14, 1935, H.M.S. *Electra* was 100 miles S.W. of C. Spartel (North Africa). At about 17.30 G.M.T., weather being fine and visibility a maximum, Lieut. Cobham was on the bridge with a midshipman and a signalman. Suddenly to the westward, about 200 yards off, what seemed to be a sea-serpent was seen, travelling at about 30 knots on a slightly divergent course. "It had a small head, on the surface, creating a bow-wave, and behind, at intervals of approximately 12 feet, there were four humps, each with a bow-wave. Every 20 seconds or so the beast submerged for a few moments. Inspection with binoculars showed the phenomenon to be a flock of small birds of the guillemot family (*Alle alle* or *Fratercula arctica*). They were flying in five 'V'-formations, skimming so closely over the water that from time to time they were hidden by a swell. The light, due to a heat haze, was peculiar. The sea, to the westward, appeared to be an oily grey colour, against which the birds showed black. All three of us had the same impression on sighting, and so 'real' was the appearance that after establishing the truth with binoculars, the birds still looked exactly like a sea-serpent when seen with the naked eye."

Avon Biological Research

THE annual report of the biological research which is being carried out on the River Avon at Southampton in association with the University College there gives an account of the varied lines of work

pursued in the second year of this scheme (Southampton: University College. 2s. 6d.). The general condition of the coarse fish in the area is described, with a special note on the incidence of 'black spot' disease among them. Methods are being sought for checking the loss of fish in mill-races, in the flooding of water-meadows, and by poisoning from decaying masses of weed. The use of green light has been tried to deter fish from entering dangerous waters, as well as a revolving fish screen which automatically keeps itself free from debris. Preliminary experiments have been made on the hatching and rearing of salmon and trout under natural and artificial conditions, and the resulting yield and condition of young fish were determined. The work was seriously hampered throughout by the drought conditions of 1933-34.

National Institute of Agricultural Botany

THE fifteenth annual report (1933-34) of the National Institute of Agricultural Botany, Cambridge, shows that continued progress has been made in all departments. An important change in the stations at which crop testing is carried out took place in the autumn of 1934, when a new centre was established at Askham Bryan near York, in place of that at Good Easter, Essex, which was closed down. The results at the latter station had proved so similar to those at Cambridge, that it seemed more valuable to extend the Institute's activities in a northward direction. Two new winter wheats from the Cambridge University Plant Breeding Institute were tested (162/8/1E, and W.70 A) and gave very promising results, while 'Resistance', the new winter oat which had proved so outstanding in former trials, was put on the market for distribution. Continued progress is recorded in the work of the Official Seed Testing Station, 29,487 samples being dealt with during the year under review. With regard to the activities of the Potato Testing Station at Ormskirk, eighty-seven entries were received for the official immunity trials, and all but three of these remained free from wart disease in the field. It is noteworthy that, with the exception of three varieties known to be duplicated, all the new varieties entered for the trials proved to be distinct. This is a striking tribute to the way in which the Potato Synonym Committee has been able to check the practice of distributing old varieties under new names and at an enhanced price.

Report of the Development Commissioners

THE twenty-fourth report (1933-34) of the Development Commissioners which has just been published (London: H.M. Stationery Office. 2s. net) deals mainly with the various purposes for which advances from the fund were made to assist agriculture, rural economy and fisheries. In general, the allocation of grants was very similar to that in the previous year, but although no actual payments were made, arrangements were completed whereby the work at certain British institutes, hitherto financed by the Empire Marketing Board, could be continued.

Since detailed descriptions of the scientific work in progress at the various research institutes aided by the Development Fund are published elsewhere, only a brief outline of their work is given in the present report. The scheme, organised by the Society of Friends, for assisting unemployed men in cultivating allotments, was once again given financial support, in view of the great success of the work in 1933. Disappointment, however, is expressed that it was not possible to assist as many as had been hoped, chiefly owing to the difficulty in securing suitable land. The Rural Economy Section reports progress on nearly all sides, and rural industries are being developed over most of Great Britain on practical and profitable lines. Fishery research has also produced valuable results, particularly with regard to the herring and haddock industries. The determination of the best-sized mesh to use to ensure that undersized fish are not landed has enabled definite legal regulations to be enacted, and the survey of young haddock stock has rendered it possible to forecast the quantities of marketable fish and their probable distribution in future years. The report concludes with a financial statement and a schedule of the grants allocated during the year under review.

Agricultural Research in East Africa

THE Colonial Office has issued the sixth annual report (1933-34) of the East African Research Station at Amani (London: H.M. Stationery Office. 1s. net), from which it is evident that progress has again been made in all the various research activities with which the Station is concerned. As regards coffee investigations, the earlier impression that heavy applications of organic manures to *arabica* coffee effectively offsets the harmful influence of soil acidity has now been confirmed, while culture solution studies suggest a marked correlation between acidity of the medium and the degree of branching of the roots which occurs, high acidity being associated with an unbranched type of root system. Results of importance have also been obtained by the plant pathology section, as the vector of the mosaic disease of *Cassava* has been definitely proved to be a species of white fly (*Aleurodidae*). On the biochemical side comes the discovery that the fermentation of coffee is an unnecessary process so far as quality is concerned, though the difficulties of correlating quality with the method of preparation of the coffee are still not overcome. The cultivation of sisal (*Agave amaniensis*) continues to increase, and the first lot of seedlings raised at the research station are now becoming available for fibre tests, the standardisation of which has been considerably developed during the past year.

Fishery Research in the U.S.S.R.

THE organisation of fishery research in the U.S.S.R. is the subject of a brief but highly important article by Prof. B. S. Ilyin in the current issue of the *Journal du Conseil* (9, No. 3. Conseil Permanent International pour l'Exploration de la Mer. Andr. Fred Høst et Fils, Copenhagen. December 1934). The Scientific Institute of Marine Fisheries, formerly the

Central Scientific Institute of Fisheries (Moscow), and the State Institute of Oceanography (Moscow) have been united under the name of the "Union Scientific Institute of Marine Fisheries and Oceanography". The new Institute is designed to function as a planning, guiding and co-ordinating centre for the activities of the numerous fishery stations situated around the coasts of the U.S.S.R. Its purpose is to promote the welfare of the fisheries by acquiring data concerning marine biological and oceanographical phenomena, and intelligently applying the results. In this connexion the formation of an economic section is of especial interest and importance in view of present events and tendencies in the fishing industry of Great Britain. The Institute will issue three series of publications—*Transactions*, *Records* and *Bulletins*—all in Russian, but the first two will be furnished with English, French or German summaries. The address of the Institute is Moscow, Verkhne Krasnoselskaya 17.

Research in the Electrical Industry

THE fourteenth annual report of the British Electrical and Allied Industries Research Association (the E.R.A.) shows that the electrical industry is fully alive to the commercial value of research. It has been well supported both by the Government and the various branches of the industry during last year, and although we do not agree that there can never be a point "at which research has all the support it needs and deserves", it has certainly not been "oversubscribed" in the past. The long list of researches the Association has before it, still inadequately financed, shows that there is need for further co-operative help. It is interesting to read that designers of insulating material for electrical material are now attaching less importance to a knowledge of the electric strength of their materials and more to their thermal conductivity. The importance of Fourier's theorems on the conduction of heat is being fully recognised, and also that temperature is a leading factor in electrical breakdowns. For some years the flame of the Méker burner has been the standard for the determination of "resistance to naked flame". It has been found that the standardisation of the burner flame in conjunction with simple correction factors is unsatisfactory, as flame temperature is not correlated to the calorific value of the gas in a simple manner. Further experiments are being made to develop a standard flame for scientific tests in connexion with 'inflammability'. The electrical resistivity map of the soil of England and southern Scotland has now been completed, and a summary of the work done on telephone interference has been published. Tests on radio interference are in progress. A list is given of the Government departments, engineering and scientific institutions, universities and colleges which have co-operated in the work of the Association.

Progress in Radio Communication

A paper by Col. A. S. Angwin giving a review of the progress of radio communication for the year

1934 (*J. Inst. Elec. Eng.*, Feb. 1935) is of general interest. The great technical progress made in broadcasting during the last two years is reflected in its rapid development. At the beginning of 1932, the number of licensed listeners in Europe was nearly 14 millions, and two years later it was nearly 20 millions. In 1929 the total power used in broadcasting was 420 kilowatts, whilst five years later it was more than ten times greater. Now that an average high-power station consumes 2 million electric units a year, it is important to use only transmitters of high efficiency. The extended use of short-wave telegraph working in ships has enabled the British P.O. stations to communicate regularly with whaling boats in the antarctic and in eastern waters. Directive aerials have been erected at these stations covering all the main shipping routes of the world, and this has greatly improved the services. Additional radio-telephone services from Great Britain to South Africa, Egypt and India have been opened up, while services to Japan, Shanghai, Kenya and Iceland are projected. By extension to circuits already existing, radio communication is now possible with nearly all the South American States. The outstanding feature in radio research has been the intensive study with the help of the cathode ray oscillograph of the propagation of waves in the ionosphere. The methods now in use indicate that the reflected signal resulting from a single pulse incident on the ionosphere consists frequently of a doublet the components of which are separated by a small time-interval. The reflected components are apparently electrically polarised waves of opposite rotational sense.

Machine Mining and Labour Problems

ALTHOUGH machine mining has made comparatively rapid progress during recent years, there is still room for a great advance in mechanisation. In a paper by Mr. J. Dooley, printed in the *Mining Electrical Engineer* of February, it is stated that in Yorkshire, which is one of the most progressive coal fields of Great Britain, only about one third of the coal produced is cut by machines and only about a sixth is loaded on to conveyor belts. There are a few coal seams from which coal simply rolls over into the 'tub', and it would be quite unnecessary to 'machine-cut' the faces of these seams. But even in these cases mechanical loading could be economically applied by means of conveyors of suitable design. Another economic factor which has to be taken into account is the possibility of a shortage of suitable labour in the near future. This question may rapidly become acute as newer and more attractive industries and interests arise to attract the boys and young men who would otherwise automatically enter the pits. It is true that to some extent machines displace labour temporarily, yet the position may be reversed, and collieries be compelled to put in machines because sufficient labour is not available. It is essential for colliery managers to get to work with new ideas, and arrange and organise systems of work so that full advantage be taken of the existing types of machinery. There are machines already in use

designed to carry enormous loads in supporting the roof and protecting other machines employed for cutting, loading and conveying coal simultaneously. American collieries have very large outputs per 'man shift', far in advance of anything ever attempted in Great Britain.

Pacific Science Association

THE Fifth Pacific Science Congress of the Pacific Science Association was held in Canada in 1933 under the presidency of Dr. H. M. Tory, president of the National Research Council of Canada. The Congress, which was held under the auspices of the National Research Council of Canada and through the generosity of the Government of Canada, was a notable achievement in the history of the Association. Representatives of no less than thirty-two countries attended the Congress, while the total number taking part in the meetings exceeded four hundred. The meetings were held in Victoria, B.C., on June 1-4 and in Vancouver, B.C., on June 5-14. The success of the Congress has now been crowned by the publication of the *Proceedings* in five large volumes amounting to more than four thousand pages (Toronto: University of Toronto Press; London: Oxford University Press, 1934. 5 vols. 84s. net). These volumes form a noteworthy summary of scientific knowledge from many aspects contributed by research workers of those countries bordering the Pacific Ocean. It is clearly not possible to review the contents of these volumes, but mention should be made of the lavish hospitality extended to the members and participants by the Canadian authorities. The many social functions and the interesting excursions arranged for the entertainment of the visitors must have largely fulfilled one of the main objects of the Pacific Science Association, which is "to strengthen the bonds of peace among Pacific peoples by promoting a feeling of brotherhood among the scientists of all the Pacific countries". This alone should be sufficient tribute to the devoted care and energy given by those responsible for the organisation of the Congress.

German Science

A NEW quarterly review in English of German science has appeared under the title "Research and Progress" (Terramare Office, Berlin W.8), the editor being Dr. Karl Kerkhof. In the second number, which appeared in April, the articles are mostly geographical or cultural and historical in character. Prof. Erich von Drygalski discusses the effect of the polar regions on the history of the earth, dealing with the influence of currents of air from the pole from the physical, biological and human points of view, while Prof. Rudolf Spitaler considers the influence of shifts in the earth's axis on the production of earthquakes. Prof. Diedrich Westermann deals with a subject on which he has already made his views familiar to English readers—the changing African. The introduction of syphilis from the New World in 1493 is characterised by Prof. K. Sudhoff as a legend; it is suggested, however, that it may have spread by earlier contacts between the Old

World and the New through eastern Asia. No reference is made to recent research, which seems to point to its existence in Europe in early pre-historic times. The cults and ritual of myth are discussed in two articles, one by Prof. K. Th. Preuss on the significance of birth and death and their relation to initiation and other forms of ceremonial in which sex is an element, and the second by Prof. Gustav Hübener, who regards the position of the hero in early epics as based upon his power as an exorcist. Although this does not exhaust the list of contents, mention can be made here of one other paper only—Prof. Erich Haenisch's interesting suggestion that the vertical arrangement in Chinese writing is due to the form of the ancestral tablet. The papers are brief, running to two or three pages only, and the treatment summary and popular. As a counter to English comment on Germany's 'purge', it does not make a really impressive showing.

Studies of the Rarer Elements

In his address as retiring president to the Chemical Society given on March 28 and entitled "Recent Researches on Certain of the Rarer Elements" (*J. Chem. Soc.*, p. 554, April 1935), Prof. G. T. Morgan outlined some of the most important advances which have been made in recent years in the study of the rarer elements. The British Empire is endowed with mineral resources to an extent unsurpassed by those of any other nation. It is obviously the duty of British chemists to undertake the systematic investigation of the rarer elements of the Empire, for it is certain that results of inestimable value will be forthcoming. Prof. Morgan is himself an outstanding leader in this kind of work and the results which he and his colleagues have accumulated form the main topic of the address. The extraction of germanium and gallium from Northumberland coal-ash has been started by Dr. G. R. Davies. Certain seams of Northumbrian coal give an ash containing up to 1 per cent of germanium and 0.05 per cent of gallium. The germanium is distilled out with acid as tetrachloride, whilst gallium trichloride remains in the still. A diagram of the apparatus is given. Rhenium has been extracted from Australian molybdenite by a lengthy process involving fractional volatilisation and ultimate separation with organic reagents such as 8-hydroxyquinoline and dipyrindyl. The address concludes with some notes on the co-ordination compounds of ruthenium, amongst which is an ammine which dyes natural silk in red shades but is extremely difficult to isolate in a state of purity.

A Central Statistical Institute

DESPITE the immense increase in the amount of statistical material which has become available during recent years, investigators still lack the data for even approximate measurement of many of the most important economic forces. In an article in *World Survey* of May 1935 entitled "The Case for Economic Measurement", Mr. G. D. H. Cole pleads for the establishment of a Central Statistical Institute in

Great Britain which would undertake the regular and prompt compilation and issue of this type of information, including regular surveys of production, prices, wholesale and retail trade, population movements and the like. He also advocates the publication of an annual "Progress of Britain Report" like that issued by the Government of India. The annual "Statistical Abstracts of the United Kingdom", it is true, go back nearly to the middle of the nineteenth century, and though greatly improved since the early issues, they have by no means been expanded in proportion to the development of the official *corpus* of statistics taken as a whole, and anyone who wants to collect the bare essentials of the current statistics in Great Britain has to work through much scattered material in numerous official publications. Mr. Cole also states that the publications of the Stationery Office on the subject are often expensive; while in most towns it is impossible to find any place where even the most important public documents can be consulted, and for private students or even small institutions, the cost of buying the bare minimum of requisite reports is excessive.

Prices of Biological Books in 1934

THE analysis of the cost of biological books in 1934, by John R. Miner (*Quart. Rev. Biol.*, Dec. 1934, p. 496), illustrates the significance of the devaluation of the dollar in affecting relative prices of American and foreign books. The estimates of cost are worked out in cents per page, the price of a foreign book being converted at the current rate of exchange, and the total number of pages upon which the calculations are based is 123,876. The only country in which prices have fallen is U.S.A. where (at 0.93 cents a page) there has been a drop of almost 9 per cent compared with 1933 prices. British Government publications have dropped from 1.39 to 0.89 cents a page and are now the cheapest of the lot apart from U.S. Government publications, which are issued at the amazingly low price of 0.18 cents a page; but the British Government sample was too small to be reliable. British books, on the other hand, have risen in terms of dollars by 45.5 per cent, French by 35 and German by 32. As to relative prices, British books now slightly exceed in price American books (0.96 against 0.93), France stands at 1.00 and Germany at 1.89 cents a page. As was noted in the report for 1933, the high prices of German scientific books and periodicals have proved a hardship to libraries and individual workers, and although as the result of a conference with German publishers some reductions in the prices of scientific periodicals have been made, evidently these reductions do not extend to scientific books.

Books on Horticulture

MESSRS. WHELDON AND WESLEY, LTD., of 2, 3 and 4 Arthur Street, New Oxford Street, London, W.C.2, have rendered a valuable service to gardeners by compiling a "Comprehensive List of Books on all Branches of Modern Horticulture, and a Selection of the Early Literature" (New Series, No. 39, 1935).

More than 1,000 titles are included in the forty-four pages of the pamphlet, and they cover every aspect of gardening, both practical and scientific. The section on early literature contains eighty-seven numbers, and includes the rare "Nievve Herball" by Dodoens, the first English edition of which was published in 1578. Sections on soils, manures, diseases, pests and propagation introduce the garden reader to well-chosen books on these subjects, whilst volumes describing vegetables, fruit, greenhouse produce, cacti, alpines, orchids, roses and other flowers are amply represented, as well as works on garden design and general practice.

The Green Flash

A NOTE in NATURE of May 25, page 866, gave a number of references to observations of the green flash and the conditions producing the phenomenon. In connexion with this subject, Dr. Raymond M. Bell, of the Pennsylvania State College, directs attention to Admiral Byrd's account of the phenomenon in the *National Geographic Magazine* (58, 186; 1930). Admiral Byrd observed the green colour for as long as thirty-five minutes in Antarctica as the sun rolled along the horizon.

Announcements

A REUNION dinner of former students of the University of Leipzig will be held in London on November 2; further particulars will be announced later. Those who desire to attend should send their names either to Prof. W. Wilson, F.R.S., Bedford College, London, or to Prof. F. J. Wilson, Royal Technical College, Glasgow, as soon as possible, but not later than October 1.

THE International Congress on Malaria which was to have been held at Madrid next October has been postponed to the spring of 1936.

A SOCIETY OF EUGENICS has recently been founded at Bucharest under the presidency of Prof. G. Marinesco, professor of nervous diseases and electrotherapy in the University.

AN international radio station for the distribution of medical consultations to ships of every nation on the high seas has been founded at Rome with the Marchese Marconi as president of honour.

THE autumn meeting of the Iron and Steel Institute will be held in Manchester on September 16-18. Further information can be obtained from the Secretary, The Iron and Steel Institute, 28 Victoria Street, London, S.W.1.

THE tenth international congress of the history of medicine will be held in Madrid under the presidency of Prof. G. Marañón on September 23-29, when the following will be the principal subjects for discussion: Arabian medicine in Spain; medicine in America during its discovery and colonisation; medical folklore in various civilised countries. The subscription is 75 pesetas each for members of the International Society of the History of Medicine and 100 pesetas

for others. Further information can be obtained from the Secretariat of the Congress, Arrieta 12, Madrid.

At the eighteenth annual meeting of the American Society of Ichthyologists and Herpetologists held at the Carnegie Museum, Pittsburgh, Pa., on May 2-4, the following officers were elected for the ensuing year: *President*, Clifford H. Pope, American Museum of Natural History; *Vice-Presidents*, Henry W. Fowler, Philadelphia Academy of Natural Sciences, Tracy I. Storer, University of California, E. H. Taylor, University of Kansas; *Secretary*, M. Graham Netting, Carnegie Museum; *Treasurer*, A. W. Henn, Carnegie Museum; *Editors*, Carl L. Hubbs and Helen T. Gaige, Museum of Zoology.

A GENERAL discussion on "Phenomena of Polymerisation and Condensation" has been arranged by the Faraday Society to be held in Cambridge, on September 26-28. The following workers from outside Great Britain have promised contributions and hope to be present: Dr. H. J. de Boer (Eindhoven); Dr. R. Houwink (Eindhoven); Prof. J. R. Katz (Amsterdam); Dr. O. Kratky (Vienna); Prof. H. Mark (Vienna); Dr. J. C. Patrick (Yardville, U.S.A.); Dr. G. Salomon (Zurich); Prof. R. Singer (Berne); Prof. H. Staudinger (Freiburg-im-Breisgau); Prof. H. I. Waterman (Delft); Dr. H. B. Weiser (Houston, U.S.A.); Prof. G. S. Whitby (Ottawa). It is also hoped that Prof. A. Favorskij (Leningrad), Prof. F. Medredjev (Moscow), Prof. K. H. Meyer (Geneva) and Dr. W. Carothers (Wilmington, U.S.A.) will be present. Further details can be obtained from the Secretary, Faraday Society, 13 South Square, Gray's Inn, London, W.C.1.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A junior assistant, a research investigator and a junior research investigator to the British Non-Ferrous Metals Research Association—The Secretary, Regnart Buildings, Euston Street, N.W.1 (June 17). A lecturer in bacteriology in the University of Birmingham—The Secretary (June 22). A civilian educational officer in the Royal Air Force Educational Service (engineering or physics)—The Secretary (A.E.), Air Ministry, Adastral House, Kingsway, London, W.C.2 (June 24). An assistant lecturer and demonstrator in botany in University College, Southampton—The Registrar (June 26). A temporary assistant in farm economics in the Department of Agriculture for Scotland—The Secretary, Department of Agriculture for Scotland, Queen Street, Edinburgh, 2 (June 29). Mechanical engineers and chemists for the Supply Board Technical Establishment under the Director of Ordnance Factories—The Under-Secretary of State (C.5.), The War Office, London, S.W.1 (July 1). A professor of mechanical engineering in Osmania University, Hyderabad—The High Commissioner for India, General Department, India House, Aldwych, London, W.C.2 (July 6). A professor of mathematics in the University of Aberdeen—The Secretary (July 23). A tutor in either biology or the history of science in the Harlech Residential College for Adult Education, North Wales—The Warden.

Letters to the Editor

The Editor does not hold himself responsible for opinions expressed by his correspondents. He cannot undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. No notice is taken of anonymous communications.

NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 1002.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Passage of Helium through Compact Solids

IN NATURE of January 5, p. 30, experiments were described showing that gelatine, celluloid and cellophane, like vitreous silica, will allow helium (but not air) to pass fairly freely through them at the ordinary temperature. I have since found that vitreous boron trioxide has the same property. Vitreous borax, like the common glasses, does not possess it.

As regards the behaviour of single crystals, I have tried a number of them, and have failed to prove the passage of helium at the ordinary temperature through any. The provisional positive result with a beryl crystal before reported has proved to be erroneous, and is withdrawn.

Experiments on crystals at a higher temperature are in hand. The known facts about the extraction of helium from minerals by heat suggest that a positive result is likely.

RAYLEIGH.

69 Cadogan Square.

May 31.

Isotopic Constitution of Platinum and Rhodium

THE analysis of the platinum ions from a high-frequency spark¹, using a new spectrograph, shows that this element consists of five isotopes with masses 192, 194, 195, 196, 198. The middle three form a triplet of almost equal strength, while the heaviest is decidedly weaker and the lightest very faint.

In the new spectrograph, the ions are deflected through 90° in a cylindrical condenser and are then further deflected through 180° by a magnetic field. The distances and radii of curvature are arranged so as to bring a divergent bundle of ions with small differences in their energies to a focus at the centre of the photographic plate. With a slit 0.1 mm. wide, images of about the same width were obtained, giving a resolving power of 1 in 1,000. Using an alloy of platinum with 10 per cent rhodium as electrodes of the spark, the isotopes of platinum were widely separated, and the doubly charged platinum ions could be compared directly with the rhodium isotope at 103, previously observed by Dr. Aston. No comparison to the latter could be found even though the main line was much over-exposed. From its position we would expect platinum to have very nearly integral masses. On this assumption the average of six photographs gave an atomic weight of 102.92 ± 0.03 for rhodium, in approximate agreement with the chemical atomic weight.

A. J. DEMPSTER.

University of Chicago.

May 23.

¹ NATURE, 135, 541, April 6, 1935.

Absorption of Slow Neutrons

FERMI and others¹ have shown that slow neutrons are very strongly absorbed by various elements; they found that the absorption curves are by no means exponential. The arrangement used in their experiments was to put the flat test-piece between sheets of the absorber inside a hole in the paraffin block that contained the source. Experiments that we have made under similar conditions have led to the same result, the absorption observed being the

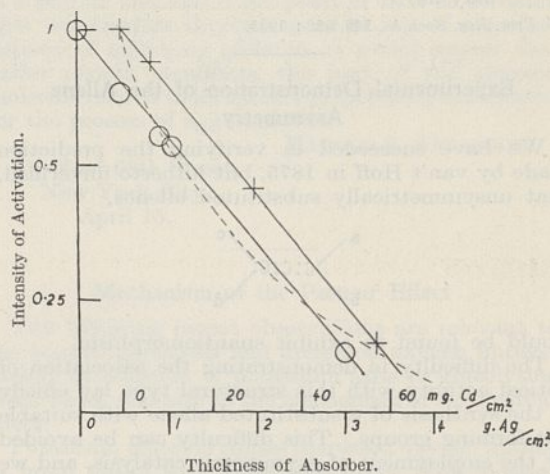


FIG. 1.

same whether the activation of the 20 sec. or the 2 min. period of silver is taken as measure of the intensity.

With this arrangement, however, no simple law of absorption can be expected. So we have tried to find an arrangement in which the measured absorption gives directly the true absorption coefficient. The measurements were made in the following way:

(1) The test piece of silver and the absorber were placed outside the paraffin block containing the source, which consisted of 150 mC. radium emanation mixed with beryllium. If the test piece is put inside a hole in the paraffin, a neutron which has already crossed the test piece once can be scattered back again so as to return to the test piece, so that the effective thickness of the absorber becomes greater than the measured value. In our arrangement no neutron can reach the test piece a second time after having passed through it once.

(2) The paraffin block was shaped so that there was no wax in the direct path (about 20 cm.) between the source and the test piece; the activation produced by fast neutrons could therefore be allowed for, by subtracting the activity produced in the absence of paraffin.

An Ancestral Habit in a Sea-Urchin

THE heart-urchin *Echinocardium cordatum* is one of the most abundant species in the littoral fauna of the British Isles. It is found everywhere where smooth sandy beaches occur and it is distributed all over the bottom of the North Sea to the Danish coast. Its normal mode of life is to excavate a burrow for itself situated about 6 inches below the surface of the sand: this burrow is connected by a vertical shaft with the surface. The roof of the burrow is supported by a cockscomb-like crest of curved spines and the surface of the urchin is quite unpolluted by the sand which forms the wall of the burrow. Through the vertical shaft the urchin protrudes the long tube-feet which belong to the anterior ambulacrum: the discs terminating these tube-feet are fringed with fingers so as to resemble small sea-anemones and with these the urchin sweeps up small animals lying on the bottom. So effective are they, that where *Echinocardium* abounds no mussels can exist: for as soon as the young mussels metamorphose from free-swimming larvæ, they are seized by the tube-feet of the buried *Echinocardium* and conveyed to its mouth.

The heart-urchin is capable of deserting its burrow and moving elsewhere to dig out a fresh one; but, so far as hitherto observed, its movements are carried out by the spines of its under-surface, which are curved and end in spoon-shaped tips: obviously tube-feet could give little support in shifting sand.

The habits of the regular sea-urchin form a complete contrast to those of the heart-urchin. When opportunity is afforded of seeing the regular urchin in its natural surroundings, it is easy to see that it is pre-eminently a climber. It is found clinging to vertical faces of rock; it uses its long tube-feet as cables to pull it forwards whilst it steadies itself with its spines. Gifted with sharp razor-like teeth, it gets its living by scraping the short algal growth from the rocks on which it climbs. In my opinion, this climbing habit explains the evolution of the globular sea-urchin from a flattened starfish-like ancestor.

During a recent visit to Plymouth as a member of the committee which annually inspects the biological station there, I observed a half-grown *Echinocardium cordatum* confined in a square glass tank with vertical walls. To my amazement I saw that the animal had climbed one of the vertical walls, to which it was clinging by its tube-feet, using these in the same manner as does the regular sea-urchin.

Now all the evidence available points unequivocally to the conclusion that the heart-urchins have sprung from ancestors which, did they live now, would be regarded as regular urchins, so that we find buried deeply in what we may call 'psychic constitution' of the heart-urchin an inherited habit which, in the normal circumstances of its life, can rarely if ever be called into play, but which is nevertheless there and can function if the necessity for it arrives. Truly the inner constitution of this, as of all other animals, is made up of layers of habits!

E. W. MACBRIDE.

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May 22.

Mixed Agglutination

IF a mixed suspension of sheep erythrocytes and a certain strain of Friedländer bacilli are made to agglutinate in the presence of both homologous antisera, what appears to be a novel form of agglutination—*mixed* agglutination—is observed. The clumps obtained under our conditions by thus simultaneously mixing two antigens and their antibodies in the same system are seen to consist not only of red cells adherent to red cells, and not only of bacilli adherent to bacilli, but also of bacilli and red cells adherent to one another. Control experiments with only one antiserum do not yield the mixed clumps, although occasionally a red cell or two may be seen adherent to the specifically agglutinated organisms, and vice versa.

It is planned to carry out similar experiments on other systems composed of two or more antigens and their respective anti-sera to ascertain if this phenomenon, as yet observed only in these preliminary experiments, is a general one. If the phenomenon is a general one, and if the point of view be accepted that sensitisation involves more or less of a surface deposit of anti-body globulin, it would appear that under certain conditions the part of the globulin molecule related to its specific properties is unessential for the process of agglutination.

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April 15.

Mechanism of the Pasteur Effect

THE following recent observations are relevant to the aerobic glycolysis and increased oxygen uptake¹ caused by addition of potassium salts to glycolysing brain slices, and also to the mechanism of the Pasteur effect.

Potassium chloride causes increased oxygen uptake in brain tissue with substrates other than glucose, for example, fructose and lactate, which cannot form lactic acid in nitrogen. Here no aerobic glycolysis results. Further, the rate of disappearance of lactate ($-Q_L^0$) is markedly increased by potassium:

Substrate	Without M/10 KCl		With M/10 KCl	
	Q_{O_2}	Q_L^0	Q_{O_2}	Q_L^0
Fructose 0.2 per cent	- 6.9 - 6.5	+ 0.2 + 0.2	- 10.5 - 9.2	- 0.1 - 0.65
Lactate 0.2 per cent	- 9.2 - 9.1	- 1.75 - 1.4	- 14.05 - 14.7	- 5.25 - 4.10

Again, potassium chloride causes aerobic glycolysis in the case of mannose², which can form lactic acid anaerobically.

The following theory is put forward to explain the co-existence of aerobic glycolysis and increased respiration with glucose, as well as the sparing action of oxygen on the glycolysis of normal cells. Oxygen may be supposed so to affect the cell permeability as to set a limit to the rate at which glucose can reach the cell enzymes. Inhibition of the Pasteur effect consists in a removal of this limitation, so enabling more glucose to reach the intracellular enzymes. This increased permeability results in an increased rate of both respiration and lactic acid formation.

The view that agents which inhibit the Pasteur effect do so by affecting cell permeability is readily acceptable in the case of potassium. It is an old suggestion³ that metal ions may affect cell surfaces by converting a water-in-oil emulsion to an oil-in-water emulsion. The fact that the inhibition of the Pasteur effect, brought about by potassium, is reversed by calcium is a point, on the whole, in favour of such a hypothesis; thus we found that a Q_L^0 of 16.5 in presence of glucose and $M/10$ potassium chloride was reduced to 2.0 by addition of $M/20$ calcium chloride, though addition of sodium chloride in the same concentration did not reverse the potassium effect. Further, we found that rubidium and caesium had a similar effect to potassium in causing aerobic glycolysis. Values of Q_L^0 on the same brain in the presence of $M/10$ concentration of the chlorides of these metals were, for potassium 10.3, for rubidium 10.35 and for caesium 5.85, while for magnesium a value of 2.9 was obtained.

In view of the present evidence, we consider that in the absence of oxygen, the permeability of the cell is so altered (see Cowan⁴) that the enzymes are completely accessible to glucose. The enzymes are saturated, and the rate of lactic acid formation becomes maximum. In the presence of oxygen the enzymes are much less accessible to the substrate. Glucose reaches the enzymes relatively slowly, and lactate is either not formed, or is formed at a slower rate than that at which it can be oxidised. If lactate be the substrate added, it too can only slowly gain access to the enzymes, and therefore its rate of removal is relatively low except when potassium is added.

KENDAL DIXON.
ERIC HOLMES.

Sir William Dunn Institute of Biochemistry,
Cambridge.
May 15.

¹ Ashford and Dixon, *Biochem. J.*, **29**, 157; 1935.

² Dixon, *Biochem. J.*, **29**, 973; 1935.

³ Clowes, *J. Phys. Chem.*, **20**, 407; 1916.

⁴ Cowan, *Proc. Roy. Soc.*, B, **115**, 216; 1934.

Statistical Aspect of the Production of Primary Lesions by Plant Viruses

AN analogy has frequently been drawn between the production of bacterial colonies on artificial media and of primary lesions on the leaves of susceptible host plants inoculated with an extract of virus-diseased tissues. In a recent paper, Youden, Beale and Guthrie¹ have carried this analogy one step further, and have suggested that the relation between the numbers of lesions and the relative concentrations of virus particles in the inoculum may be described in the same way as the relation between the numbers of bacterial colonies and the concentration of bacteria in the plated suspension. Their equation takes the form:

$$y = N(1 - e^{-ax}),$$

where y is the number of lesions given at any concentration x of the virus, N represents the maximum lesions obtainable, and a is a constant.

There is no reason to doubt that this equation is fundamentally correct, but there is good reason to doubt whether it applies to the majority of the dilution data which they have collected from various published papers and cited in proof of agreement

(Ref. 1, Table II). If the values for low dilutions are fitted by this equation, the calculated values for higher dilutions are almost uniformly too small, and sometimes, as in the following case quoted by Youden, Beale and Guthrie from a paper by Samuel and myself², the differences are far beyond the limits of the experimental error:

Lesions observed.	12144	7470	4314	3363	2010	1003
Lesions calculated by Youden, Beale and Guthrie.	11756	8572	3932	1415	467	150

The standard error of the total 1003, for example, is 79.4. Youden, Beale and Guthrie, in transcribing this series, omitted the two figures for the weakest concentrations; they are 477 and 234, and the calculated values would be approximately 48 and 15.

As proof of agreement, these authors plot values of $\log(N-y)$ against concentration and show that, in the cases they choose for the purpose of illustration, the values fall approximately on a straight line. This gives a misleading idea of the goodness of fit, as when N is much greater than y , y may vary widely without causing wide departures from a straight line. About two years ago, attempts were made to apply this equation to a series of experiments performed by Mr. Samuel and myself in which samples of crude juice from plants diseased with tobacco mosaic were diluted with distilled water. The more accurate the experiment and the wider the dilution range it covered, the more apparent it became that under our conditions the relation of lesions to concentration could not be described in these terms. For some time I have been working to find under what conditions the equation does apply, and to what departures are due; briefly, it applies only to very carefully purified suspensions of virus. Distortions exist with samples which are carried to that stage of purification where only slight pigmentation remains.

It is doubtful, therefore, what meaning can be attached to the constants calculated by Youden, Beale and Guthrie from equations that fit only portions of the dilution series; and until this has been decided the equation derived from the Poisson series should not be used for the correction of results obtained by the primary lesion method except with very carefully purified samples of viruses.

J. G. BALD

(Australian Council for Scientific
and Industrial Research).

Botany School,
Cambridge.
May 13.

¹ Youden, Beale and Guthrie, *Contrib. Boyce Thomson Inst.*, **7**, 37; 1935.

² Samuel and Bald, *Ann. Appl. Biol.*, **20**, 70; 1933.

The Dyestuff Industry

I FEAR that Prof. Armstrong is very angry with me (*NATURE*, June 1, p. 907); for with him such phrases as "management and commercial side", "commercial community", "commercial outlook", "commercial mind" are of course terms of comprehensive opprobrium, and lie at the opposite end of the scale to such mellifluous, desirable and creditable phrases like "true technical leadership". Perhaps after all I do deserve his anger, for he says "I have more than once discussed the situation, most recently in an article in the *Pharmaceutical Journal*". As I regularly read most of what Prof. Armstrong writes,

this was not news to me, although I have not yet reached the stage when I can, just because Prof. Armstrong says so, accept it as the complete and absolute faith.

It may be that I must both live and die a rebel. But I do think it high time that someone might at least call a halt to this fifty years merciless (and to my mind, unfair) belabouring of the commercial man for the loss of a great and scientific industry; and it accords with poetic justice that this should be done by one who, if he cannot claim to be a chemist, cannot claim to be anything at all.

However, I am not unduly alarmed because Prof. Armstrong does agree with me that the pioneers *did* leave the industry, and that the industry *did* languish; and, mark you, they were captains of their own industry—in those days “the commercial and management side” had not even arrived. Prof. Armstrong further tells us that when they, Perkin and Nicholson, retired, “the fate of the industry was sealed already in 1865”. Why? I can only gather from his letter that it was due to Perkin being “without imaginative power” and in the case of Nicholson because *his* partners “would not move with the times”.

May I hope that when Prof. Armstrong reads a lecture which he did not hear, he may find that he is not in such complete disagreement “with the side represented by Mr. Cronshaw—the managerial and commercial side” as a hasty pen led him to suppose.

I observe that Prof. Armstrong, obviously warning to his theme, says that “History cannot be written at a distance from the events by those who have had no direct knowledge of the period considered, and of the men concerned”, a dictum that would have robbed the world of a large number of its greatest historians. It automatically robs chemistry of an attractive and provocative historian except for the space of four score years.

In his last paragraph, Prof. Armstrong has some hard words to say about the industry. I fear he has not the necessary feeling for the conditions prevailing. No one who is in a position to know shares his view, but this cannot be a novel situation for Prof. Armstrong. In one thing his letter completely persuades me: that it is possible to have “direct knowledge of the period considered and of the men concerned” and still not write history. However, for that we shall have to wait and see.

CECIL J. T. CRONSHAW.

Dyestuffs Group,
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June 5.

Prediction of Earthquakes

THE appalling havoc wrought by earthquakes in India during the past eighteen months has attracted wide attention to the fact that, so far, science has failed completely to devise any means of providing a warning of the imminence of such disasters. At a lecture on Indian earthquakes, given at the Royal Society of Arts in March of last year¹, this fact was deplored both by the lecturer, Sir Edwin Pascoe, and by Sir Thomas Holland, both of whom have held the position of director of the Geological Survey of India. In referring to the Bihar earthquake of January 1934, Sir Thomas Holland emphasised that “There was no warning whatever and that destruction was sudden and complete in a few minutes”. The same words apply equally well to the more

recent disaster of Quetta and, in fact, to most major earthquake disturbances. The value of a warning, in the saving both of life and property, can scarcely be exaggerated; even if it is of a general character and comes long ahead of the actual disturbance.

As there are no reasons for supposing that this long-felt want will always lie beyond the powers of science, it is reasonable to suggest any line of approach which conceivably might lead to the desired end. One of these, which apparently has never been considered, lies in the possibility that anomalous electrical potentials may arise in the ground during the building up of the stress conditions which ultimately result in an earthquake. Electrokinetic phenomena may reasonably be looked for under such conditions, and if they could be detected and the resulting ground potentials proved to be measurable, then it is not unlikely that when mapped they would afford a clue as to the stress distribution in the district examined. In fact, to anyone with a fertile imagination and familiar with some of the recently developed methods in the electrical branches of applied geophysics, it seems just conceivable that the position of an epicentre might be predetermined in this way. Furthermore, the changes in the potential gradients with time might provide evidence as to the imminence of an earthquake disturbance.

A virtue which may be claimed for this tentative suggestion is that it is one which could be tested without great difficulty and, assuming that telegraph or other land lines could be used for the measurements, the expense would be relatively small. Periodical measurements of the potential differences existing between points on a network of stations in an area subject to seismic disturbance might well provide information of real value.

A. B. BROUGHTON EDGE.

London.

June 4.

¹ *J. Roy. Soc. Arts*, 82, No. 4247, April 13, 1934.

Critical Phenomena in the Oxidation and Self-Inflammation of Hydrocarbons

MESSRS. NEUMANN and Aivazov direct attention¹ to the negative temperature coefficient of the combustion of hydrocarbon mixtures under certain conditions; this phenomenon, which has also been referred to by Pease² and by Beatty and Edgar³, seems well established. The explanation given in the letter is a formal presentation of the views which have been put forward in various communications dealing with hydrocarbon combustion, the peroxide theory and knock in engines. The step $A \rightarrow B$ is the normal process whereby the hydrocarbon is oxidised to aldehyde.

The peroxide theory postulates that this process takes place via an intermediate peroxide which in normal circumstance may be written $RCH_3 + O_2 \xrightarrow{k_1} (RCH_3O_2) \xrightarrow{k_2} RCHO + H_2O$, but in favourable circumstances the intermediate step can give rise to chain branching and hence eventually to ignition in a lower temperature range. The conditions for maximum concentration of X or RCH_3O_2 are as indicated in Neumann and Aivazov's letter. The conditions in which chain branching occurs are particularly important in connexion with the phenomena of knock; thus the presence of anti-knocks lower the effective concentration of X , while

the efficacious proknocks all seem to disrupt in such a way as to lead to a similar type of branching. The mechanism whereby this branching leads to reformation of X and thus autocatalysis is discussed in a forthcoming publication.

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A. EGERTON.
A. R. UBBELOHDE.

¹ NATURE, 135, 655, April 27, 1935.

² J. Amer. Chem. Soc., 1929 and 1934.

³ J. Amer. Chem. Soc., 56, 102; 1934.

Electronic Energy Bands of Solid Copper, Nickel, Cobalt and Iron

DURING the course of experiments on the soft X-radiations of the elements copper, nickel, cobalt and iron, evidence of electronic energy bands has been obtained. The examination of the radiations was made with a tangential grating vacuum spectrograph, and the lines under investigation were the group comprising the L series. These, and especially the L_a line, have been obtained with considerable intensity. Examination of the plates has shown a blackening on the long-wave side of L_a . Microphotometer records demonstrate that this is due to the fact that the line, although possessing a comparatively sharp peak, drops to zero very slowly on this side, and extends almost to the L_η line. Making an allowance for the slit width of the instrument, the wave-length difference between the maximum of intensity of the line and the end of the 'tail' is, for copper, 1.21 Å. This corresponds to the large energy difference of 77.5 electron volts. The other three elements give energy differences somewhat less, but of the same order.

The distribution in this band, namely, a fairly sharp short-wave edge and a gradual diminution on the other side, suggests that the electrons in the initial state (M_{IV}, ν) may follow, very roughly, a Fermi distribution. Such an explanation has been shown to be applicable to the K_a lines of a number of the light solid elements in which the initial state contains the valence electrons¹. In the present case the M_{IV}, ν electrons are expected to be only partially bound, and some such distribution is therefore not altogether unexpected. It might be anticipated that the energy distribution of the M_{IV}, ν electrons would resemble more closely that of a semi-conductor than that of a metal, and it is therefore satisfactory to note that there is a marked similarity in shape between the present bands and that of the K_a line of graphitic carbon.

Taking the value 77.5 volts as the energy-spread in a Fermi distribution, the density of M_{IV}, ν electrons in the metal may be calculated. The result is too high, and corresponds in fact to the impossible value of 37 electrons per atom. It seems very likely that this is because the electrons are not completely free and cannot, normally, occupy the whole of the space in the lattice of the metallic crystal. Assuming that the number of electrons in the M_{IV}, ν group of copper is 10, one obtains the result that these are free to move in 27 per cent of the volume of the crystal.

F. C. CHALKLIN.

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¹Houston, *Phys. Rev.*, 38, 1791; 1931. O'Bryan and Skinner, *Phys. Rev.*, 44, 602; 1933. 45, 370; 1934.

The Phenomenon of 'Wings' as a Vibrational Raman Effect: A Correction

WE have shown in our previous experiments¹ that the wings accompanying the primary scattered line in liquids are mostly connected not with the rotation of molecules but with slow oscillations probably characteristic of the crystal lattice, and have pointed out that this phenomenon is thus connected with quasi-crystalline structure of liquids.

In our note in NATURE of March 16, 1935, an error has crept in: the data and photograph given for the crystal of naphthalene do not, in fact, refer to this substance, but to the p -dibrombenzene crystal. In the case of naphthalene crystal, we have observed in the region of wings four Raman lines with frequencies: $\nu_1 = 45 \text{ cm.}^{-1}$, $\nu_2 = 73 \text{ cm.}^{-1}$, $\nu_3 = 109 \text{ cm.}^{-1}$ and $\nu_4 = 124 \text{ cm.}^{-1}$.

We give in the following table the oscillation frequencies in the region of wings for crystals so far examined by us. In all the substances studied, the

Crystalline substance	Frequencies in cm.^{-1}			
Benzene C_6H_6	20	38	62	104
p -Dibrombenzene $\text{C}_6\text{H}_4\text{Br}_2$	20	38	93	93
Diphenylether $(\text{C}_6\text{H}_5)_2\text{O}$	22	38	67	104
Naphthalene C_{10}H_8	45	73	109	124

benzene ring is present, and this may probably explain the appearance of frequencies common to some of the crystals.

We have studied the state of polarisation of new lines in the crystals of p -dibrombenzene and diphenyl ether when the exciting light was unpolarised and polarised. For different lines, various coefficients of depolarisation ρ were found, ranging from $\rho = 0$ to $\rho \approx 1$. For one line of p -dibrombenzene, $\nu = 20 \text{ cm.}^{-1}$, we have found $\rho \gg 1$ (in the case of polarised exciting light). Moreover, the coefficients of depolarisation for these lines depend upon the orientation of the crystal. As in melting the crystal, these Raman lines broaden in a continuous spectrum around the primary line, it is not surprising that in many liquids the wings are strongly depolarised. The depolarisation factor $\rho_n = \frac{2}{3}$, which is to be expected for rotational Raman lines, found for the wings by some observers when unpolarised exciting radiation was used, can be regarded as a fortuitous coincidence.

E. GROSS.
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Optical Institute,
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April 7.

¹ NATURE, 135, 100, Jan. 19; 431, March 16, 1935.

Distribution of Nuclear Mechanical Moments

TOLANSKY has suggested¹ that some importance might be attached to the relatively frequent occurrence of small values of those nuclear spins which seem to be due to neutrons, as compared with protons. Even without a detailed nuclear model, an interpretation of the trend may be given.

The nature of the effect of the exclusion principle on the average energy of similar particles is well known. The symmetry of states with opposite spin allows the particles to have a smaller average kinetic energy and energy of binding than they might have with parallel spins. This tendency (together with

the favour bestowed by second-order effects on the spin with the greatest number of states) seems to be effective in making even numbers of neutrons and of protons have zero moments. But for protons this preference for opposite spins is opposed by the effect of the exclusion principle on the average repulsive electrostatic energy. If the spins are parallel, the particles avoid very small separations, thus decreasing the average Coulomb energy. Since the binding-type energy is apt to have no singularity at coincidence², the Coulomb energy may predominate at small separations and be relatively more important in determining spins than in questions of stability.

Although the actual states of the nucleus are probably an intricate mixture of the states of a representation of single-particle quantum numbers, their energy should be affected by the same trends as determine the order of states in a simple representation. If we consider a representation which includes orbital moments, the magnetic spin-orbit coupling (which is apt to be very strong, especially in heavy nuclei) introduces another tendency toward smaller moments for neutrons than for protons. If the spin gyromagnetic ratio is positive for protons and negative for neutrons, as seems likely from deflection data, this tends to make spin and orbital mechanical moments parallel for protons and opposite for neutrons.

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Department of Physics,
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May 6.

¹ NATURE, 135, 620, April 20, 1935.

² Majorana, *Z. Phys.*, 82, 137; 1933.

Production of [Electron Pairs and the Theory of Stellar Structure

IN the discussion of problems of stellar structure, only the deviations from the perfect gas laws arising from degeneracy due to the exclusion principle for the electrons have so far been considered. In fact, as has recently been shown by one of us¹, these deviations involve far-reaching limitations on the possible stellar configurations under given conditions. Thus, it can be deduced from the form of the equation of state of a degenerate gas, taking due account of relativity, that in order that degeneracy should develop in any part of a star, the ratio β of gas pressure to total pressure at that point must satisfy the condition

$$\frac{960}{\pi^4} \cdot \frac{1 - \beta}{\beta} < 1; \tag{1}$$

and on the standard model, in which β is assumed to be constant throughout the star, this implies the existence of a critical mass

$$\mathfrak{M} = 6.6 \odot \mu^{-2}, \tag{2}$$

(\odot denoting the mass of the sun and μ the molecular weight) above which degeneracy cannot set in at all. A study of the equilibrium of completely degenerate gas spheres leads further to the result that there is an upper limit

$$M_3 = 5.7 \odot \mu^{-2} \tag{3}$$

to the masses of such configurations; this affords the possibility, for stars of mass $\leq M_3$, of a course of evolution leading to complete degeneracy through

intermediate stages comparable to the observed white dwarf configurations.

Quite another type of deviations from the perfect gas laws, however, arises from the existence of a definite distribution of positrons as well as electrons in equilibrium with temperature radiation, and in this note we desire to point out the bearing of this fact on the theory of stellar structure, and especially to indicate to what extent the conclusions summarised above have to be modified.

In the first place, no effect of the latter type can take place if the electron assembly is completely degenerate; for in that case all the states of negative energy will necessarily be occupied, which on Dirac's well-known picture implies the total absence of positrons. For the theory of stellar structure this obvious remark has the consequence that, under white dwarf conditions, the influence of pair production on the configuration will be entirely negligible, and the possibility of evolution mentioned above, for stars of mass $\leq M_3$, can be upheld without modification.

More generally, the presence of an equilibrium distribution of pairs in addition to the 'excess' of electrons, which is proportional to the material density, will give rise to a correction term in the equation of state, and the effect of this term on the stellar structures may conveniently be surveyed on the standard model. It is found that for a fixed value of the ratio β , the correction increases with temperature, tending to a finite limit as the temperature tends to infinity. When the condition (1) is fulfilled, the maximum deviation from the perfect gas law is less than 2 per cent, which means that the effect is altogether negligible for stars of mass $< \mathfrak{M}$, in which degeneracy of the electron assembly is able to occur. For more massive stars, however, the correction term becomes increasingly important. Thus already when $1 - \beta = 0.2$, corresponding on the standard model to a mass of $12.6 \odot \mu^{-2}$, the maximum effect amounts to 7 per cent. For very massive stars, say, of mass greater than $30 \odot \mu^{-2}$, equilibrium configurations analogous to the white dwarf configurations for masses $< M_3$ —but differing from the white dwarfs in that the deviations from the perfect gas laws now arise from the production of pairs and not from degeneracy—are therefore formally possible, and the question suggests itself: Do such configurations exist in Nature?

A detailed derivation of the results here summarised is to be published elsewhere.

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L. ROSENFELD.

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April 25.

¹ S. Chandrasekhar, *Mon. Not. R.A.S.*, 95, 207-260; Jan., 1935.

Formation of Mercury Molecules

IT has long been known that mercury vapour is ionised by photons having energies considerably less than that corresponding to the ionisation potential of the mercury atom. Rouse and Giddings¹ showed in 1926 that mercury vapour is ionised by its resonance radiation, 2537 Å. To explain this effect, Houtermans² suggested that an excited atom in the 2^3P_1 state of 4.9 volts energy may combine with a metastable atom in the 2^3P_0 state of 4.7 volts energy to

form an ionised molecule and a free electron. The energy available for ionisation of this molecule is $(4.9 + 4.7)$ volts plus the heat of dissociation of the neutral molecule, which Winans³ gives from band spectra data as 0.15 volt, making a total energy of 9.75 volts.

The existence of mercury vapour molecules has never been demonstrated. So far as chemical evidence is concerned, the ratio of the specific heats and vapour density determinations all show that mercury vapour is strictly monatomic. Nevertheless, the occurrence of bands in the absorption and emission spectra of mercury vapour demand the presence of molecules.

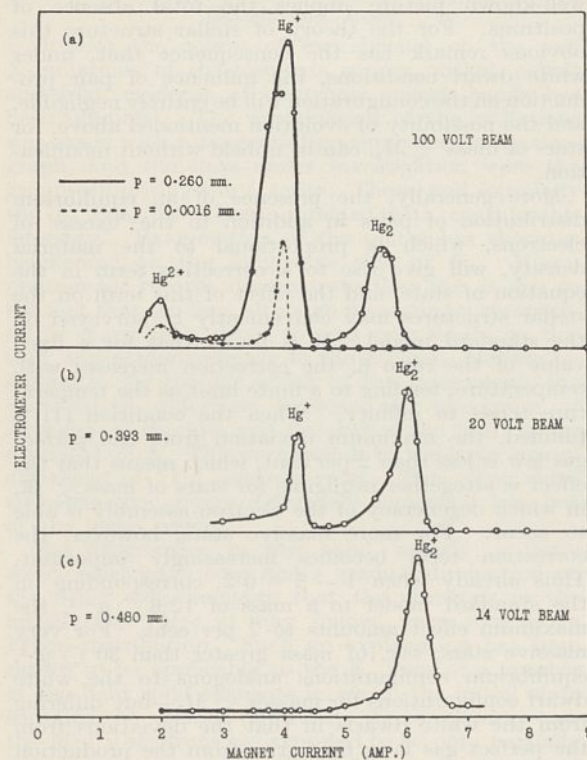


FIG. 1.

We have obtained definite evidence that diatomic molecular ions are produced in mercury vapour by electron impact. The apparatus consists of an ionisation chamber containing a tungsten filament and a system of gauzes to accelerate the ions, which are magnetically analysed by the refocusing method. The ionisation chamber can be maintained at different temperatures by an electric furnace.

In the four curves shown in Fig. 1, the total accelerating potential applied to the ions was 26 volts, six volts being used to draw the ions out of the region where they are formed, and another twenty volts to accelerate them into the analyser. The broken curve in Fig. 1(a) shows the result obtained when the pressure of mercury vapour was 0.0016 mm. of mercury. The curve shows the presence of Hg^+ and Hg^{2+} ions, but no trace of a molecular ion. The continuous curve in Fig. 1(a) shows the result obtained for a pressure of 0.26 mm. of mercury. In addition to the atomic ions, there now appears a strong peak of Hg_2^+ ions. The energy of the electrons producing ionisation was 100 volts for both curves. Fig. 1(b) shows the result obtained

when the energy of the electrons was reduced to 20 volts, and Fig. 1(c) for a beam of 14 volts. The curves are not drawn to the same ordinate scale.

We see that as the energy of the electron beam decreases, the ratio of molecular to atomic ions increases, until at 14 volts the probability of atomic ionisation is so small that the atomic ion peak does not appear. The fact that the molecular ion peak is still quite strong provides evidence for the theory that the molecular ions are formed by mutual attachment of two excited atoms or of an excited atom with a normal atom. Measurements of the variation in height of the molecular peak with pressure indicate that it varies with the square of the pressure, which supports the above theory.

This theory of the formation of the molecules clearly reconciles the chemical evidence of their non-existence with the band spectra evidence of their presence; for, unless the atoms are excited by light or electron impact, the vapour may remain monatomic. This would require the neutral unexcited molecule to be unstable.

Work is in progress to determine the variation with electron energy of the probability of formation of the molecular ion, and an investigation of the nature of the ion formed by irradiating the vapour with the resonance line 2537 Å. is also being undertaken. A full account of these experiments will be published shortly.

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J. C. MILLIGAN.

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St. Andrews.
April 29.

- ¹ Rouse and Giddings, *Proc. Nat. Acad. Sci.*, **12**, 447; 1926.
² Houtermans, *Z. Phys.*, **41**, 619; 1927.
³ Winans, *Phys. Rev.*, **37**, 897; 1931.

A Simple Method of Heterochromatic Photometry

As is well known, it is difficult to compare the intensities of lights of different colour. We can tell when one is much brighter or much darker than the other, but values obtained for the point of balance by the direct methods differ widely amongst themselves. It is consequently necessary to use the flicker photometer or the step-by-step method; in the latter method a series of lights of different colours intermediate between the colours to be compared is used, and the one end colour is compared with the first of these, the first with the second, the second with the third and so on. Thus by reducing the difference in colour its disturbing effect is eliminated at the expense of some time and a cumulative error in the settings.

I have found that lights of different colour can be compared easily by the ordinary Rumford or shadow photometer, if the rod is replaced by a partially transparent strip of glass. The method is most easily understood by the description of a particular case:

A green inside-colour-sprayed 40-watt Osram lamp was compared with an 8 c.p. carbon lamp. The matt glass screen of the photometer was at 0 cm. on the bench and the 8 c.p. lamp at 380 cm. As rod I used first of all a strip of black paper mounted on a plate of clear glass, then a strip of fogged photographic film mounted on a similar plate, and finally a lighter strip of film mounted on another plate. The two films transmitted respectively about $\frac{1}{15}$ and $\frac{1}{3}$ of the light incident on them. With the opaque strip the one shadow was green and the other orange; with the dark film, owing to the colours mixing, the

difference in the colours of the shadows was not so pronounced, and with the light film it was less still.

The same observer then made ten settings with the opaque strip, ten settings with the dark film, and ten settings with the light film. The mean position of the green lamp was found to be at 162.2 cm., 169.9 cm., and 171.1 cm. in the three cases, the probable errors of the means being 3.5, 1.6 and 2.9 cm. respectively. Thus the dark film gave the most accurate and the opaque strip the least accurate results. It is obvious that for each pair of lights there must be a most favourable density for the film, for if it were perfectly transparent, there would be no shadows.

It would be interesting to compare the accuracy of this method with that of the step-by-step method, but the comparison should be made by someone practised in the routine of the latter method.

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May 2.

Preparation of Colloidal Metals

In the course of an investigation of the properties of thin dielectrics at high field strengths, an interesting phenomenon has been observed, involving the passage of substances through the dielectric, and leading to a method for the preparation of colloidal suspensions of liquid metals and alloys in semi-conducting media.

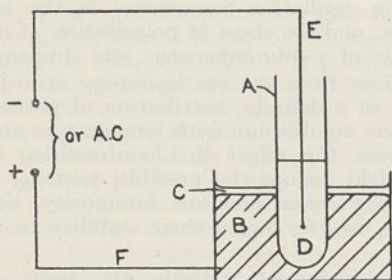


FIG. 1. Diagram of apparatus for preparation of colloidal metals: A, cellulose acetate cup; B, mercury bath; C and D, tricresylphosphate; E and F, metallic electrodes.

Referring to the diagram, if a cup-shaped semi-permeable membrane (for example, 0.1 mm. thick), prepared from cellulose acetate and containing a semi-conducting liquid such as tricresylphosphate, is immersed in a bath of mercury, then an electric field of the order of 40 kv./mm. applied between the mercury and the tricresylphosphate will cause a copious flow of mercury through the cellulose acetate, the mercury remaining colloiddally dispersed in the tricresylphosphate. Either alternating or continuous voltages may be used, but in the latter case the polarity must be as shown. The mercury is covered with a thin layer of the semi-conducting medium, which serves to wet the surface of the cup as the latter is lowered into the mercury. The suspensions made by this means have remained stable for considerable periods.

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May 14.

Influence of an Electric Field on the Thermal Conductivity of a Solid

A SUBSTANCE with a permanent electric moment, such as bees-wax, was allowed to solidify in an electric field. Afterwards it showed permanent greater thermal conductivity in the direction of the field, which had been applied before solidification occurred, than when it solidified without an electric field. When an alternating field (50 cycles) was applied during the solidification, no alteration of thermal conductivity was noticed.

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March 25.

Cryolysis, Diffusion and Size of Particles

PROCEEDING from earlier considerations¹, the view was put forward recently that under the effect of freezing², particles of aqueous solutions of lyophilic biocolloids will undergo disaggregation or aggregation according to the prevailing concentration of the particles.

To test the validity of this conclusion, further experiments were carried out with the object of determining the speed of diffusion of frozen (at -17° and -79° C.) and unfrozen solutions of sodium oleate, ovalbumin and polyacrylic acid. Under our experimental conditions and with these substances, it could be shown that the effect of freezing causes in solutions of concentrations up to 1 per cent a disaggregation which could be measured by an increased speed of diffusion, and in solutions of concentrations higher than 1.5 per cent an aggregation manifesting itself by a decreased speed of diffusion in comparison with that of the unfrozen solutions. There was only one exception observed. This occurred in experiments carried out with freshly prepared solutions of polyacrylic acid, due to the fact that this substrate swells before it undergoes solution. The more the concentration is diminished, the more the disaggregation prevails; and the more the concentration is increased, the more we can observe an aggregation which may lead up to a coagulation.

These observations may afford further support to explanations given elsewhere for the transient increase in activity of frozen solutions of zymases, peroxidases and tyrosinase in connexion with the carrier theory³ of enzymatic activity, may also explain the well-known effect of increased fertility of soil after a severe winter period, and may also have some bearing on the explanation of the behaviour of certain lyophobic colloids during the freezing of muscle plasma.

Details of these experiments will be published shortly elsewhere.

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April 15.

¹ F. F. Nord, NATURE, 120, 82; 1927. *Trans. Faraday Soc.*, 26, 760; 1930.

² F. F. Nord, *Science*, 75, 54; 1932.

³ A. P. Mathews and T. H. Glenn, *J. Biol. Chem.*, 9, 51; 1911.

Products of Hydrolysis of Glycogen

ATTEMPTS in this laboratory to repeat the isolation of a trisaccharide from the products of hydrolysis of glycogen by glycerol extracts of muscle, as described by Barbour¹, have been unsuccessful; this is in agreement with the results recently reported by Carruthers².

In confirmation of Barbour's results, however, it was found possible to obtain a hydrolytic product with a reducing power equivalent to 30-33 per cent of the glycogen disappearing, and to obtain therefrom a phenyl osazone similar in crystalline form to

that described by Barbour. Nevertheless, attempts at purification of the products of hydrolysis according to the methods described by Barbour were uniformly unsuccessful, and in view of similar negative results reported by Carruthers, investigation of this trisaccharide appears to merit further consideration.

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April 4.

¹ *J. Biol. Chem.*, **85**, 29; 1929.

² *J. Biol. Chem.*, **108**, 535; 1935.

Points from Foregoing Letters

LORD RAYLEIGH reports that vitreous boron trioxide, like vitreous silica, allows helium to pass through it. Single crystals do not allow the passage of helium, and the report of a previous positive result with beryl crystal is now withdrawn.

Using a new mass-spectrograph and ions from a vacuum spark, Prof. A. J. Dempster finds that platinum consists of five isotopes and that rhodium is single.

With an improved experimental apparatus, W. Ehrenberg and HuChienShan find that slow neutrons are absorbed exponentially by cadmium and silver, with production of radioactive elements. This suggests that either the active neutrons are of fairly homogeneous speed or that a difference in speed does not greatly affect their chance of collision with the nuclei.

Van't Hoff predicted sixty years ago that optically active substituted compounds could be prepared from the hydrocarbon allene. By means of optically active catalysts, Dr. Peter Maitland and Dr. W. H. Mills have now succeeded in preparing stable dextro- and levorotatory allene derivatives.

Dr. A. Müller has calculated from X-ray data the volume occupied by a CH₂ group in organic compounds of the straight-chain and of the ring type. The molecular volumes are identical at low temperatures, but as the temperature increases the CH₂ in a straight-chain compound occupies more space than that of a ring compound, possibly due to its greater mobility.

Having observed a heart-urchin, *Echinocardium cordatum*, climbing on the vertical wall of a glass tank, a way in which it never acts in its natural surroundings, Prof. E. W. MacBride suggests it is the result of a latent habit, inherited from ancestors more like the ordinary sea-urchin, which is pre-eminently a climber.

Potassium salts increase the lactic acid formed in brain tissue, through the breakdown of glucose (in the presence of oxygen), and calcium opposes the effect produced by potassium. K. Dixon and Dr. E. Holmes believe this to be due to a change in the permeability of the cell membrane, which regulates the amount of glucose that reaches the cell enzymes, and that oxygen, like calcium, decreases this permeability.

J. G. Bald finds that the relation between the concentration of virus particles introduced into host plants and the number of lesions produced, as expressed by the formula of Youden, Beale and Guthrie, applies only to carefully purified suspensions of virus.

From measurements of the intensity of soft X-radiations obtained from copper, nickel, cobalt and iron, and from the distribution of electronic energy deduced therefrom, F. C. Chalklin infers that the electrons in those elements are not completely free and cannot normally occupy the whole of the space in the lattice of the metallic crystal.

In a previous communication dealing with the wings accompanying the primary scattered line in the Raman spectrum of liquids, Dr. E. Gross and M. Vuks gave, as for naphthalene, certain data and a photograph obtained with a *p*-dibromobenzene crystal. They now correct this error, and give additional data concerning oscillation frequencies in the region of the wings, and the state of polarisation of new lines in crystals of *p*-dibromobenzene and diphenyl ether.

Deviations from the gas laws may arise from the existence of a definite distribution of positrons and electrons in equilibrium with temperature and radiation. From this effect S. Chandrasekhar and Dr. L. Rosenfeld deduce the possible existence of stars of very large mass and low luminosity, similar to the white dwarfs, owing their stability to different causes.

By analysing magnetically the ions produced in mercury vapour at various pressures and voltages, Dr. F. L. Arnot and J. C. Milligan show that molecular mercury ions exist. These are apparently formed only by the union of two atoms, of which one at least must be excited, a fact which may explain the conflicting evidence concerning the existence of mercury molecules.

When solutions of sodium oleate (soap) and other colloids are frozen, their particles, as shown by the speed of diffusion, aggregate if the concentration is higher than 1.5 per cent, and disaggregate if the concentration is less than 1 per cent, according to Dr. F. F. Nord and F. E. M. Lange. This may explain the temporary increase in activity of frozen solutions of certain enzymes, the increased fertility of soil after a severe winter, etc.

ERRATUM. Dr. S. Mukerji writes to correct an error in the note on his letter in NATURE of April 6. He points out that the blood-sucking *Phlebotomus argentipes* is apparently the vector of *Leishmania donovani*, a protozoon which causes the malaria-like fever kala-azar in India. *P. papatasi*, which is a vector of *L. tropica*, a protozoon morphologically identical with *L. donovani*, produces a localised skin infection popularly known as 'Oriental sore' or 'Delhi boil', and not the kala-azar fever.

Research Items

Celtic Mythology. In his Sir John Rhys Memorial Lecture for 1934, "Aspects of Celtic Mythology" (*Proc. Brit. Acad.*, 20. Separate, Oxford, Humphrey Milford, pp. 44. 3s. net), Dr. A. G. van Hamel puts forward the view that the mythical and heroic lore of the Celtic world in its succession of oath-strengthening gods, divine magicians, spirits of the land, and exemplary heroes, functioned as a guarantee of undisputed possession of the land. Gods are rare in the original sources of Celtic lore, and there is little evidence, except as reported from Gaul, of worship or sacrifice. The Immortals operated through magic, and the important element in relations with them is to avoid the infringement of taboo. Throughout Irish myth and legend runs the idea of protection of the land, which is especially ensured by knowledge of the local traditions. This gives power over the demoniacal forces associated with these localities. There is a graduation in the magic of protection. Highest come the 'divine magicians' who, while not actually gods, are immortals who protect the spirits of the land and the heroes such as Finn and his followers. Next come the spirits of the land, the Tuatha de Danann in Ireland and the Children of Llyr in Wales; and thirdly there are the heroes—Finn in Irish story, Arthur with his knights, corresponding in Wales; and with them are the kings to whom the actual function of 'protection' is entrusted. Although a great deal of folklore has gathered around both Finn and Arthur, it is improbable that either of them existed as men, although it is possible that in the latter a pre-existing function of 'protection' may have been attached to some prominent figure. The common elements in the function of 'protection', which is directed especially against magical forces, as seen in their exploits of slaying wild animals, especially boars, points to the mythical origin in the two instances. The significance of these heroes lies in their exemplary character. They are paradeigmatic, that is, the recitation of the legends in analogous circumstances ensures the like event. Hence the importance of the legends in education and the prominence of apprenticeship in the Druidical system.

Early Indian Iconography. In connexion with the figure of a squatting goddess on the underside of a terracotta figure of a toad, Mr. K. de B. Codrington has raised the question as to the derivation of certain hybrid forms, and of this figure in particular, in the early development of Indian iconography of the Mathura school (*Man*, May, 1935). The figure under consideration is in the Victoria and Albert Museum, South Kensington. It has no known pedigree, but almost certainly came from Mathura, the capital of the Kushan dynasty, and may be assigned to the early second century A.D. This derivation is supported by the treatment of the figure and the details of the beaded belt, necklace and hair, which are all in the native Indian tradition. On the other hand, the position of the goddess and her association with the toad point to the Baubo toad-goddess myth, which Dr. M. A. Murray has brought into association with the Sheila-na-gig; and the possibility that the present specimen was intended for toilet use recalls the further point that Baubo was a hand-maiden. Similar squatting goddesses, with hands touching the

pubenda, are known in India, as, for example, the Bharhuta goddesses and the railing figures from Mathura itself. The derivation from the Baubo tradition is more probable than an indigenous origin. Mathura was the scene of the development of Indian iconography, which at this time was just emerging. The Kushans had just made their way into India from Central Asia, and on Kanishka's coins the Indian Buddha figure rubs shoulders with a polyglot and hybrid Olympus in which appear Helios, Mao, Athro, Manaio and others, while at the same time the hybrid so-called Greco-Buddhist art appears in Central Asia, Afghanistan and Gandhara. If this figure be accepted as Baubo, it is one of the few, if not the only, example of a directly borrowed classical icon. The type recrudesces at Badami in the sixth century, and in the Elura *Kailasa* which was cut by architects from the south. In the female the posture is associated with the *Devi* in some of her manifestations as *Kali*.

Correlation of Physical and Mental Culture. Dr. L. P. Jacks in an essay in the *Hibbert Journal* (January 1935) deals with the new movement in physical culture, which aims at combining it with mental culture, and treating it as equally important. This synthesis, he says, would give physical culture its rightful place in education, the true end of which is not the acquisition of knowledge but the harmonious development of the whole man. At present this is realised only in the earliest stages of training—in kindergartens and Montessori schools—though the increasing importance attached to manual arts and the steady development of the Scout and Guide movements are hopeful signs. Exercises involving co-ordination and rhythmical 'patterned' movement are the chief features of the new physical culture, and it is obvious that what Carlyle called 'rhythmic human companionship' is essential for the welfare of the modern world. All our training must culminate in the interweaving of interests, if we are to bring order out of the present chaos, and humanity must change its habits as well as its opinions. There is at present no true 'social' system, but everywhere the need and desire for it: if a new type of education existed which developed in men's own lives the qualities they are always seeking outside, a solution might be found. To achieve this, trained leaders are essential, and a new profession should be created; then, if the quality of the human material does not decline, the world may be saved.

Beetles associated with Giant Lobelias and Senecios in East Africa. The giant species of *Lobelia* and arborescent *Senecio* constitute one of the most arresting features of the alpine floras of the isolated East African mountains. Both these genera of plants are represented there by a number of species, which are characterised by highly discontinuous distribution. It was, therefore, of exceptional interest to study the insects associated with these plants, and Dr. Hugh Scott's work on the Coleoptera (*Linn. Soc. J., Zool.*, 39; 1935) will be of value both to botanists and to zoogeographers. Not less than 49 species of beetles belonging to 13 families were found in the association. Only four of them are widely distributed, and can be regarded as casual visitors to the plants,

while all others represent a highly special fauna. The genera of which this fauna is composed are partly widely distributed, while the others are peculiar and are very restricted in their distribution. These are probably specialised components of the Ethiopian fauna. The genus *Thamnurgus* was, however, previously known only from the Palæartic region. The association between the insects and the plants may be a very ancient one, and the possibility of a parallel development of both may be considered. It is remarkable that, while the alpine species of *Lobelia* and *Senecio* are giant members of the respective genera, some of the beetles associated with them are also gigantic in comparison with their nearest relatives. It is also of interest that about 50 per cent of them are flightless.

Development of a Nemertean. J. E. Smith (*Quart. J. Micro. Sci.*, 77, Pt. 3, 1935) describes the development of *Cephalothrix rufifrons*, a nemertean worm with a direct development. The spherical larva which issues from the egg is equipped with the rudiments of most of the adult organs. Owing to the confusion of the germ-layers at the time of appearance of the mesoderm, the true nature of the secondary body cavity—whether it is a re-expansion of the blastocoel or a true coelom—remains a matter of doubt. Gastrulation, effected by invagination, involves both endoderm and ectoderm, so that the blastopore is carried into the lumen of the gut; but this pore afterwards closes and the stomodæum and mesenteron are separated. Communication between these two parts of the gut is re-established later at or near the point of closure of the blastopore. A hind-gut is not formed until very late in development, and it is considered to be endodermal and not in the nature of a proctodæum, that is, not ectodermal. The formation of nephridia and of cerebral organs has not been observed and it is concluded that the latter are not present. The relationships of the various developmental types of the Nemertea are discussed and the conclusion is reached that there are two types of direct development, that the pilidium larva and the larva of Desor are more closely allied to the simpler direct, and least specialised type of development here described than to the other type of direct development seen in the Ecnephela.

Enteropneust Larvæ. G. Stiasny has published an account of the three Tornaria larvæ found in the Bay of Naples (*Pub. del. Staz. Zool. di Napoli*, 15, Fasc. 1; 1935). Two of these, *T. Krohni*, Stiasny, and *T. tergestina*, Stiasny, are recorded for the first time in that neighbourhood. They are provisionally identified as the larvæ of *Glossobalanus minutus* and *G. elongatus* respectively. The third species is shown definitely to be the larva of *Balanoglossus clavigerus*. An account is given of the biology of *G. minutus*. Stiasny has also described elsewhere several exotic Tornaria larvæ (*Verhand. Kon. Akad. Wet. (Tweede Sectie)*, 34, No. 2; 1934), of which two, *T. ramanujami*, a balanoglossid type of larva, and *T. uchidai*, a ptychodera type, are new species. Useful comparative tables are given of the diagnostic characters of the various species.

Growth and Tropistic Responses in Plants. Results of great interest are summarised by Prof. F. A. F. C. Went (*Biol. Rev.*, 10, No. 2) in an account of the modern work on growth and tropisms carried on in

his laboratory. In these investigations the coleoptile of oats and other grasses, a hollow cylinder in which the first seedling leaf develops, has been of much use. If the coleoptile is amputated, growth stops for about three hours owing to the removal of a substance (auxin) evidently produced in the young tip. This substance diffuses into agar and can thus be used to measure the effect on growth rate when applied to other seedlings. Innumerable experiments with this basis have been carried out in the last decade. Auxin *a* can be obtained from animal urine, where it is in turn derived from plants. It is an organic hydroxy-acid, while auxin *b* is a keto-acid, and a third growth substance discovered by Kögl is β -indolyl-acetic acid. These substances have no effect on cell division, but they increase the plastic extensibility of the cell walls. Auxin retards the growth of roots, probably by extending the transverse cell walls. It moves only from tip to base of the coleoptile, its movement being very rapid and only accounted for by the aid of protoplasmic streaming. Its production is inhibited by ethylene, which stops growth when present in very minute quantities. Many experiments go to show that both phototropism and geotropism can be explained by the movement of auxin in the plant. The shaded side gets more auxin than the illuminated side, and so grows faster. Negatively geotropic organs respond in the same way, but auxin inhibits the growth of roots and so gives positive geotropic curvatures. The relation of these responses to the statolith theory is not discussed.

Germination Experiments with Peas in Heavy Water. J. Brun and L. Tronstad have made several series of germination experiments with two forms of peas (*Pisum sativum*) at high, intermediate and low concentrations of heavy water (*Kgl. Norske Videnskabers Selskabs Forh.*, 7, 171; 1934). Germination took place up to 40 per cent D₂O, but not from 50 per cent and upwards, which is in agreement with the results of G. N. Lewis with tobacco seeds. The alleged stimulation of growth at low concentrations could not be confirmed. The experiments were complicated by the formation of moulds, which took place up to the highest concentrations employed, namely, 98.4 per cent D₂O, as was found by K. F. Bonhoeffer and his collaborators.

Landslides in Japan. Prof. N. Miyabe has made a careful study of the distribution and phenomena of landslides in Japan (*Earthq. Res. Inst. Bull.*, 13, 85-113; 1935). They have recently been most frequent in the prefectures of Nagano and Niigata on the north-west side of the Main Island, the rocks in which they occur being chiefly shales. The rates at which they move vary widely, from about a foot a year to 100 feet an hour. In the above prefectures, they occur most frequently in April, with a smaller maximum in July; the former may be caused by the melting of the previous winter's snow, the latter by the heavy summer rains. Thus, the factors most effective in starting landslides are (1) destructive earthquakes and (2) water, rain and melted snow.

Dust Separation by Electrostatic Methods. The most efficient method of removing dust and water, tar and other liquid particles from air and gas appears to be the electrostatic method of which Sir Oliver Lodge

was the pioneer more than fifty years ago. There are now some 3,000 electric filters employed in a wide range of industries, and 95-98 per cent of the total dust can be removed from the gaseous medium irrespective of the size of the particles. In an article on the advantages of electrostatic methods of dust separation published in the March number of the *Electrical Power Engineer*, it is stated that the modern 'Lodge-Cottrell' service represents an association of the patents, researches and experience of several companies. It includes the companies of Sir Oliver Lodge and his associates in Great Britain, Dr. F. G. Cottrell in the United States and Dr. Erwin Moller in Germany. The basic principle consists of towers through which passes the fume-laden air. In the towers is a series of vertical metal pipes called the collector electrodes which are connected with the earth. The discharge electrodes are from points on rods or wires hung close to the collector electrodes. These are connected with a high-tension power supply, and thus brush discharges take place from the points. All the solid and liquid particles in the fumes are repelled against the collector electrodes and either fall down to the bottom of the tower into a hopper, or adhere to the electrode, the dust-free air or gas passing on. To get rid of the adhering particles, motor-driven rapping hammers vibrate the electrodes and shake off the dust. The high voltage is produced by a motor-driven rectifier operated by the ordinary electric supply. Owing to recent improvements, the electric power required per million cubic feet of gas is less than two electric units (2 kwh.).

Failure of Aircraft Propellers in Flight. With the ultimate aim of solving the larger problem of the causes of failures of aircraft propellers in flight, a very interesting series of investigations into the effects of vibration is being made at the National Bureau of Standards of the U.S. Department of Commerce. The fatigue fractures usually exhibited suggest that such failures are due to alternating stresses set up by vibration and, in order to obtain data on this aspect of the problem, it was decided to ascertain experimentally the frequencies and stress distribution of non-rotating blades subjected to vibration, and to compare with these the values as computed by the usual theoretical methods (*J. Research Nat. Bur. Stand.*, Feb. 1935). The experimental procedure consisted in applying, at the hub, controlled impulses and in measuring the amplitudes of tip vibration and the corresponding strains at various points along and across the blade. From these observations, stress distributions for both fundamental and second harmonic modes were obtained. For the calculation of the same values theoretically it was necessary to simplify the problem by making such assumptions as that all cross-sections are symmetrical and their axes of constant direction. The very divergent results obtained would appear to throw doubt on the validity of such assumptions, particularly in their influence on frequency values. It would seem almost necessary in such a case where the actual blade of experiment differs so materially from the theoretical blade of calculation to make a blade conforming to the theoretical conditions, and to compare the experimental results obtained from it, on one hand, with those of the actual blade, and, on the other hand, with the theoretical results which, properly, apply to it. Such an intermediate experiment would considerably help in determining the value of the investigation.

Tautomerism of Acetyl-Acetone. That acetyl-acetone exhibits tautomerism has long been discussed in textbooks, but that several tautomeric forms of the compound can co-exist is less familiar (G. T. Morgan, *J. Chem. Soc.*, April 1935). Examination of its reactions with the tetrachlorides of selenium and tellurium have revealed its complex nature. The univalent radical $C_5H_7O_2^{\cdot}$ is known to combine with many different elements to form three distinct types of derivatives; but selenium and tellurium differ from other elements in yielding derivatives of the bivalent radical $C_5H_6O_2^{\cdot}$. It is shown that whereas the *trans*-monoenoic form reacts with other elements, selenium tetrachloride selects the *cis* form, whilst tellurium tetrachloride prefers the dienolic modification, ultimately yielding a *cyclotelluropentanedione*. Further studies have revealed the existence of a deep-red bisarylditelluride, which is an analogue of azobenzene.

Geometrical Transformations. One of the most important topics in analytic geometry is that of Cremona and other rational transformations. The older work in this subject has been summarised in the "Encyklopädie der mathematischen Wissenschaften" and Bulletin 63 of the National Research Council (Washington, 1928). Miss H. P. Hudson's "Cremona Transformations in Plane and Space" appeared in 1927. So much work has been done since these publications appeared that it has now been necessary for the National Research Council to issue a supplementary report ("Selected Topics in Algebraic Geometry", 2, Bulletin 96). After a list of twenty-one books (none earlier than 1924), there follow six chapters dealing respectively with curved and ruled surfaces, mapping, systems of lines in *n*-dimensional space, Cremona transformations, multiple correspondences, surfaces and varieties. Each chapter ends with a bibliography, the shortest of which mentions 79 papers, and the longest 239. The report is of great value to the working geometer.

Spectroscopic Parallaxes of Stars. An important catalogue of spectroscopic parallaxes has just been published by Prof. W. S. Adams and others of the Mount Wilson Observatory (*Astrophys. J.*, 81, 187; 1935). The methods used are the same as those in previous work of this kind, namely, the comparison of the intensity of a line sensitive to absolute magnitude with a neighbouring line of fixed intensity, calibrating curves connecting the intensity difference with absolute magnitude being constructed from the known data of trigonometrically measured stars. As some of the lines used are really blends, separate curves have to be drawn for groups of stars within narrow ranges of spectral type. The only differences between the method of this latest list and that of earlier ones from Mount Wilson lie in the use of some additional pairs of lines, and in the application of minor corrections to the reduction curves on account of the large increase in the available number of trigonometrical parallaxes. The new list contains the spectroscopic absolute magnitudes and parallaxes of 4,179 stars, mostly of types *F-M*, but with a few *A*-type stars, and includes most of the stars given in previous lists (completely re-measured). All Boss stars of these types north of declination -26° are included as well as many fainter stars from the selected areas or of special interest on account of proper motion. This is the largest catalogue of stellar parallaxes hitherto published, and the Mount Wilson observers are to be congratulated on this result of their labours.

The Twin Polygraph and Strobograph

ULTRA-RAPID CINEMA-PHOTOMICROGRAPHY

By A. G. LOWNDES, Marlborough College, Wilts

THE process consists primarily of filming rapidly moving micro-organisms by means of intermittent light. The source of light is an open arc-light and the intermittent character is obtained by rotating, at high speed, a suitable disc, pierced by one or several slots, between the arc and the microscope. The number of exposures per second obtained in this way is almost unlimited while the time of each exposure can be made very small. Thus if the disc is rotating at 100 rev. a second, and there are 12 slots in it, the number of exposures will be 1,200 a second. If each slot subtends an angle of 1° , the exposure will be $1/100 \times 1/360 = 1/36,000$ sec.

receive several images (hence polygraph). If the object is still, the images will be superimposed and will coincide, while if the object moves they will be spread over the frame of film.

With certain objects (for example, a cilium or the long antennule of a copepod) it is advantageous to get several images on one frame, and the interpretation and measurement of the movement presents little difficulty, but in other cases it is unwise to get more than three images on one frame.

The process was originally invented for the investigation of limb-movement of minute Crustacea, or ciliary movement, etc., and was not intended for

projecting purposes, but in certain cases these *polygraph* films were highly successful when projected. Two such films showing the movement of the ostracod sperms under the highest powers of the microscope were shown in Section D (Zoology) at the Aberdeen meeting of the British Association. For projecting purposes better films are obtained by the *strobographic* process, but such films are only obtainable if the object shows metachronal or rhythmic movements. In this case the high-speed disc carries one slot only and the speed is tuned-in to the object, giving the ordinary stroboscopic effect. The camera is then tuned-in to the disc so that a single frame receives a single image.

The advantages of the method are: (1) the great saving in cost of film; (2) the comparatively low cost of the apparatus (camera, microscope, motors, arc-light and resistances, etc., £350); (3) the large number of exposures per second: (4) the ultra-rapid exposures.

The alternative method of obtaining rapid exposures is by running the film through a camera at a very high rate. This is the principle of the slow-motion camera, and has the disadvantage that when in use film is costing about 3s. 9d. a second, while the camera itself (without microscope or lighting) may cost anything up to £2,000 or even more. The number of exposures is about 250 a second while the time of exposure is about $1/3,000$ sec. Slow-motion films are, however, eminently suitable for projecting purposes. Another disadvantage is that the camera only attains full speed after an interval of 1-2 sec., and about 24 ft. of film is wasted every time the camera is stopped.

In the polygraphic and strobographic processes, speed and exposure depend on the disc only, and this can run continuously without using film. So far, a speed of 24 frames a second has proved ample, and with a twin film the cost is 6d. a second, or 3d. with a single film. The speed of the disc can be varied and the slots are adjustable, so that the time of exposure, the interval between exposures, and the number of exposures a second can all be adjusted to suit the

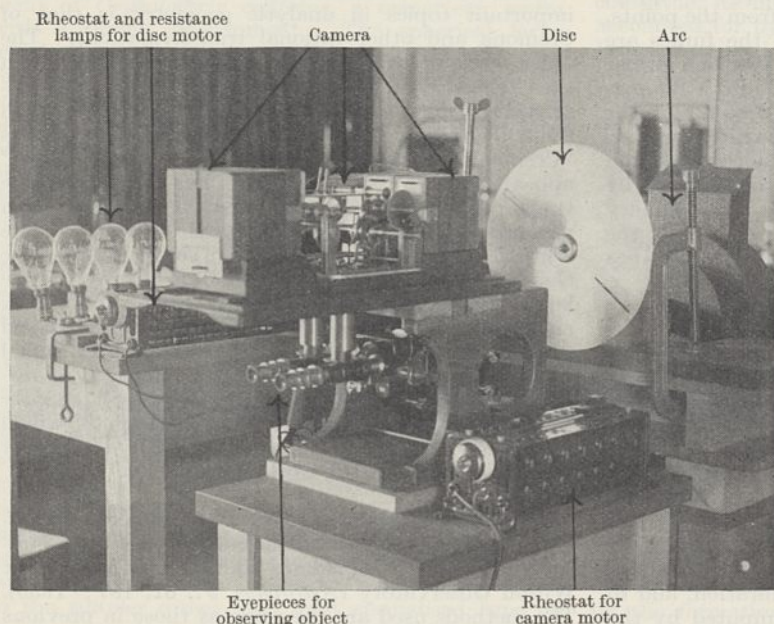


FIG. 1 Twin polygraph and strobograph.

Attached to the eyepiece of the microscope is a suitable cinema camera, and matters are so arranged that it is possible to see the object all the time it is being filmed. Nearly all cinema cameras work on the principle of the intermittent frame, or so that during exposure the film is still and then moves forward one frame; the shutter of the camera cutting off light during the change of frame. In filming micro-organisms this introduces a difficulty, for if an organism gives a spasmodic leap, the critical point is as likely to occur during cut-off as during exposure. In order to overcome this, a microscope is used possessing a single objective but two eyepieces, while the camera is constructed so that a film works in conjunction with each eyepiece, cut-off in one occurring during exposure in the other. Thus so long as the camera is working, continuous exposure is assured.

The next important point is that the speed of the camera is not that of the high-speed disc; the two are worked quite independently by separate motors. The speed of the camera is much lower than that of the disc, so that each frame of film will

object. The camera can be driven at speeds varying from 20 to 120 frames a second, while a single or twin film can be used. At these low rates the camera can be started or stopped practically instantaneously without loss of film, and one can expose either 1 ft. or 100 ft.

The apparatus is somewhat cumbersome, since the arc and high-speed disc must be on separate stands or tables from the camera and microscope, while in high-power work the camera itself with its motor must be insulated from the microscope, otherwise vibration will cause difficulties.

International Congress for Scientific Management

THE International Congress for Scientific Management to be held in London on July 15 and subsequent dates is the sixth of a series which have been held in various European capitals since 1924. The hosts of the Conference are a Council—nominated by a number of societies interested in one phase or other of the management movement, and the technical societies—which has appointed an executive committee composed of outstanding industrial leaders and others with Sir George Beharrell as chairman. The patron is H.R.H. The Prince of Wales. The organisation is in the hands of committees having as chairmen, Dr. E. F. Armstrong, Sir Henry Fowler, Mr. G. R. Freeman, Sir George Courthope, Prof. Winifred Cullis. The genesis of the invitation is the desire both to entertain the delegates in England, to show that Britain has a factory and business organisation fully up to the most modern practice, and to arouse public interest in general in the subject of scientific management.

The work of the Congress is divided into six sections each of which will hold four technical sessions. The sections will deal with development, distribution, educational and training, manufacturing, agricultural and domestic management respectively. At each session, papers falling under a specific heading will be discussed. The papers, of which there are two hundred, in six distinct volumes, are already in type and have been circulated to members: each paper has a summary in three languages. The papers for each session have been summarised by an expert *rapporteur*, which summary alone will be read, leaving the session available for discussions which are to be the main feature of the meeting. Presidents of eminence—in all twenty-four—have been obtained for each session.

The Conference will be opened at noon on July 15 by H.R.H. The Prince of Wales, who is taking a keen interest in it and is expected to speak at some length on particular phases of the subject.

The subject chosen for the first plenary session is

the topical one of management problems arising from Government intervention, which is expected to give rise to an illuminating discussion.

The second plenary session will be devoted to consideration of the simplification of data, the place of statistics and the standardisation of terms.

A large number of visits has been arranged to factories and to places of interest for members of the agricultural and domestic science sections.

At the end of the Congress, tours have been arranged in special trains with sleeping cars to enable the overseas visitors to combine the inspection of some of our most famed scenery with visits to some highly organised factories, chosen so as each to illustrate a different phase of the management problem. The social side of the Congress has not been neglected and every opportunity will be given for members to fraternise.

Many of the papers are of outstanding interest and make important contributions to the development of management regarded as an exact science; the authors of the British papers were invited to contribute them by the organising committee as representing the best experience in the particular phases. The information accumulated in the volumes is such that no industrial library can afford to be without them.

It is anticipated that the Congress will have a large, if not a record, membership, but its arrangements have been made as far as possible sufficiently elastic to allow for expansion. There are few in business or wishing to attain managerial rank who are unlikely to profit by attending its deliberations: moreover, every support is deserved by the organisers, who are working on a purely voluntary basis with the sole object of giving testimony to the up-to-date state of British business organisation in every phase of activity.

Intending members should apply immediately to Mr. Harry Ward at 21 Tothill Street, Westminster, S.W.1, so that they may receive the Congress papers in ample time to give them the necessary study.

Fuel Research in Great Britain

THE Fuel Research Station at East Greenwich was open for inspection on June 4, and about 250 guests were received by Sir Harold Hartley, chairman of the Fuel Research Board, and Dr. F. S. Sinnatt, Director of Fuel Research. The whole of the plant was on view, and the work in progress was explained and demonstrated.

Particular interest was taken in the new semi-commercial scale plant for the hydrogenation-cracking of tar to motor spirit. This plant commenced working on March 1, and was on view for the first time. It is designed to deal with 300 gallons of tar or creosote a day. One passage through the plant converts about

half the tar to motor spirit, and by recirculating the residue the whole of the tar can be converted, yielding an equal volume of spirit. Demonstrations were given of a new plant for the dry cleaning of coal, while a washery table was preparing 'ultra clean' coal containing less than $1\frac{1}{2}$ per cent of ash, from a commercial coal containing about 5 per cent. The coal survey that is being carried on throughout the coal fields of Great Britain has shown that large quantities of 'ultra clean' coal of various types can readily be prepared if required for special purposes.

The pulverised fuel burners designed at the Fuel Research Station, and now in commercial use, were

shown working in both Lancashire and water tube boilers. A method of dividing a stream of air-borne coal into two equal streams was illustrated; owing to the unequal distribution of the coal over the cross-section of the pipe when pulverised coal is carried in a stream of air, this equal division has presented difficulties. An ingenious device for estimating the rate of settlement of a suspension of a solid in a viscous liquid was on view. The tube containing the suspension forms part of a pendulum, the change of the period of swing of which is a measure of the rate at which the centre of gravity of the system moves downwards. This apparatus was designed for investigations into the stability of suspensions of coal in oil, but may have other applications.

The experiments in the full-scale horizontal gas retorts, showing the advantages of introducing steam during the last portion of the carbonising period, were of special interest to gas engineers.

Fauna of Indian Salt Lakes

LEUT.-COL. R. B. SEYMOUR SEWELL has made an interesting study of the fauna of the salt lakes of Calcutta (*Rec. Ind. Mus.*, 36, Part 1, 1934). Recent changes in the general character of some of the rivers in Lower Bengal have had a profound effect on these salt lakes and their associated streams, indirectly influencing the general character of the fauna of certain areas, silting in the rivers and canals due to various causes being the main factor in these changes.

The chief zoological interest in this brackish-water area lies in the fact that it forms one of the main highways by which marine organisms gradually establish themselves in fresh-water. In the neighbourhood of the large river estuaries there is a very great amount of available food, both organic and inorganic, and there is a considerable lowering of the salinity in the surface water. The coastal species must be able to withstand a wide variation of salinity, and a further step from brackish- to fresh-water would not be difficult.

The region was almost certainly part of the Bay of Bengal, and with a gradual extension of the delta seawards the water of the rivers and lakes became less salt, but extremely slowly. Both marine forms from the coastal waters and fresh-water species from the rivers would be carried into the salt lakes. There seem to be few instances of a definite attempt at migration upstream from the sea to the fresh-water areas above the influence of the tide.

Although other groups are mentioned and to a certain extent listed, the copepods are studied in the greatest detail. There are true fresh-water forms in the Hooghly River, and in the salt lake with the pools and canals there are normal brackish-water forms; associated with the latter we may get definitely marine forms, a gradual change from fresh-water to salt-water species showing in the plankton from the fresh-water of the river system towards the sea.

With regard to the widely distributed *Pseudodiaptomus*, it is a question whether migration has been from the sea into fresh-water or from fresh-water to the sea, or from brackish-water into both regions. The author is of the opinion that it is of marine origin, and that there has been, and still is, a tendency towards migration into brackish- and on into fresh-water.

University and Educational Intelligence

CAMBRIDGE.—Mr. G. H. A. Wilson, Master of Clare College and formerly M.P. for the University, has been elected Vice-Chancellor for the academical year 1935-36.

Dr. W. H. Thorpe, of Jesus College, has been re-appointed University lecturer in entomology. Dr. D. H. Barron has been appointed University demonstrator in anatomy.

Miss Dorothy Hill, of Newnham College, has been awarded a Senior Studentship by the Royal Commissioners for the Exhibition of 1851.

OXFORD.—Dr. N. V. Sidgwick has been granted the title of professor during the tenure of his readership in chemistry.

Dr. A. H. Gardiner, vice-president of the Egypt Exploration Society and research professor of Egyptology in the University of Chicago, has been elected honorary fellow of the Queen's College.

IN order to encourage research on eugenic problems, and on the genetical and statistical methods needed, if they are to be profitably attacked, the Eugenics Society has decided to provide the funds for a research studentship of £250 a year, tenable at any of a number of suitable research departments in the United Kingdom. The studentships will bear the name of Leonard Darwin, honorary president of the Society. To make the awards and administer the studentships, an independent committee has been set up with the co-operation of the Royal Society, the Royal Society of Edinburgh, and the Royal Statistical Society. The studentships will be renewable for a second year.

THE Social Studies final report of the American Historical Association (Scribner, 1934, pp. 168, 1.25 dollars) has become one of the chief subjects of educational discussion in America. Dealing as it does with some of the most vital issues of contemporary social life in that country and being, according to one critic, a "daringly realistic" indictment of the present social order, it has, naturally, come in for a good deal of abuse. In *School and Society* of March 30 appears an address by Prof. Jesse H. Newlon to the American Educational Research Association, in which some of the attacks on it are answered. Among these are complaints of paying lip-service to democratic ideals while knifing them in the back by enlarging on trends towards collectivism, of countenancing the indoctrination of students with subversive ideas, of decrying objective tests and the scientific method generally, of needlessly disparaging existing methods of instruction in teacher-training institutions as mechanical and sterile, of irrelevant criticism of systems of control and administration of schools. The answers throw much interesting light on current educational practices. Prof. Newlon holds that the scientific method has become a sort of fetish—educational research being concentrated on it as a chief objective in the delusive belief that it can not merely illuminate, but also provide qualitative solutions of problems of educational policy. Summing up the significance of the report, it dares, he says, to make a social analysis and, in harmony therewith, to recommend policies for making education a more effective instrument for social reconstruction.

Science News a Century Ago

Cholera Statistics for 1831-32

On June 15, 1835, Sir David Barry read a paper to the Statistical Society "On the Statistics of Epidemic Cholera as it occurred in Great Britain between the 26th of October 1831 and 31st of December 1832". Sir David divided his paper into two main parts dealing respectively with the progress of cholera in Great Britain and in the Metropolis. The disease, he said, prevailed as an epidemic in London during the ten months February 9 until December 31, the whole number of new cases being 11,020 and of deaths 5,275. The total numbers of new cases and deaths, for Great Britain and the Metropolis, were 80,203 and 30,924 respectively. In concluding his paper, he made observations on the quarantine regulations, in the course of which he said that the history of cholera by no means justified the apprehension which re-enacted the old expensive plague-precaution system of delaying the landing or sale of cargoes, until the promulgation of a paper by the Central Board of Health in January 1832 entitled "Reasons founded on Authentic Facts in the History of Spasmodic Cholera, for establishing a Specific Code of Sanitary Restrictions for that Disease, considered independently of Plague, Yellow Fever, and other Infectious Maladies" put a period to the evil. England having thus taken the initiative in the amendment of the quarantine laws, considerable mitigation very soon followed in other countries, with great relief to trade and without compromising the security of the public health.

Sir David Barry (1780-1835) had been employed by the Government to investigate the yellow fever epidemic at Gibraltar in 1828; and, on the outbreak of the cholera epidemic, was sent to Russia to report on it.

Metamorphoses in the Crustacea

Among several papers submitted to the Royal Society on June 18, 1835, was one "On the Supposed Existence of Metamorphoses in the Crustacea" by J. O. Westwood, secretary to the Entomological Society. A report of this paper in the *Philosophical Magazine* said: "The author refers the principal modifications of form which occur during the progressive development of animals to the three following heads: 1st, that of an animal produced from the egg in the form which it is destined to retain through life, its only change consisting of a series of moultings of the outer envelope, attended merely by an increase in size, and not by the acquisition of new organs; 2ndly, when the animal at its exclusion from the egg, exhibits the form which it continues to possess, subject to a series of moultings, during several of the last of which certain new organs are gradually developed; and 3rdly, when the form of the animal at its exclusion from the egg, is totally different from that under which it appears at the later periods of its existence; such change of form taking place during two or three of its general moultings, and consisting, not only in the variation of the body, but also a complete change in the nutritive and digestive systems and in the acquisition of various new organs. This last phenomenon peculiarly characterizes what is termed a metamorphosis . . ."

Balloon Excursion Extraordinary

Under the above title, the *Mechanics' Magazine* of June 20, 1835, quoted the following extract from the *New York Journal of Commerce* relating to a balloon flight a short time before. "Mr. Clayton, a volunteer aeronaut in the West, made an ascent from Cincinatti, and was observed to pass off in a southeasterly direction. Nothing more was seen of him for a number of days and great anxiety was felt for his safety. At length, nine days after his departure, he returned to Cincinatti, having made the most extraordinary excursion on record. He did not, indeed, ascend as high as a number have done before him, but the distance he sailed is beyond all precedent, being not less than 350 miles. All this was accomplished in 9½ hours, which is at the rate of nearly 37 miles an hour. The greatest height to which he ascended was about 2½ miles." Commenting on this, the *Mechanics' Magazine* said: "The longest aerial voyage previously on record was, we believe, that of M. Garnerin in 1807, who travelled 300 miles in 7½ hours".

Societies and Academies

DUBLIN

Royal Dublin Society, April 30. J. H. ORTON: The biological condition of re-laid oysters. Exceptionally high mortality had occurred amongst these oysters, but no disease was recognised, and their poor physiological condition and the presence of 'chambering' in the shells made it probable that the mortality was due to abnormal weather conditions. G. T. PYNE: A simple titrametric method for the approximate determination of milk phosphates. This method is suitable for the estimation of soluble and of total phosphates. J. BAYLEY BUTLER, J. CARROLL and MISS KIRBY: The toxicity of native pyrethrum. Experiments show that pyrethrum prepared from Irish-grown plants approximates in toxicity to that obtained from plants grown in England, and exceeds that from most other sources.

Royal Irish Academy, May 13. K. G. EMELÉUS: The Faraday dark space. New evidence is brought forward to show: (a) that resonance radiation emitted from the negative glow and travelling in straight lines is of importance in fixing the length of the Faraday dark space; (b) that there is a secondary electron emission from surfaces in the Faraday dark space. JAMES SMALL and ISOBEL K. JOHNSTON: Mathematical evolution in Compositæ, including proof of normal death of species. Udry Yule's mathematical theory of evolution is confirmed in detail, but modified by the old-age death of species, not according to chance, after a limited lifetime. The ages of the tribes of Compositæ, calculated from Yule's formulæ, in doubling periods, when plotted against a time scale in million years, follow an exponential curve, the BAT curve, with the formula $k + nd = T.2^n$. For Compositæ, grasses and Angiosperms in general, $k = 0.6$, $d = 0.9$, $T = 1.09375$ million years. The BAT curve is based upon observed points for Compositæ, but it applies to Mrs. Reid's percentage extinctions for the Pliocene deposits and to Lyell's shell curve which goes back to Palæocene, with for molluscs an 11 million-year doubling period and a 66 million-year lifetime for species. It applies also with simplicity to the evolutionary history of species-number in Angiosperms back to Jurassic, and of the

grasses back to the Upper Cretaceous. The principles have been checked by Yule on snakes and lizards, and two groups of insects, so that the mathematical forms are generally applicable to both plants and animals.

EDINBURGH

Royal Society, May 13. J. A. KITCHING: Ecology of intertidal rock surfaces on the coast of Argyll. The general and detailed distribution of various of the commoner animals and seaweeds on the coast of Argyll are described, with special reference to the effects of wave action, angle of slope of rock surface, mutual interrelations, and other factors. Various Fucoids are limited by mechanical shock of the waves. Certain barnacles require wave action, but are restricted by the rubbing of algal fronds. Various organisms which on wave-beaten coasts are confined to deeper water extend up to the low-tide mark in very sheltered localities. Fucoid fronds protect certain organisms from desiccation, and overhanging rocks act similarly. L. J. WILLS: Rare and new ostracoderm fishes from the Downtonian of Shropshire. These include one specimen provisionally referred to *Ctenaspis*, Kiaer, new to Britain; *Anglaspis macculoughi*, A. S. Woodward, a rare form, but in this instance abundant and in perfect preservation, which displays many details of the boney structure and impressions of the gill-pouches and brain-case; *Tesseraspis tessellata*, gen. et sp. nov., a large form with polygonal tuberculated plates fused into a shield; *Phialaspis*, gen. nov., *symondsi*, Lank., a large shield with smooth central area and tuberculated border. The last two are probably Drepanaspids. IAN SANDEMAN: Mathematical representation of the energy levels of the secondary spectrum of hydrogen (3). Using the observational data of C. R. Jeppesen, the molecular constants of the ground state of H_2 are calculated on the basis of J. L. Dunham's theoretical work. A somewhat similar analysis is carried out for the ground state of H_2^+ . Energy values are calculated by the method of G. Jaffé, and a simple mathematical formula is found to fit these values in the neighbourhood of the position of equilibrium. The molecular constants of the two states are compared.

PARIS

Academy of Sciences, April 29 (*C.R.*, 200, 1501-1552). EMILE COTTON: Certain singular integrals. JEAN CABANNES and JEAN DUFAY: The Vegard-Kaplan bands in the spectrum of the night sky. Discussion of the results of observations made between 1933 and 1935 at the Pic du Midi, Montpellier, Saint-Genis-Laval and Forcalquier. LUCIEN DANIEL: Achenes of deficient appearance in the dandelion. GEORGES BOULIGAND: The conditions of variance of propositions. CARLOS E. DIEULEFAIT: Correlation *au sens des modes*. J. GERONIMUS: Some inequalities for polynomials the first coefficients of which are given. V. AVAKUMOVIĆ: An extension of the condition of convergence of inverse theorems of summability. SZOLEM MANDELBROJT: A problem of Carleman concerning analytical functions. SIMON STOLOW: Remarks on the definition of the nearly analytical functions of Lavrentieff. AMÉDÉE GUILLET: A viscosimeter formed by a sphere in rotation in a fluid. LOUIS LEPRINCE-RINGUET: The sudden changes of velocity and direction shown by the trajectories of electrons of great energy. RADU TITEICA: The absorption spectra of the alkaline

bichromates. ANDRÉ CHARRIOU and Mlle. SUZANNE VALETTE: The influence of water on the sensibility of photographic emulsions. Rapid emulsions become less sensitive after absorbing water. The experiments show the necessity of protecting photographic apparatus used in aerial photography against large temperature variations. HORIA HULUBEI: The use of X-rays for showing the deformation of a crystalline network under the action of an electric field. Proof of the variation of the reticular constants of quartz and mica under the action of a static electric field. VICTOR HENRI and C. H. CARTWRIGHT: The absorption spectrum of benzene at a high temperature. LOUIS BOUCHET: The properties of a zinc of exceptional purity compared with those of other specimens of zinc. The pure specimen was obtained by fractional distillation in a vacuum and contained less than 0.0001 per cent of impurities. The extra pure zinc is more resistant to hydrochloric and sulphuric acids than ordinary zincs, but is more rapidly attacked by nitric acid. MAURICE CHAIX: The ultra-violet absorption spectra of some arylthionium salts. HENRI TRICHÉ: An arrangement for quantitative spectrum analysis. CHARLES COURTOT and TSÉ-YEI-TUNG: Critical study of the action of thionyl chloride on phenol. M. BURGAUD: Some recent magnetic observations made in the south and south-west of China. PIERRE LAUMONT and MARC SIMONET: The genetic and cytological study of the tendroid forms which appear in the descendants of the intergeneric hybrid *Egilops triuncialis* × *Triticum durum*. MICHEL A. MACHEBEUF, MMES. GEORGETTE LÉVY and MARGUERITE FAURE: Researches on the chemical nature of the lipid haptene fixing agent of tubercle bacilli killed by heat. ALEXANDRE BESREDKA and LUDWIK GROSS: The local immunisation of the skin against the sarcoma of mice.

AMSTERDAM

Royal Academy of Sciences (*Proc.*, 38, No. 4, March 30, 1935). H. J. JORDAN: Tonic contraction and tonic retention of the contraction in the muscles of *Aplysia limacina* under the influence of alternating temperatures. M. W. WOERDEMAN: Experimental analysis of some phenomena of fertilisation and cleavage. Experiments on the artificially inseminated eggs of *Paracentrotus lividus* and *Echinus miliaris*. W. H. KEESOM and K. W. TACONIS: An X-ray goniometer for the investigation of the crystal structures of solidified gases. Apparatus for the production and examination of the crystals of solidified gases at low temperatures. Data for ethylene. W. H. KEESOM and J. HAANTJES: The vapour pressure of neon at liquid hydrogen temperatures. Vapour pressures between 15° and 20.4° K. and their representation by the theoretical formula. E. COHEN, W. A. T. COHEN-DE MEESTER and A. K. W. A. VAN LIESHOUT: The influence of mechanical deformation on the velocity of transformation of polymorphous metals. Rolling, drawing or bending of white tin wires enormously increases the velocity of transformation into grey tin. J. H. C. MERCKEL: Surface tension of homologous series. Properties such as surface tension and adsorption show a linear or quadratic dependence on the length of the carbon chain. A. HERRMANN: Linear differential systems and matrix equations. C. VISSER: The angular derivative of univalent functions. C. VISSER: Boundary correlation in conformational transformation. H. FREUDENTHAL: The R_n -adic development of

spaces and groups. H. G. BUNGENBERG DE JONG and P. V. D. LINDE: Coacervate sols and their relation to the theory of lyophilic colloidal stability. In a narrow range of concentration of added alcohol, glycogen sols show marked opalescence. The observed phenomena are explicable in terms of the small electrical charge and its non-uniform distribution on the sol particles. H. G. BUNGENBERG DE JONG: Oriented coacervates and their bearing upon the formation of colloid-crystals. The coacervates from sols of *Amylum solubile* sometimes coalesce with the observance of preferred orientations. These oriented coacervates consist of thin hexagonal plates the properties of which were determined. H. J. C. TENDELOO: Researches on adsorption electrodes. (2) Mineral electrodes. Investigation of mica (muscovite) as an electrode in determining ion exchange. A. H. W. ATEN, JR.: Adsorption and ion exchange. Deduction of the Langmuir adsorption isotherm allowing for the interaction between ions. J. STURMAN: Oxidation velocities of some unsaturated hydrocarbons with peracetic acid in acetic acid solution. A. DE BUCK and N. H. SWELLENGREBEL: The salivary glands in hibernating *Anopheles maculipennis* var. *messeae* and semi-hibernating *Anopheles maculipennis* var. *atroparvus*. The paper describes a means of identifying the two species in the presence of one another and shows that they behave differently, one taking blood and the other fasting in the same environment. H. GERTH: The distribution and evolution of the larger Foraminifera in the tertiary sediments. Java, Western India, South-Western France and the West Indies are compared with regard to the appearance and evolution of the larger Foraminifera in the tertiary.

CAPE TOWN

Royal Society of South Africa, March 20. I. DONEN: Studies in deciduous fruit. (2) The effect of time and picking on chemical changes in store of the Kelsey and Gaviota plums. W. E. ISAAC: The organic matter content and carbon-nitrogen ratio of South African soils of the winter rainfall area. The C/N ratios of the soils studied range from 11.2:1 to 22.9:1, with an average for the twelve soils of 16.6:1, and evidence is presented for regarding the C/N ratio of the winter rainfall region soils of the South West Cape as being of the order of 15:1. Within a rainfall locality, the C/N ratio widens with increasing organic matter content. In passing from soil to subsoil, with one exception (Krom River farm), there is a marked decrease of organic carbon and nitrogen and thus of organic matter, and this is accompanied by a narrowing of the C/N ratio. C. VON BONDE: Reproduction, embryology and metamorphosis of the Cape crawfish, *Jasus lalandii*. The embryology is worked out in detail for the first time and all the stages from the time of the extrusion of the eggs and their attachment to the pleopods of the female's abdomen worked out. The nauplius stage, which is here passed in the egg, appears 35 days after the eggs are laid. A new stage in the larval development, the 'pre-naupliosoma', is described, as this stage was actually observed immediately the eggshells burst. The various stages in the subsequent metamorphosis are described, the experiments having been conducted in a specially constructed hatching box. An attempt is made to determine the rate of growth of the crawfish from the time the first true crawfish form was observed up to the time of sexual maturity.

GENEVA

Society of Physics and Natural History, March 21. E. HELD and M. K. PONS: A pure auxogen action obtained by heating the urine of a pregnant woman. M. A. MOSZKOWSKA: A luteinising principle of the posterior lobe of the hypophysis. The author has proved that alkaline extracts of the posterior lobes of the hypophysis of the ox exert a special luteinising action on the ovaries of guinea pigs. It affects the granular tissue exclusively, thus differentiating it from the endocrine actions of extracts of the pre-hypophysis. E. GUYENOT and J. MEIERHANS: The swim bladder and pneumatic canal in the Cyprinidae. The author has undertaken the study of the function of the pneumatic canal of the air bladder of the phytostome fishes. This canal forms the normal method for rejecting the excess gas in the bladder when the external pressure is gradually lowered. DON ZIMMET and E. FROMMEL: The action of a nucleosidic preparation (lacarnol) on the nervous excitability and conductivity. DON ZIMMET, B. GHINSBERG and L. JANCU: The influence of a hormonoid preparation (padutine) on the development of the egg of *Rana temporaria*.

LENINGRAD

Academy of Sciences (C.R., 1, Nos. 7-8, 1935). L. PONTRJAGIN: The Betti numbers of compact Lie groups. G. APELROT: Contribution to the problem of real continuous solutions of differential equations of the simplified fundamental form. A. POPOV: Certain definite integrals. A. MARKOV: Quenching method as applied to the photometry of astronomical objects which are just visible. V. NUMEROV: General formulae for the development of perturbing forces in the calculation of absolute perturbations in polar co-ordinates. N. SHISHAKOV: (1) Structure of the surface of oxidised iron. (2) Powder method in electronography. D. IWANENKO: Electrodynamics and the Dirac theory of holes. N. DOBROTIN, I. FRANK and P. CHERENKOV: Observations of cosmic rays with the Wilson camera on the Elbrus. L. TUMERMAN: Dependence of the fluorescence spectra of solutions on the viscosity of the solvent. V. LEVSHIN: Connexion between the spectra of absorption and of luminescence in weak solutions of dye-stuffs. A. TEREININ: Internal recombination during photodissociation of polyatomic molecules. K. ABLEZOVA and S. R. ROGINSKIJ (1) A new type of promotor. (2) Hydration by the adsorbed atoms of hydrogen. W. SHULEJKIN: Active films on the surface of the sea. I. KNUNJANZ: Condensation of aliphatic oxides with α -aminopyridine. B. MOLDAVSKIJ and S. LIVSHITS: Isomerism of carbohydrates. (1) Chlorination of isomers of hexane and octane by means of antimony pentachloride as a method for their quantitative determination. J. SYRKIN and V. VASILJEV: Velocity of reaction and the quantity of catalyser. M. USANOVICH: Anomalous electrical conductivity. K. SUKHORUKOV, E. KLING and D. KLJACHKO: Formation and distribution of bios. N. PROKOPENKO: Finds of rock-forming orthites in the rocks of Central Asia. I. ZASLAVSKIJ: Contraction and chemical structure of the terrestrial globe. V. BARANOV and S. KRECHMER: Application of photographic plates with a thick emulsion layer to the study of the distribution of radioactive elements in natural objects. S. KRAEVOJ: Experimental production of mutations in *Pisum*. (1) Lasting chromosome modification produced by X-rays. (2) Permanent semi-sterility caused by X-rays. DONTCHO

KOSTOFF: Conjugation between morphologically different chromosomes in *Nicotiana* species hybrids. **M. GAVRILOVA**: Reversibility of the vernalisation process. **L. SERGEEV**: Salt resistance of wheats and its dependence on variety. **S. SOLDATENKOV**: Artificial ripening of subtropical fruit by means of alcohol and ethylene. **I. SHAROV**: Problem of regeneration of the epidermis in planarians. **A. SVETOVIDOV** and **G. EREMEJEV**: The European and the Amur bitterling (*Rhodeus sericeus*). **A. LISOVSKIJ**: Orthitic granites from Karamazar.

Ninth Report of the Commissioners for the Exhibition of 1851 to the Rt. Hon. Sir John Gilmour. Pp. 43. (London: Royal Commissioners for the Exhibition of 1851.)

Technical Publications of the International Tin Research and Development Council. Series A, No. 17: Factors Influencing the Formation and Structure of Hot-dipped Tin Coatings. By E. J. Daniels. Pp. 10. (London: International Tin Research and Development Council.) Free.

OTHER COUNTRIES

U.S. Department of Commerce: National Bureau of Standards. Circular of the National Bureau of Standards, C 406: Standard Time throughout the World. Pp. 24. (Washington, D.C.: Government Printing Office.) 5 cents.

Smithsonian Institution. Explorations and Field-Work of the Smithsonian Institution in 1934. (Publication 3300.) Pp. iv+88. Smithsonian Miscellaneous Collections. Vol. 93, No. 9: New Species of Tertiary Cheilostome Bryozoa from Victoria, Australia. By Ferdinand Canu and Ray S. Bassler. (Publication 3302.) Pp. 54+9 plates. (Washington, D.C.: Smithsonian Institution.)

Brooklyn Botanic Garden Record. Vol. 24, No. 3: Books and Manuscripts illustrating the History of Botany. Pp. 159-194. (Brooklyn, N.Y.: Brooklyn Botanic Garden.)

Egyptian Government: Ministry of Public Works. Annual Report for the Year 1928-1929. Part I. Pp. ii+59+26 plates. (Cairo: Government Press.) 30 P.T.

Ministry of Agriculture, Egypt: Technical and Scientific Service. Bulletin No. 144: The Rust of Cowpea. Part 1: The Disease. By Dr. Tewfik Fahmy. Pp. iii+10+9 plates. (Cairo: Government Press.) 5 P.T.

Publications of the Dominion Observatory, Ottawa. Vol. 12: Bibliography of Seismology. No. 4, October, November, December, 1934. By Ernest A. Hodgson. Pp. 67-94. (Ottawa: King's Printer.) 25 cents.

Tanganyika Territory: Geological Survey Department. Bulletin No. 7: Outline of the Geology of the Musoma District; being a Preliminary Geological Survey of the Musoma Goldfields, with the exception of the Nigoti and Ikoma Areas. By G. M. Stockley. Pp. ii+64+7 plates. (Dar es Salaam: Government Printer.) 4s.

Amani Memoirs. A Synecological Study of the Usambara, Tanganyika Territory, with particular reference to Birds. By R. E. Moreau. Pp. 43+2 plates. (Amani: East African Agricultural Research Station.)

Det Kongelige Departement for Handel, Sjøfart, Industri, Håndverk og Fiskeri. Norges Svalbard- og Ishavsundersøkelser. Meddelelse Nr. 26: Some Echinoderms from Franz Josef Land, Victoriaøya and Hopen, collected on the Norwegian Scientific Expedition 1930. By James A. Greig. Pp. 10. Skrifter om Svalbard og Ishavet, Nr. 54: Bibliographie des ouvrages norwégiens relatifs au Groenland (Y compris les ouvrages islandais antérieurs à l'an 1814.) Par Hroar Vardal. Pp. 119. 12.00 kr. (Oslo: Jacob Dybwad.)

Bergens Museums Årbok, 1934. Heft 2, Naturvidenskabelig rekke, Nr. 9-14. Pp. 60+90+10+16+32+28. (Bergen: A/s John Griegs Boktrykkeri.)

Union of South Africa. Report of the South African Museum for the Year ended 31st December 1934. Pp. 17. (Pretoria: Government Printer.)

National Geographic Society. Contributed Technical Papers. Stratosphere Series, No. 1: The National Geographic Society—U.S. Army Air Corps Stratosphere Flight of 1934 in the Balloon Explorer. Pp. 122. (Washington, D.C.: National Geographic Society.)

U.S. Department of the Interior: Geological Survey. Bulletin 851: The Book Cliffs Coal Field in Garfield and Mesa Counties, Colorado. By Charles E. Erdmann. Pp. vi+150+21 plates. 35 cents. Professional Paper 179: Origin of the Copper Deposits of the Ducktown Type in the Southern Appalachian Region. By Clarence S. Ross. Pp. v+165+44 plates. 45 cents. Professional Paper 185-B: Paleozoic Formations of the Mosquito Range, Colorado. By J. Harlan Johnson. (Shorter Contributions to General Geology, 1934-35.) Pp. ii+15-44+7 plates. 10 cents. (Washington, D.C.: Government Printing Office.)

U.S. Department of Agriculture. Technical Bulletin No. 471: Chemical Studies of Infertile Soils derived from Rocks high in Magnesium and generally high in Chromium and Nickel. By W. O. Robinson, Glen Edgington and H. G. Byers. Pp. 29. (Washington, D.C.: Government Printing Office.) 5 cents.

Mémoires de Musée Royal d'Histoire Naturelle de Belgique. No. 63: Beitrage zur Kenntnis Tertiärer Sirenen. 1: Die Eozänen Sirenen des Mittelmeergebietes; 2: Die Sirenen des Belgischen Tertiärs. Von Otto Sickenberg. Pp. 352+11 plates. No. 64: Die Plizoäen Baeren Belgiens. Teil 1: Die Baeren von Hastiere. Von Prof. Dr. Kurt Ehrenberg. Pp. 126+13 plates. No. 65: Contribution à l'étude des Echinoides du Frasnien de la Belgique. Par Eug. Mailleux. Pp. 16+2 plates. No. 66: L'Aérolithe du Hainaut. Par Dr. M. Lecompte. Pp. 39+3 plates. Hors Série. Résultats scientifiques du Voyage aux Indes Orientales Néerlandaises de LL. AA. R.R. le Prince et la Princesse Léopold de Belgique. Publiés par V. Van Straelen. Vol. 3, Fasc. 15: Crustacea Brachyura. By Isabella Gordon. Pp. 78. Vol. 3, Fasc. 16: Rhizocephales (Supplément), par H. Boschma; Stomatopod Larvæ, by M. V. Lebour. Pp. 17. (Bruxelles.)

CATALOGUES

Oertling British Precision Balances and Weights. Pp. 27. (London: L. Oertling, Ltd.)

Catalogue of recently purchased Botanical Books, including some interesting items from the Library of the late Miss Willmott, and many on Flowers and Flower Gardens, Floras, Gardening, etc. (No. 237.) Pp. 20. (London: Dulau and Co., Ltd.)

Technical Brochure No. 2: Shell-Wild-Barfield Quenching Oils. Pp. 20. (London: G. W. B. Electric Furnaces, Ltd.)

Apparatus for Radiology: High Tension Transformer Units. (Publication No. A/35.) Pp. 18. (London: Newton and Wright, Ltd.)

Holiday Photography. Pp. 20. (London: Burroughs Wellcome and Co.)

Forthcoming Events

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

Sunday, June 16

BRITISH MUSEUM (NATURAL HISTORY), at 3 and 4.30.
Capt. Guy Dollman: "British Mammals".*

Monday, June 17

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—J. M. Wordie:
"An Expedition to the Canadian Pacific".

Tuesday, June 18

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.30—(at the London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1).—Dr. H. K. Fry: "Native Life in Central Australia" (Film).

Thursday, June 20

ROYAL SOCIETY, at 4.30.—Prof. Otto Loewi: "Problems connected with the Principle of Humoral Transmissions of Nervous Impulses" (Ferrier Lecture).

ST. MARY'S HOSPITAL, LONDON, at 5.—Dr. Joseph Needham: "Problems of Chemical Embryology".*

Official Publications Received

GREAT BRITAIN AND IRELAND

The National Physical Laboratory. Report for the Year 1934. Pp. iv+260+16 plates. (London: H.M. Stationery Office.) 13s. net. Development Commission. Twenty-fourth Report of the Development Commissioners being for the Year ended the 31st March 1934. Pp. 122. (London: H.M. Stationery Office.) 2s. net.

Amgueddfa Genedlaethol Cymru (National Museum of Wales). Some Aspects of Forestry in Wales: a Handbook to a Temporary Exhibition based on the Tree Collections in the Department of Botany, May 1-September 28, 1935. By H. A. Hyde. Pp. 22. (Cardiff: National Museum of Wales.) 3d.

The Kent Incorporated Society for Promoting Experiments in Horticulture. Annual Report (Twenty-second Year) 1934: East Malling Research Station, Kent, 1st January 1934 to 31st December 1934. Pp. 264+22 plates. Free to Associate Members; 4s. to non-Members. Misc. Publication H. 23: Supplementary Annual Report (Twenty-second Year): General Development and Activities, East Malling Research Station, Kent, 1st January 1934 to 31st December 1934. Pp. 22. (East Malling: East Malling Research Station.)

The Carnegie United Kingdom Trust. Twenty-first Annual Report, January-December 1934, approved by the Trustees at their General Meeting held on Friday, March 8th, 1935. Pp. vi+88+6 plates. (Dunfermline: Carnegie United Kingdom Trust.)

The National Council for Civil Liberties. Annual Report and Balance Sheet 1934. Pp. 36. (London: National Council for Civil Liberties.)

Air Ministry: Aeronautical Research Committee: Reports and Memoranda. No. 1573 (T. 3407 a, b, and c): On the Calculation of Stresses in Braced Frameworks. 5: The General Solution for a Cylindrical Tube of Regular Polygonal Cross Section. By R. V. Southwell and J. B. B. Owen. Pp. 85+2 plates. (London: H.M. Stationery Office.) 4s. net.

The Lister Institute of Preventive Medicine. Report of the Governing Body, 1935. Pp. 35. (London: Lister Institute.)

Hull Museum Publications. No. 182: Excavations at the Roman Fort at Brough-on-Humber. By Philip Corder. Pp. 38. 1s. No. 183: What to see in the Hull Museums. By Thomas Sheppard. Pp. 16. 1d. No. 184: Record of Additions. By Thomas Sheppard. Pp. 36. (Hull: Hull Museum.)

Report by the Hydrographer of the Navy on the Surveys carried out by H.M. Naval Surveying Service and on the Work of the Hydrographic Department for the Year 1934. Pp. viii. (London: Admiralty.)