



SATURDAY, JULY 23, 1932

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Science and Social Economics

THOUGH it is recognised that science touches the life of society closely at many points, there are other spheres in which the contribution of science is only just beginning to be perceived. The full effect of the changes in the structure of society, whether in Great Britain or elsewhere, produced by the impact of applied physical science in such ways as the increased facilities for transport over great distances; rapid long-range communication by telephone, wireless, aeroplane; the cinema and broadcasting; and the spread of mechanical production on a large scale in such parts of the world as India, China, and Russia has yet to be perceived. The extent of the influence of these forces or the magnitude of the changes they have produced will undoubtedly be vast but are largely unpredictable. Least of all can they be ignored in a country like Great Britain.

It is largely because of this that authorities like Prof. W. McDougall have attributed much of the responsibility for our present position to our neglect of the social sciences, and have pleaded for the direction of our most powerful intellects from research in the physical sciences into research on the biological, the human and the social sciences. In this manner it would become possible to build the social sciences and especially the science of economics on the basis provided by anthropological research.

There is thus visualised a further wide field in which science can make a contribution of vital importance to the development or even the existence of society. As a balance to the violent changes produced directly or indirectly in our social or industrial life by physical science, there would be accumulated an adequate volume of scientific knowledge of human nature and the life of society which would facilitate the adjustment of our social, economic, and political life in a rational way and apart from sectional prejudices. The development in this way of economics, politics, jurisprudence, criminology, etc., on a basis of facts and a sound or scientific psychology, would afford sure guidance in dealing with the many difficult problems which confront us in national administration, finance, unemployment, trade cycles and international relations to-day.

We have already attempted in administration of the backward races the experimental application of biology or psychology to problems of national and international conduct, and the success achieved indicates the value which such

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methods, when widely applied and based on a firm foundation of adequate research, can have in dealing with the racial relations and the evolution of co-operation in place of competition. The confusion which exists in economics to-day is not due to the absence of statistical facts but to our lack of scientific knowledge of imponderable psychological factors having their basis in human energies, in the personal and group loyalties of men, their fears, their ideals, passions, and ambitions. Only by patient research leading to the gradual development of exact knowledge can the world hope to win a more perfect control over the economic organisation resulting from the mechanical mass production made possible by the rapid progress of physical science in the last century.

The contrast between the comparative freedom with which scientific knowledge and development have influenced industrial development and their almost negligible influence in the control of national and international policies which so largely determine the development or stagnation of industry and society as indicated above is startling, and the danger grows. It must not be imagined, however, that science or scientific research offers a ready-made solution of all our present difficulties, or indeed that it is more than one factor in the solution of our national social and industrial problems. It is claimed, however, that in the modern State the problems of national life to an increasing extent involve scientific factors, and cannot be handled aright without scientific knowledge. There can be no adequate control unless the full facts of the situation are taken into consideration and accurately appraised by those competent to assess the scientific aspects along with other factors.

As has often been stated in these columns we need an increasing number of administrators who count among their qualifications a first-hand experience of scientific technique, and a scientific outlook is as essential in national affairs as in industry, if the resources and contribution of science are to be utilised to full advantage. Recent experience indicates that this is likely to be an essential condition of progress. The comparative impotency of Parliament in the present industrial situation is largely due to its lack of inherent scientific and technical knowledge, as well as to the absence of such knowledge in those holding high administrative appointments in the civil service. No severer handicap has been imposed on Great Britain in the present crisis than the exclusion, often deliberate, of technical and scientific men of administrative ability from responsible administrative

posts in industry or in Government service. Not until this defect is remedied in Parliament, as in Government service and industries generally, can we expect to see not merely effective and scientific reorganisation of our industries from the point of view of the nation as a whole, but also the initiation of the task of wise international co-operation in a spirit of unselfishness and world service.

The possibilities of the application of scientific method in national and political affairs are indicated by the success of those pieces of reconstruction work in post-War Europe which were based on an impartial scientific analysis of the problem by relevant experts and linked up with the appropriate action. The Austrian and Hungarian reconstruction schemes and the Greek Settlement scheme are examples of a new technique in international affairs, and demonstrate convincingly the function of the technical expert in linking up knowledge and power. The Dawes and Young Commissions are similar examples of this new method of applying the forces of science and expert skill and wisdom to problems declared insoluble by governments and hopelessly vitiated by human prejudice. That their solution was only temporary, and that the problem threatens to be sucked once more into the maelstrom of politics, merely indicates the imperative need for extending this same technique to national and international problems of disarmament, tariffs, reparations, and War debts, etc., which react on the issues involved.

The application of scientific method to the unemployment problem and other industrial or economic difficulties has been further suggested not only in the Macmillan report, which, apart from its assertion that the task of capital development should be attempted in a much more systematic and far-sighted manner than hitherto, visualised a comprehensive rebuilding and replanning policy for our larger towns and industrial centres, the replanning and refitting of staple industries, and the electrification of railway systems, but also by the International Labour Office in its proposals for practical action on unemployment in Europe, which were recently submitted to the Commission of Inquiry for European Union. Without elaborating a definite scheme, the memorandum outlines such ideas as a definitely planned international road system to meet the present-day requirements of rapidly increasing motor traffic, and to provide connexions between the special roads for motor traffic which are at present being constructed everywhere independently in the most advanced countries of Europe; the co-ordination of regional



systems of navigable waterways; the international distribution of electric power, and the concerted and uniform substitution on all European continental railways of a suitable system of automatic coupling in place of the present screw couplings, which are annually responsible for many fatal accidents.

Schemes of this type planned in advance as a definite programme would enable public works to be postponed from a boom period and carried out in a time of depression. They should thus be of direct value in reducing the incidence of unemployment as well as in encouraging the spirit of European co-operation on which the Macmillan report laid such stress.

There is indeed much evidence of a widespread recognition that an era of conscious and deliberate management must succeed the present era of undirected natural evolution. Scientific workers themselves have urged support of leaders who would attempt to plan the reconstruction of the world on the basis of a definite five-year or similar plan.

General Smuts's plea that the scientific expert and his report giving a just and impartial lead to governments should be regularly accepted just as judicial decisions are accepted, as a matter of course, is perhaps less visionary than when it was uttered, and the value of the mature, sober, impartial spirit of science in the functioning of our national and international system may be the nearer recognition because of the present chaos. Sections of the community are disposed to accept the leadership of science, and to adopt a well thought out and comprehensive scheme of national and international reconstruction based upon an authoritative and scientific analysis of the whole situation.

The participation of the scientific worker in this task of reconstruction on equal terms with representatives drawn from other sections of the community should at least enable us to relate administrative action to the full facts of the situation, shatter the influence of prejudice or sectional interests in determining national policy, and bring to an end those gigantic forms of national and communal waste which largely are the result of ignorance on the part of our administrators. Above all, it would ensure that human values and human factors, the neglect of which is responsible for so many of our present difficulties, receive full and sympathetic appraisal because as a result of scientific study they are at last adequately understood.

### Bibliographia Zoologica

*An Introduction to the Literature of Vertebrate Zoology: based chiefly on the Titles in the Blacker Library of Zoology, the Emma Shearer Wood Library of Ornithology, the Bibliotheca Osleriana, and other Libraries of McGill University, Montreal.* Compiled and edited by Dr. Casey A. Wood. Pp. xix + 643. (London: Oxford University Press, 1931.) 63s.

THE publication of this imposing volume suggests a consideration of the more important resources already available. For the older literature, that is, up to 1776, we must still rely on Haller's "Bibliotheca Anatomica", which would be an enduring monument to the memory of that remarkable man even if it did not represent but a fraction of his stupendous labours. For the later work there is so far nothing to beat Carus and Engelmann and its continuation by Taschenberg, although the utility of the latter part is sadly discounted, if not destroyed, by the lack of the indexes, which latter, we are informed, are not to be printed—a lamentable decision on the part of the famous German publishing house responsible for the work.

Of works on private libraries, Dryander's catalogue of Sir Joseph Banks's collection is by far the most useful, and is worth its weight in gold. The most distinguished example of the catalogues of public institutions is that of the Natural History Museum at South Kensington—a library not rich in the older literature but containing almost everything else. This catalogue is a masterpiece of bibliographical research, as we had a right to expect from two such adepts as Bernard Woodward and Davies Sherborn. The format of the work under review has been based on the South Kensington example, and no better model could have been selected. The Royal Society's catalogue arouses very mixed feelings. Whilst it would have been easy to have improved this work without materially increasing the cost of compilation, it is, nevertheless, indispensable to every student of the literature of science. The first three series can be obtained in the second-hand market at quite a reasonable cost, but the last series of seven volumes, bringing the work down to 1900, is published at more than £41—a price which rules out the private purchaser and, for that matter, most institutions. On what principles of business and equity this can be justified it is difficult to see.

A work which catalogues any single private or



public library, unless that library be an exceptionally large one, has always one defect and one merit. Its defect is that it is necessarily incomplete, but its merit is that, so far as it goes, it is reliable, since every entry has been written with the work to which it relates in front of the recorder. A compilation, on the other hand, is bound to repeat the errors and misprints of previous compilations. For example, it is generally found that the mistakes in Agassiz' "Bibliographia Zoologiæ" are directly inherited from Boehmer. We must therefore be careful to distinguish between an original bibliography and a second-hand compilation, since it is sound procedure to neglect the latter wherever possible. Dr. Casey Wood's catalogue, however, is a worthy example of the former class of work, and convinces us that the library of the premier University of Canada, at all events so far as zoology is concerned, must be a remarkably fine one. It must not be forgotten, also, that it was to McGill University that the late Sir William Osler bequeathed his own magnificent collection of early medical and anatomical works, some of which figure in the present catalogue.

Dr. Wood has divided his work into three sections. The first (146 pages) is a review of the literature of vertebrate zoology as represented in the McGill libraries up to the year 1930. The second (26 pages) comprises three indexes, which enable the reader to trace works published at specific dates, and those relating to particular geographical regions and to the larger zoological groups. The third section (469 pages) is the alphabetical list of titles. Sections 1 and 2 serve as a very useful introduction, and convert what would otherwise be a mere list into a serviceable guide. Here we find chapters dealing with the beginnings of zoological literature and with the medieval and modern periods. These chapters are brief but informative, and are to be regarded as skeleton outlines for the benefit of the inexperienced rather than as original contributions to the history of zoology. The whole work is a valuable addition to the bibliographical resources of the working zoologist, and Dr. Casey Wood has earned our thanks for reducing so useful a catalogue to the accessibility of print.

Unhappily, with the single notable exception of Edinburgh, universities cannot afford the luxury of printing their library catalogues, but no one can doubt that, were they able to do so, the gain to learning would be considerable. Of the great national libraries of France, England, and Germany, the publication of the French catalogue alone is rapidly approaching completion, but the printing

of the English and German catalogues has only just begun, and at the present rate can scarcely be completed within fifty years.

In glancing at Dr. Wood's volume we noticed a number of slips, amongst which were the following: P. 23—Rommel's *De Fœtibus* (1680) is nothing more than a crude description of a case of abdominal pregnancy and has no embryological interest. P. 42—Haller's connexion with the "*Historia Ranarum*" (1758) is purely nominal. This beautiful and important book was entirely the work of Roesel. The entry under Haller on p. 375 should be deleted, and that under Roesel on p. 541 retained. P. 43—Bonnet was not the discoverer of parthenogenesis in *Aphidæ*, but Leeuwenhoek in 1695. P. 104—Boussuet's "*De Natura Aquatiliū*" (1558) is a metrical version of Rondelet and not a supplement to it. On p. 541 the French translation of Rondelet is wrongly stated to be "probably of Boussuet's edition". It has no relation to Boussuet whatever. Also, why query the place of publication, when it is clearly given on the title-page? Pp. 196-7—where the authors of anonymous works are known, they should be indicated. Thus the catalogue of the Ashmolean is by P. B. Duncan and the "*Mémoire instructif*" is by E. F. Turgot. On p. 604, what appears to be another copy of the latter work is catalogued under Turgot. P. 325—Dryander's catalogue of Banks's library is asserted to have "passed through half a dozen editions". Only one edition of this work was published. What is evidently referred to is the "*Catalogus librorum qui desiderantur in bibliotheca J. Banks*"—obviously another story. The entry under Banks on p. 220 is correct except that for 1798 read 1796. P. 430—the Dutch edition of Leeuwenhoek is not a complete set of all his works, neither was he a physician. A number of his important contributions to the *Phil. Trans.* do not appear in the collected works, Dutch or Latin. P. 498—Oken's "*Allgemeine Naturgeschichte*" is interesting only as an example of the complete potboiler, but as a piece of zoological literature it is neither rare nor important. P. 520—the work catalogued under Pitfeild is not by this author but only translated by him. Nor is it correct to say that this work is not in the South Kensington catalogue, where it is to be found under "Paris", and Pitfeild's name, as usual, is incorrectly spelt. P. 589—"The Book of Nature" does not include Swammerdam's works on respiration and on the structure of the uterus, and does not therefore constitute his *Opera omnia*.

F. J. COLE.



### A Modern Domesday Book

*The Victoria History of the County of Kent.* Edited by William Page. Vol. 3. Pp xv + 452 + 37 plates. (London: The St. Catherine Press, 1932.) 63s.

WITH the issue of the third volume, the general section of "The Victoria History of the County of Kent" is brought to a close; the remaining volumes, comprising the topography of the county, will deal with the history and topography of the individual parishes.

When a county has so much that is of moment to the archæologist and the historian, it may seem profitless to compare one volume with another. Each has its special attraction for different classes of reader. Here undoubtedly the most considerable contribution is the account of the Roman remains, which include the site of Richborough, of the first importance for the final phase of the Roman occupation. This has been completed by Dr. R. E. Mortimer Wheeler, partly from material which had been brought together by the late Prof. Haverfield and Miss Marjorie Taylor. Romano-British Kent, as a main line of communication with the Continent, is of exceptional interest. Dr. Wheeler's article in its combination of description and historical reconstruction is a model for the treatment of archæological material in a work on this scale and of this character. The somewhat disappointing material afforded by the Domesday survey, with which Prof. N. Nielson and the Rev. F. W. Ragg deal, is more than counterbalanced by the interesting "Domesday Monachorum", again the work of Prof. Nielson. Both Miss Maud Simkins, in her survey of the political history, and Dr. Gilbert Slater, on the social and economic conditions, handle their material with a due appreciation of its relation to the character and purpose of the whole work as a county record. In an informative account of the industries, Miss Ethel M. Hewett has included a history of the coal mining project which takes a hopeful view of its future prospects.

It may not be out of place to recall that the first volume of "The Victoria History of the County of Kent", which dealt mainly with natural history and archæology, appeared so long ago as 1908, while the second volume, of which the principal topic was ecclesiastical history, appeared in 1926. The long interval which has elapsed since the publication of the first volume is to be deplored; but it was inevitable in the unforeseen conditions which arose.

The "Victoria History of the Counties of England" was begun in 1899 under the general editor-

ship of Sir Laurence Gomme and Mr. H. A. Doubleday and since 1902 has been in charge of Mr. William Page. It was dedicated to Queen Victoria, who commanded that it should bear her name, and it has been continued as a memorial of her. It was planned on a grand scale as a national historical survey which would be of permanent interest and value. It includes not only natural features, flora and fauna, antiquities, a new translation of Domesday Book, and political, social, and economic history, but also in each county, under the final section of topography, there is a detailed description and history of each parish, with an account of the land and its owners from the Conquest, or before, downwards. This section has entailed a research in manorial and family histories and records, in which no effort has been spared to secure that it should be exhaustive. This alone will make of the Victoria Histories a treasure-house of facts of much more than local significance. It is, however, no exaggeration to say that from any point of view the "Victoria History of the Counties of England" is a work of national importance.

When publication was interrupted at the outbreak of war in 1914, 71 volumes had been issued, and a large amount of material for future volumes had been prepared. That an undertaking of this magnitude and character should have been carried so far without assistance from outside reflects the greatest credit on editor, staff, contributors, and publisher. The increased cost of production after the War precluded the continuation of the work until the generous assistance of Viscount Hambleton enabled publication to be resumed in 1927. Unfortunately, this assistance is no longer available, and until support is obtained from other sources it will not be possible to carry on the preparation and issue of further volumes.

In view of what has been said as to the character of the work and the field it covers, it is abundantly evident that its continuation does not fall short of being a matter of national concern. Even if in present conditions help from the national exchequer is out of the question, the counties directly concerned might well assist, especially where attempts are being made to arouse interest in local history as part of the curriculum of the county schools. Perhaps this, too, may seem to take too optimistic a view. In that event, the work is such as should present a strong appeal to any one of our universities. Not only would a university which assumed responsibility for the Victoria County Histories, issuing the volumes through its university press, confer a lasting benefit on academic



studies in several branches of history and science, but it would also provide an exceptionally favourable field for its research workers in the collection and preparation for publication of material under the supervision of those departments of the university whose subjects come within the scope of the "History". Too much time, thought, and money have been expended on the work so far as it has gone for it to be allowed to come to premature end without some strenuous effort to secure its successful completion. Even if it be too much to expect in these difficult days that sufficient support for the completion of the work will be forthcoming, it is greatly to be hoped that steps will be taken to preserve for research purposes the vast amount of material which has been collected from original sources for various volumes of the "History" yet unpublished.

### The Future of China

*The Capital Question of China.* By Lionel Curtis. Pp. xix + 322. (London: Macmillan and Co., Ltd., 1932.) 10s. 6d. net.

MR. LIONEL CURTIS has done a public service in writing this book. It treats of the plight of at least a fifth of the human race, to whose condition our past actions have demonstrably contributed. It traces the effects of a leaven of modern scientific thought, working in a society not socially or politically organised to receive it. It gives a short but adequate survey of the antecedents, and makes a few tentative suggestions for ameliorative action. Here, no doubt, the reader will feel the need of further guidance; but, as Mr. Curtis insists again and again, the first essential is that we in the West, and especially the British and American peoples, should take an increasing interest in the matter and inform ourselves as to the state of affairs.

This purpose the book admirably fulfils, and, as our more immediate concerns in the West become less harassing, we shall be able to turn with a calmer and more united mind to the even larger problems which the future of China unfolds. But every one should read the book without delay, if only to revive his memory of recent events and put them in the right setting of world-history at the most crucial meeting point of East and West. Three lines of contact have persisted since the middle ages and have been much extended in modern times: trade, which has led to the foreign concessions and 'unequal treaties'; religion, which has been steadily and heroically promoted by

Christians of all sects, with good humanitarian results, but without increasing the political stability of the country; science, which in recent years has been eagerly studied by the élite of the younger generation, and is the strongest revolutionary force. All this has gone on without the political training which Rome afforded in the ancient world and England has given to India and other parts of the modern world.

Mr. Curtis deals briefly but fairly with the Manchurian question and the claims and recent actions of Japan. He stands firmly for the essential unity of China, and holds that Japan will live to regret her 'gunboat' policy. The two definite suggestions which he makes for British policy are: that we should set up our legation in close contact with the Chinese government, the place being somewhere in the Yangtze valley; secondly, that we should send out some one of full diplomatic standing and the highest personal qualifications to advise and co-operate with the Chinese central authorities. Cromer and Milner suggest to him the desirable type among English administrators; Dwight Morrow, whose work in Mexico had no proconsular touch, seems a nearer analogy. But the problems of Mexico are child's play in comparison; China is an ancient world thrown into chaos.

F. S. MARVIN.

### Short Reviews

*Witwatersrand Mining Practice.* By Prof. G. A. Watermeyer and S. N. Hoffenberg. (Published by the Transvaal Chamber of Mines, Gold Producers' Committee.) Pp. xxxii + 895. (Johannesburg: Hortors, Ltd., 1932.) 45s.

THE Mines of the Witwatersrand have produced gold worth more than £1080 millions sterling, and their annual output is half the annual world production of gold. The underground practice of so important a field, which contains some of the deepest mines of the world, is of interest to all mining engineers, especially as within the last decade great advances have been made in underground working methods, as a result of exhaustive research by the mining groups.

This volume contains up-to-date descriptions of all branches of Rand underground practice. The aim of the authors has been to provide a work which would serve both as a reference book to the mining engineer and a textbook for the student. The first objective has been achieved, for the abundant technical data, the clear illustrations, and good index make the volume of great service to those wishing to keep abreast of modern underground practice on the Rand, without the inconvenience of consulting the transactions of a number of different technical societies. In order to serve as a textbook of mining with special



reference to Witwatersrand practice, many of the chapters have been provided with introductory matter to treat each subject in a connected manner. It is difficult to combine the amount of detail desirable for a handbook of reference with the breadth of treatment needed for a textbook. From the point of view of a textbook, the chapters on underground methods of working could have been improved by a broader review of the methods described.

T. P.

*Merchant Venturers in Bronze.* By H. Peake and H. J. Fleure. (The Corridors of Time, 7.) Pp. viii + 168. (Oxford: Clarendon Press; London: Oxford University Press, 1931.) 5s. net.

IN "Merchant Venturers in Bronze" the authors of "The Corridors of Time" have now come to the early and middle bronze age. At the beginning of this period, somewhere about 1900 B.C., the fall of Hissarlik, as they interpret the evidence, caused a dislocation of the trading activities radiating from the Troad, but by no means interrupted the spread of a knowledge of bronze. The argument for the localised development of culture already put forward, in the case of outlying areas visited for the supply of metal, is here carried further in its application to western Europe.

The period covered, which extends over the greater part of the second millennium, is one of special interest, as it comprises not only the extension of the use of bronze in central Europe—of which the account given here may, perhaps, appear to make light of difficulties, though with some success—but it also embraces the great racial movements of the Aryans into India, the Kassites into Mesopotamia, and the Hyksos into Egypt. It has also to deal with the foundation of the Mycenaean civilisation and with the numerous problems to which the origin and early development of that civilisation gives rise, such as, for example, the chronological and cultural relation of the tholos tomb and the shaft-graves of Mycenae, a problem for which an ingenious solution is suggested. The period is a maze of difficulties; and if the size of the volume precludes very detailed treatment, it does at least serve as a guide along the darker stages of the way.

*Engineering Mechanics.* By Prof. F. L. Brown. Pp. xi + 477. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1931.) 20s. net.

THE book is written from the point of view of the engineering student, and the applications of the principles of mechanics are treated conformably with engineering practice. Thus the examples are drawn from roof trusses, bridge girders, journal bearings, pump impellers, automobile engines, and the like. Applications in other directions are ignored as inappropriate. The subject matter is clearly expounded, with many well-executed diagrams which should render the text easy to assimilate. The usual ground is covered in two parts, the first dealing with statics and the second with kinematics and kinetics. The author makes a

point of omitting any reference to the term 'mass' in the development of the last-named subject until after he has restated and explained Newton's Laws of Motion independently of it. Indeed, he avoids the use of the word throughout, urging that it is not essential to the elucidation of problems which particularly concern the engineer. Appended to each section of explanatory text is a selection of illustrative examples, with solutions or answers. With its modern instances, the book is thoroughly up to date, and should prove useful to the engineering student.

B. C.

*A Practical Manual of Lac Cultivation.* By P. M. Glover. Pp. iv + 81 + 16 plates. (Nankum, Ranchi: The Indian Lac Association for Research, 1931.) n.p.

IN view of the importance of the lac industry to the Indian Empire, it is obviously desirable that the best practical information should be readily accessible to all who seek it. Mr. P. M. Glover, entomologist to the Indian Lac Research Institute at Ranchi, has produced an up-to-date guide to the subject, embodying the results of recent investigation carried out under the auspices of the Lac Research Institute, which will doubtlessly be welcomed by all the more progressive growers. The yield of the lac crop responds enormously to judicious inoculation and skilful cultivation, coupled with proper pruning of the host trees. Unfortunately, the lac insect itself has numerous enemies, and some of the most destructive are other insects of several kinds. The counteraction of the activities of such enemies is one of the most urgent problems that have to be faced, since they are responsible for the destruction of about sixty per cent of the crop produced in each year. These and other aspects of lac cultivation are discussed by Mr. Glover in his very practical guide to the subject.

*Check-List of Birds of the World.* By James Lee Peters. Vol. 1. Pp. xviii + 345. (Cambridge, Mass.: Harvard University Press; London: Oxford University Press, 1931.) 17s. 6d. net.

A SINGLE work giving a complete list of the birds of the world had not been published for more than thirty years, during which time very many new forms had been described and much revision had been made in classification and nomenclature. The list which Mr. Peters, of the Harvard Museum of Comparative Zoology, is compiling, and of which this is the first of ten volumes, will therefore be an invaluable work of reference for ornithologists if the remainder of the task can be accomplished without too great delay. The information given is restricted to the names of the genera, species, and sub-species, the authorities for these, abbreviated synonymies, and summaries of the distribution of each form. On many controversial points of nomenclature and validity the author has necessarily had to follow his own judgment, but apart from differences of opinion in this regard, there is likely to be little criticism of the way in which he has begun his great labour. The arrangement and the typography are admirably clear.



## The Total Solar Eclipse of Aug. 31, 1932

By Prof. F. J. M. STRATTON

THE belt of totality of the solar eclipse of Aug. 31, 1932, starts north of Siberia, and, after passing within about 300 miles of the north pole, crosses Canada and New England, and ends in the middle of the Atlantic Ocean. In Canada the track runs from the southern end of Hudson Bay south-east across Quebec, the central line crossing the St. Lawrence River at Yamachiche, where there is a Marconi wireless station (Fig. 1). The south-westerly boundary of the belt of totality passes

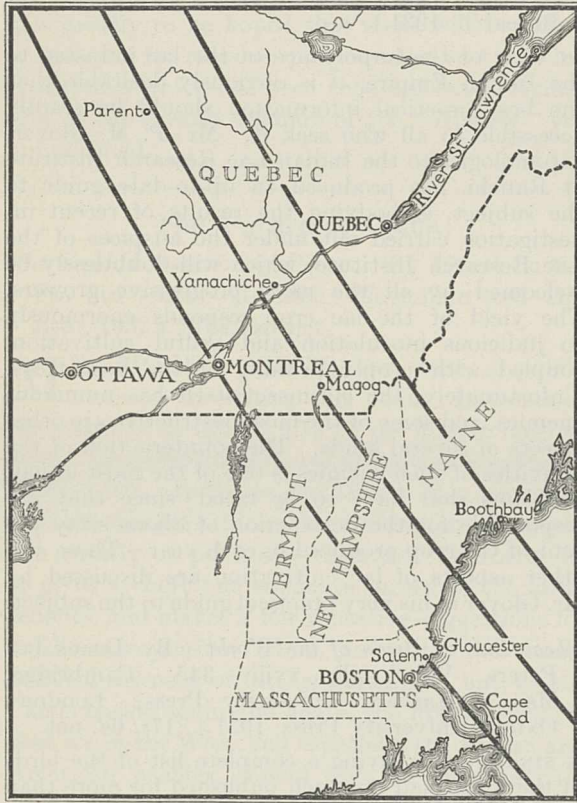


FIG. 1.—Track in Canada and New England of the total solar eclipse of Aug. 31, 1932.

through Montreal, and reaches the Atlantic coast between Salem and Gloucester; Boston is outside the belt, Cape Cod within it; the north-eastern boundary reaches the coast close to Boothbay in Maine.

Observations of the weather conditions between Aug. 16 and Sept. 14 at the hours of the eclipse have been made for a number of years at more than a hundred stations. Prof. F. Slocum, following Prof. D. Todd, has organised this work for the past five years and discussed the results (see *NATURE*, May 3, 1930, p. 673). There is no very marked difference between conditions in different sections of the track, and everything points to equal chances at any station that may be selected.

No details are available of the plans of the various American eclipse parties which will be distributed through Vermont, New Hampshire, and Maine, but it is understood that Prof. S. A. Mitchell, of the Leander McCormick Observatory, will be stationed at Magog in southern Quebec. Three British expeditions are being sent to Canada under the auspices of the Joint Permanent Eclipse Committee of the Royal Society and the Royal Astronomical Society. Dr. J. Jackson and Mr. C. R. Davidson, from the Royal Observatory, Greenwich, will join Prof. Meldrum Stewart, of the Dominion Observatory, Ottawa, at Parent, a station on the Canadian National Railway north of the St. Lawrence River; Prof. H. Dingle, of the Imperial College of Science, will work at the Macdonald Physics Laboratory of McGill University in Montreal, on the edge of the eclipse belt; Prof. F. J. M. Stratton, Dr. R. O. Redman, and Mr. C. P. Butler, of the Solar Physics Observatory, Cambridge, with Prof. J. A. Carroll, of the University of Aberdeen, will be stationed at Magog in southern Quebec. They will be joined by Dr. J. S. Foster and Miss Douglass (and possibly several others) from McGill University, Prof. G. H. Henderson, of Dalhousie University, Dr. C. S. Beals, of the Victoria Observatory, and by several of those who are making the preliminary tour of Canadian and American observatories, organised by the assistant secretary of the Royal Astronomical Society; among others, the master of Caius, Dr. F. W. Aston, Dr. W. Hall, Dr. Haughton, Dr. H. Knox-Shaw, Dr. W. J. S. Lockyer, Dr. W. H. Stevenson, and Mr. A. D. Thackeray are expected to join the Cambridge party, and to help in the observations of the eclipse.

The programmes of the three British expeditions are as follows:

(1) The Greenwich expedition will take photographs of the corona with the 6-inch lens of 45 ft. focal length lent by Mr. Worthington for use at the eclipse at Alor Star in 1929. Objective prism spectra of the chromosphere and of the corona will be secured with a telescope of 7 in. aperture and 21 ft. focal length, with a 45° prism placed before the object-glass. The range of spectrum on a curved film will be from  $\lambda 3600$  to  $\lambda 6800$ . A fourth attempt will be made—the previous attempts having been frustrated by bad weather conditions—to obtain a comparison of the intensities of the *H* and *K* lines with those of the  $\text{Ca}^+$  triplet at  $\lambda 8600$  at different heights in the chromosphere. The remaining instrument is to be a grating slit spectrograph, which will be used for a study of the spectrum of the chromosphere and corona from  $\lambda 4500$  to  $\lambda 9000$ —the dispersion will be 17 Å. to the mm. All the four instruments will be fed with beams from celostats.

(2) Prof. Dingle's objects at this eclipse are to study the bright line spectrum at the cusp with high dispersion, and the Fraunhofer spectrum at



the limb just before and just after totality. Prof. H. F. Newall and Prof. A. Fowler, from observations made in England at the eclipse of April 1912, showed what interesting results might be expected from observations of a nearly total eclipse or from observations at the edge of the belt of totality, confirming suggestions made by Mr. Evershed in 1903. Hitherto bad weather has frustrated all attempts to carry out such investigations, while the interest of the problem has only been increased by the study of spectral changes in wave-length at the sun's limb. Prof. Dingle is using a Littrow spectrograph with two  $60^\circ$  prisms backed by a plane Rowland grating (used in the first order), working with a 4 in. lens of 16 ft. focal length. The region of the spectrum to be examined will be  $\lambda\lambda 4200-4400$ , with an average dispersion of 0.6 A. per mm. The limb will be studied for about five minutes each side of totality, and the cusp for about half an hour beforehand and half an hour afterwards.

(3) The programme of the Cambridge expedition will be mainly a repetition of investigations prevented by clouds at the eclipses of 1927, 1929, in Norway, Siam, and Kedah. The polarisation of the corona will be studied by a double tube camera of 54 in. focal length, with a large nicol prism placed in front of one tube. The dependence of the polarisation on wave-length will be examined by a double-image one-prism spectrograph fed by an image-forming lens of 2 ft. focal length. The Hills quartz spectrograph will be used for a study of the ultra-violet spectrum of the chromosphere, with especial reference to the intensities at varying solar levels of the lines of the Balmer series and of the continuous spectrum at the head of the series. In the case of the corona, the chief study with this instrument will be the distribution of the radiation of the continuous spectrum. The results obtained with this spectrograph will be checked by a spectrum of different dispersion obtained from a 6 in. concave Rowland grating, used in the stigmatic

position with a reflecting collimator. The range of spectrum to be covered will be  $\lambda\lambda 3200-4600$ .

The continuous spectrum of the outer corona will be studied with a 19-inch Common mirror of 50 in. focal length and a one-prism spectrograph with Aldis collimator and camera lenses of aperture 4 in. working at  $f/3$ . An objective interferometer will be used to study the wave-length of the green coronal line and movements in the coronal gases, in particular the rotation of the corona. The latter problem will also be attacked with the 4-prism spectrograph mounted on a polar-heliostat and used for that purpose by Prof. Newall in Sumatra in 1901.

A moving plate objective grating spectrograph with a slit in the focal plane radial to the sun's limb will be used for spectrophotometric study of the flash spectrum at different levels over the range  $\lambda\lambda 4100-4700$ . The grating will be a 6 in. plane grating fed by a Cooke photovisual lens of 6 in. aperture and 20 ft. focal length. A second objective grating will, it is hoped, be used for plates stained with xenocyanin and sensitive over the range  $\lambda\lambda 8600-10600$ , while a slit grating spectrograph will be used with plates stained with mesocyanin for the region centred at  $\lambda 8600$ . The various instruments are being fed with beams from two cœlostats and Sir Francis McClean's 21-in. siderostat. The Hills siderostat will be used by the observers from McGill University for a grating spectrograph of high light-gathering power.

Finally, the 8 in. cœlostat of the Royal Irish Academy will feed the 4 in. lens of 19 ft. focal length lent by the same body, to secure direct photographs of the corona, and the 4 in. direct-vision prism of the Royal Observatory, Edinburgh, will be placed in front of the lens at the beginning and end of totality for objective-prism spectra of the flash, while Dr. Lockyer will take direct photographs of the corona with a camera lens of 4 in. aperture and 28 in. focal length.

### The Lucasian Professors at Cambridge

THE Lucasian professorship of mathematics at the University of Cambridge, from which Sir Joseph Larmor retires at the end of September after holding it with distinction since 1903, is the third oldest chair of mathematics in Great Britain. The chair of geometry at Gresham College, London, was founded in 1596, the Savilian professorship of geometry at Oxford dates from 1619, while the Lucasian chair was founded in 1663, the same year in which the Royal Society received its second charter. It was founded through a bequest by Henry Lucas, who had studied at St. John's College, Cambridge, and after having served as secretary to the Earl of Holland, chancellor of the University, was elected to represent the University in Parliament. In his will he directed his executors to purchase land to the value of £100 a year to provide for the stipend of a professor of mathematics. Lucas died in London on July 22, 1663, and that same year the deeply learned and much travelled

Rev. Isaac Barrow (1630-1677), already professor of Greek and Gresham professor of geometry, and afterwards master of Trinity, was elected first Lucasian professor.

Barrow took his duties seriously from the first, and immediately after his appointment, "the better to secure the End of so noble and useful a Foundation, he took Care that himself and his Successors should be obliged to leave, yearly, to the University ten written lectures". His opening oration was delivered on March 14, 1664, and the lectures he gave during the next five years formed the substance of his "*Lectiones Opticæ et Geometricæ*", 1669, and his "*Lectiones Mathematicæ*", published six years after his death. But divinity had stronger claims for Barrow than even mathematics, and having already seen and acknowledged the superior abilities of his pupil Newton, in 1669 he resigned in his favour.

Newton was twenty-seven years of age when



he became Lucasian professor, and he held the chair for thirty-four years, until in 1703 he became president of the Royal Society. It is unnecessary to say that it was during his years at Cambridge that all his greatest discoveries were made and his greatest works published. Some of his discoveries were first made known through his lectures. "During his tenure of the professorship", says Ball, "it was Newton's practice to lecture publicly once a week, for from half an hour to an hour at a time, in one term of each year, probably dictating his lectures as rapidly as they could be taken down. . . . He never repeated a course, which usually consisted of nine or ten lectures. . . . The manuscripts of his lectures for seventeen out of the first eighteen years of his tenure are extant."

Newton was elected Parliamentary representative for the University of Cambridge in 1688, and after that lectured but little. In 1699 he made Whiston his deputy, and four years later Whiston was appointed to the chair.

With Newton's resignation and his removal to London, mathematical studies in Cambridge suffered a loss which the University felt for very many years. "Newton's burst of illumination", wrote the late Prof. H. H. Turner, "was followed by a dark century in Cambridge mathematics which is painful to contemplate." Yet in spite of this, the chair on which Newton had shed so much lustre continued to be held by men who at least had a deep reverence for his character and his work, and each of whom in his turn did something to advance the progress of science.

William Whiston (1667-1752), the first of the five occupants of the Lucasian chair during the eighteenth century, had graduated at Clare Hall and at the time of his appointment was rector of Lowestoft. Something of his activities can be gleaned from his own whimsical memoirs. As Lucasian professor he was instrumental in getting Roger Cotes (1682-1716) made the first Plumian professor of astronomy, declaring that in mathematics he "was but a child to Mr. Cotes", and in 1707 with Cotes he began a course of philosophical experiments. But Whiston's period of office was cut short through his religious views being held obnoxious by the authorities, and on Oct. 30, 1710, he was expelled from the University. The loss of £100 a year was, no doubt, felt severely, but thanks to Addison and Steele he was able to give astronomical lectures "at Mr. Button's Coffee house, near Covent Garden, to the agreeable entertainment of a good number of curious persons and the procuring me and my family some comfortable support under my banishment".

The choice of a successor to Whiston fell on Nicolas Saunderson (1682-1739), who through small-pox had been blind from the age of one, but who was described by one of his students as "a professor who had not the use of his own eyes, but taught others to use theirs". He was one of the earliest exponents of the Newtonian philosophy and, it is said, spent seven or eight hours a day in teaching. His "Elements of Algebra", compiled

during the last six years of his life, has been referred to as "a model of careful exposition". John Colson (1680-1760), who succeeded Saunderson, was already fifty-nine when appointed to the chair; he had had as a competitor Demoivre, the intimate of Newton, who, however, was seventy-two, "almost as much fit for his coffin; he was a mere skeleton, nothing but skin and bone". In 1736, Colson had published a work on fluxions, and during the twenty-one years he held the Lucasian professorship he translated Nollet's work on experimental philosophy and Maria Gaetana Agnesi's "Istituzioni analitiche", but, said Cole, the Cambridge antiquarian, "the University was much disappointed in its expectations of a professor that was to give credit to it by his lectures".

When Colson died in 1760 at the age of eighty years, the example of Barrow and Newton was no longer followed, and neither Edward Waring (1734-1798) nor Isaac Milner (1751-1820), his successors, gave lectures or enriched the University with their writings. Waring was only twenty-five years of age when given the Lucasian chair. Afterwards he qualified in medicine and obtained a seat on the Board of Longitude, but his European fame was due to his "Miscellanea Analytica" and his contributions to the *Philosophical Transactions* of the Royal Society, for which in 1784 he was awarded the Copley Medal. Milner was both man of science and a divine, and became president of Queens' College, Cambridge, and Dean of Carlisle. Born in 1751, he was senior wrangler and Smith's prizeman in 1774, studied chemistry under Watson, and in 1783 became the first Jacksonian professor of natural philosophy. Resigning this post in 1792, "henceforth", it is said, "he gave up science in general except as an amusement". He had written works on motion, equations, the precession of the equinoxes, and natural philosophy, but after being appointed to the Lucasian chair on Waring's death in 1798, he contented himself with carrying out the minor duties of the post without doing any teaching.

It was while Milner held the chair that the writings and methods of the continental mathematicians began to be studied seriously at Cambridge, and with this came the reformation of mathematical studies not only in the University but also in the whole country. Foremost among the reformers was Robert Woodhouse (1773-1827), fellow of Caius College, who in 1803 published his "Principles of Analytical Calculations", and was chosen as Milner's successor in 1820. He held the chair for only two years, and within the next few years the chair was held by three different incumbents. From 1822 to 1826 it was occupied by Thomas Turton (1780-1864), a senior wrangler, who became professor of divinity, Bishop of Ely, and Dean of Westminster; during 1826-28 it was held by George Biddell Airy (1801-92), who vacated it to become Plumian professor of astronomy, a post he held until he was made Astronomer Royal; and in 1828 it was given to Charles Babbage (1792-1871).

With Herschel and Peacock, Babbage in 1813



had founded the Analytical Society at Cambridge, and in 1816 had translated Lacroix's "Traité élémentaire du calcul différentiel et du calcul intégral", thus ably furthering the movement begun by Woodhouse. It was the combined efforts of these four which paved the way for what has been called "the golden age of mathematics and physics at Cambridge". But, by 1828, Babbage was too deeply engrossed in his calculating machine to devote much time to the duties of a professor, and though he was sensible of the honour conferred upon him, "the only honour", he wrote, "I ever received in my own country", he contented himself with performing his duties as an examiner. As such he exerted considerable influence, and among the winners of Smith's prize examined by him was William Cavendish, afterwards Duke of Devonshire, chancellor of the University, and the founder of the Cavendish Laboratory.

Babbage held office for eleven years, when he was succeeded by Dr. Joshua King (1798-1857), who from 1832 until 1857 was president of Queens' College. By this time the new school of Cambridge mathematicians included many who were destined to become famous, and during the ten years Dr. King held the Lucasian chair, among the names of the senior wranglers and Smith's prize-winners were those of Ellis, Cayley, Adams, Todhunter, Kelvin, and Stokes, the last of whom in 1849, at the age of thirty, was chosen to succeed Dr. King. On the work of Sir George Gabriel Stokes (1819-1903), the immediate predecessor of Sir Joseph Larmor, it is unnecessary to dwell. During the fifty-four years of his tenure of the chair, he re-established the fame of the office once held by Barrow and Newton, and on the occasion of his scientific jubilee he was hailed as "the Newton of the nineteenth century".

### Centenary of The British Medical Association\*

THE British Medical Association, which is celebrating the centenary of its foundation at its annual meetings in London on July 21-29, is fortunate in having secured a chronicler worthy of the occasion in the person of Mr. Muirhead Little, who is not only a distinguished orthopaedic surgeon but is also a well-known and accomplished writer on medical history. His work contains a very full and well-written description of the history of the British Medical Association and its multifarious activities during the last hundred years, together with an account of the leading personalities connected therewith.

Mr. Muirhead Little begins with a sketch of the medical profession in 1832, a year memorable not only for the foundation of the Provincial Medical and Surgical Association, as the British Medical Association was first called, but also for the first epidemic of Asiatic cholera in England, the Anatomy Act, and the First Reform Bill. In the absence of statistical information, the sciences of epidemiology and public health did not then exist, and indeed, until the passing of the Registration Act in 1836, there were no national statistics to justify any trustworthy conclusions. The profession as a whole was not organised, for there was no hard and fast line between the qualified and unqualified practitioner, and it was not until the Medical Act of 1858, which was almost entirely the work of the Association, that the great body of practitioners first received official recognition of their existence, and their importance to the State was acknowledged. The average medical practitioner in 1832 was a man of little culture or education, and there seems to have been ample justification for the unattractive picture of the contemporary medical student drawn by Dickens in "The Pickwick Papers" and by Thackeray in "Pendennis".

Dr. Charles Hastings, on the other hand, the

founder of the Association, who was knighted in 1850, was a man of considerable abilities, some originality of mind, and great industry. At the early age of thirty-four years, he became the leading physician in Worcester, as well as being an eminent naturalist. In 1828 he founded the *Midland Medical and Surgical Reporter and Topographical and Statistical Journal*, which came to an end in 1832, being succeeded in 1840 by the *Provincial Medical and Surgical Journal*, the organ of the Association, which during the period 1832-40 had published only an annual volume of *Transactions*. It was not until 1856 that the Association, which had hitherto been known as the Provincial Medical and Surgical Association, received its present name, while its organ, which had been renamed the *Association Medical Journal* in 1853, was given its present title of the *British Medical Journal* at the beginning of 1857.

The scientific work of the Association, of which Mr. Muirhead Little gives a very full description, has formed an important part of its activities since its foundation. This work includes the discussion of scientific topics distributed over fourteen to twenty sections at its annual meetings; the dissemination of information in the *British Medical Journal* and the special journals, the *Archives of Disease in Childhood* and the *Journal of Neurology and Psychopathology*; the appointment from time to time of special committees to consider particular aspects of medical science; the arrangement of collective investigations throughout the profession; the award of scholarships, grants, and prizes; and the organisation of lectures, both among members of the profession and the lay public. Moreover, the local units, of which there are several hundreds, devote a great part of their energy to the consideration of scientific questions.

The work carried out by special scientific committees of the Association during the last fifty years includes reports on chloroform, the action of various drugs, the prevention of ophthalmia neonatorum,

\* History of the British Medical Association, 1832-1932. Compiled by Ernest Muirhead Little. Pp. viii+342+29 plates. (London: British Medical Association, 1932.)



the early recognition of uterine cancer, the treatment of fractures, the question of rheumatic heart disease in childhood, maternity and child welfare work, tests for drunkenness, the causation of puerperal morbidity and mortality, psychoanalysis and mental deficiency. The subjects chosen for collective investigation have been chloroform, pneumonia, chorea, rheumatism, diphtheria, puerperal fever, the incidence of cancer and the history of its after-treatment.

As regards the work of the local units, it is noteworthy that whereas previously the formulation of a medico-political policy occupied most of their attention, of recent years they have devoted most of their energies to the consideration of scientific and clinical matters.

An important part in the scientific work of the Association is played by the library originally started by Mr. Ernest Hart, a former editor of the *British Medical Journal*, who made a nucleus collection of books from those sent him for review. Until fourteen years ago the library was available only for reference purposes, but since 1918 members have been allowed to borrow books and periodicals.

Although the account of the work of the Association in relation to medical reform, contract practice, and national health insurance may appear somewhat wearisome to the profane and even to some members of the profession not engaged in general practice, it should be borne in mind that it was mainly by the agency of the Association that not only the status and dignity of the profession in

Great Britain were established, but also the interests of the general public were safeguarded.

Among other matters with which Mr. Muirhead Little deals are the work done by the Association on behalf of its members in the Services; its organisation of the profession in the War of 1914-18; its campaign against quackery, in which the publication of "Secret Remedies" and "More Secret Remedies" with their analyses of expensive but worthless nostrums was an important event; schemes of medical benevolence, and medical ethics. Short biographical sketches are included of some of those who devoted their energies to the growth and welfare of the Association, among the most notable being the two eminent surgeons, Sir Victor Horsley and Mr. Edmund Owen; the last two editors of the *British Medical Journal*, Mr. Ernest Hart and Sir Dawson Williams; Dr. Elizabeth Garrett Anderson, who took a large part in the admission of women to membership of the Association, and Prof. W. E. Dixon, the well-known pharmacologist, whose death we have recently had to deplore.

Mr. Muirhead Little has also included numerous excellent portraits of those who have deserved well of the Association during the last hundred years, including two of the founder, and views of the different buildings occupied by the Association in London and elsewhere. A list of the places of the annual meetings of the Association, with the names of the presidents and other principal officers, forms a useful appendix.

## Obituary

BARON G. J. DE FEJÉRVÁRY

THE death at Budapest of Baron de Fejérváry from heart-failure on June 2, after an operation for gall-stones on May 28, too early deprives zoological science of a worker rich in both accomplishment and promise, and his colleagues of a charming and helpful friend. He is mourned above all by a widow and two young children.

Geza Julius Fejérváry de Komlós-Keresztes was born at Budapest on June 25, 1894. On the completion of his university course, he entered the Hungarian National Museum in October 1916, and took up the study of reptiles and amphibians; in 1923 he was made curator of the herpetological section in the department of zoology, a post which he held until his death. Taking the degree of Ph.D. at Budapest in 1917, he became *privatdozent* for zoogeography at the R. Elizabeth University, Pécs, in 1921, and in February 1930 was appointed professor extraordinarius of zoology in that University. When the International Congress of Zoologists was held at Budapest in 1927, he served as recording secretary and afterwards edited its proceedings, tasks for which he was eminently fitted by his knowledge of the world, his courteous manners, and his facility in languages, which extended beyond the five world-tongues to Russian, Latin, and Greek. His own writings appeared in

Hungarian, German, English, French, and Swiss publications.

While based naturally on his herpetological studies, Fejérváry's contributions to science, with their clearness and precision of statement, gave evidence of a wide philosophical outlook and a keen insight. He was interested in various problems of evolution and particularly in the question of its reversibility; thus in 1920 he published "Observations sur la loi de Dollo, . . ." (*Bull. Soc. Vaud. Sci. Nat.*); in 1924, "Remarks on Nopcsa's paper on Reversible and Irreversible Evolution" (*Arch. Naturgesch.*); in 1925, "Über Erscheinungen und Prinzipien der Reversibilität, . . ." (*Paläont. Z.*); also, in 1929, he criticised Sir Arthur Keith's presidential address to the British Association (*Biol. generalis*). Among the more important of his systematic and morphological papers were: "Contributions to a monograph on fossil Varanidæ and Megalanidæ" (*Ann. Mus. Nat. Hungar.*, 16; 1918), "Die phyletische Bedeutung des Praehallux und vergleichend-osteologische Notizen über den Anuren-Tarsus" (*op. cit.*, 22; 1925), ". . . on the primary and secondary dermal bones of the skull" (*Arch. Naturgesch.*, 90, A; 1924).

In 1928, Fejérváry organised an expedition to Malta and the neighbouring islands to study questions of zoogeography; his report on this investigation was left incomplete, as also was an



extensive work on general zoology. It is to be hoped that some of the large mass of notes that remain may be in a state capable of publication.

#### BARON ERLAND NORDENSKIÖLD

WE regret to record the death of Baron Nils Erland Nordenskiöld, the Swedish ethnologist and explorer, which took place at Göteborg on July 5. Baron Erland Nordenskiöld, who was fifty-five years of age, was a member of a family already distinguished in the annals of exploration. He was the son of Baron Adolf Nordenskiöld, who discovered the North-East Passage, and a cousin of Prof. Otto Nordenskiöld, who led the Swedish Antarctic Expedition of 1902-3. He himself specialised in the investigation of the aboriginal cultures of America, and had travelled extensively among the native tribes, especially the less well-known, of both Central and South America, upon whom he had for long been recognised as the first authority.

The results of Nordenskiöld's investigations were embodied mainly in a series of "Comparative Ethnographic Studies", published in English, of which the first nine volumes, some in two parts, had appeared and others were in course of preparation. Of these, the most important was "The Copper and Bronze Ages in South America". Yet in dealing with the origin of American cultures and the problems of diffusion, the essential quality of his mind and its strict insistence on logical proof based upon a meticulous examination of the detailed evidence were best seen in his later publications, such as vols. 8 and 9 in the series, "Modifications of Indian Culture through Inventions and Loans" and "Origin of the Indian Civilizations of South America", the latter published in February last, in which he effectually vindicated the indigenous origin of certain important elements in Indian culture. He dealt with other aspects of the same problem in the Huxley Memorial Lecture delivered to the Royal Anthropological Institute in 1929, for which he received the Institute's Huxley Memorial Medal.

#### MR. G. H. HALLAM

THE death is announced of Mr. George Hanley Hallam, which took place at Tivoli on July 12. Mr. Hallam, who was in his eighty-sixth year, was a brilliant classical scholar. He was educated at Shrewsbury School and St. John's College, Cambridge, where he was bracketed Senior Classic in 1869, was Craven scholar, and won the Browne medals for a Greek ode twice and for a Latin ode. He was thereupon elected to a fellowship at St. John's College, and was appointed a master at Harrow in the following year. He retired in 1906.

Mr. Hallam had lived in Italy for many years and was keenly interested in the work of the British Schools of Archaeology in Athens and in

Rome, keeping in close touch with the latter through his friendship with the former director, the late Dr. Thomas Ashby, and the present director, Mr. Ian Richmond. He himself had a profound knowledge of the antiquities and topography of the Roman Campagna, and was a contributor to the *Journal of Roman Studies*. His most recent communication to that journal dealt with the tomb of a vestal virgin discovered at Tivoli in 1930; while another discovery, also at Tivoli, a fresco found in an underground tomb, was made the subject of interpretation in a contribution dealing with the cult of Hercules. Mr. Hallam's own residence at Tivoli was itself of considerable interest to archaeologists, for it was a convent erected on the site of a Roman villa, reputed to be the actual villa which was a gift from Mæcenas to the poet Horace. On excavation, however, it proved to be more extensive than had been thought, and is now generally held to be the villa of Mæcenas himself.

Mr. Hallam's continued interest in Harrow and his belief in the educative value of a knowledge of Italian and Roman culture were recently shown by the foundation of an annual prize to enable an Harrovian to spend a few weeks in Italy.

#### MR. THOMAS BAT'A

THOMAS BAT'A, the distinguished and enlightened Czechoslovak manufacturer who met a tragic death in a flying disaster on July 12, just as he was leaving his aerodrome at Otrokovice in Moravia on a journey to Germany and England, was a leading Central European personality. From humble beginnings he built up one of the largest and most progressive leather goods concerns in the world. Through hard work, skill, and a thorough knowledge of all the details of the industry, he evolved the model establishment at Zlín, which has grown tenfold since the War, in order to accommodate his ever expanding undertakings. He was also responsible for the new educational buildings for the young and adult employees, and also for the up-to-date hospital and clinics which were at the disposal of townfolk and others. Whilst he expected his workers to give their best service, he studied their interest in every way. He limited their duties to five days a week and encouraged them to improve their knowledge in their leisure, and anyone who showed ability or initiative obtained rapid promotion. He believed in strict discipline, but never expected anything from a worker that he was not prepared to accept himself.

Although Mr. Bat'a's energies seemed to be wholly devoted to industry, he found time for cultural pursuits and was an expert linguist. Czechoslovak educational and scientific institutes frequently received handsome donations from Mr. Bat'a, and he provided funds for the excavations in Moravia which, a few years ago, revealed relics of a prehistoric settlement. Mr. Bat'a was fifty-six years of age.



## News and Views

## Jean Antoine Claude Chaptal, 1756-1832

WHEN on July 30, 1832—a century ago—Chaptal died at the age of seventy-six years, France lost a man of science and statesman who had, perhaps, done more to further the progress of the arts, industries, and manufactures of the country than any of his contemporaries. The son of a pharmacist, he was trained as a doctor, but it was chemistry which absorbed his attention, and it was as a chemical manufacturer that he first made a reputation. Born on June 4, 1756, at Nogaret, in the Department of Lozère, he graduated at Montpellier in 1777, and four years later was appointed to a newly founded chair of chemistry at the University there. With the fortune left by an uncle he established works for the manufacture of acids, alum, white-lead, and other commodities, and his success was such that in 1793 the Committee of Public Safety employed him with Berthollet and Monge to superintend the manufacture of munitions. Under Chaptal, the output of the Grenelle powder factory was raised to  $1\frac{1}{2}$  tons a day.

CHAPTAL became one of the first professors at the *École Polytechnique*, reorganised the Paris school of medicine, and after being made a Councillor of State, became Minister of the Interior. As such he energetically promoted trade schools, industrial exhibitions and chambers of commerce, and the construction of roads and improvements in public health. It was to Chaptal that Napoleon one day said, "I intend to make Paris the most beautiful capital in the world", and it was at Chaptal's suggestion that a canal was cut for bringing water to Paris from the River Ourcq. Though his loyalty to Napoleon afterwards led to his name being removed from the list of peers, he continued to work for the common good until loss of fortune and old age overtook him. Among his many books, that on chemistry applied to the arts, published in 1806, was translated into most of the languages of Europe, and long remained a valuable work of reference. His tomb is in the *Père Lachaise*, where so many eminent men of science are buried. He was a member of the *Institut de France* from 1816 onwards, and his *éloge* was delivered before the Academy of Sciences by Thenard.

## Centenary of the British Medical Association

THE annual general meeting of the British Medical Association, which marks the official opening of the centenary meeting of the Association in London, will take place on July 23 at the Association's house in Tavistock Square, London. On July 24 a pilgrimage to Worcester has been arranged. In this city, in 1832, the project for an organised alliance of medical practitioners first took shape, under the guidance of Charles Hastings, who was born at Ludlow on Jan. 11, 1794. In the morning, Dr. W. G. Willoughby will unveil a plaque on a house in which Sir Charles Hastings formerly lived, the Mayor of Worcester assisting at the ceremony. An original portrait of Hastings (1839),

by G. F. Faulkner, from the Board Room of the City Infirmary, will be handed over to the Association. From the house there will be a robed procession to the Cathedral to participate in a commemoration service, at which the sermon will be preached by Dr. E. W. Barnes, Bishop of Birmingham. A memorial window will be unveiled by the Right Hon. Lord Dawson of Penn. Lord Dawson will deliver his presidential address on July 26, at Queen's Hall, Langham Place, London, W.1. Next day the Lord Mayor and Corporation of London will hold a civic reception at Guildhall. A centenary dinner will take place at the Albert Hall, on July 28; Lord Dawson will preside and H.R.H. the Prince of Wales will be the principal guest. The clinical and scientific work of the meeting will be divided among twenty-four sections. In that devoted to the history of medicine (president, Dr. Charles Singer), in a discussion on various aspects of British medicine during the past hundred years, Sir Edward Sharpey-Schafer, the veteran physiologist, will open a discussion on the physiology of the period, while Dr. P. H. Manson-Bahr will open another dealing with tropical medicine. Personal letters and relics of British pioneers of tropical medicine will be shown by Dr. Manson-Bahr. A large number of Dominion and foreign guests is attending the centenary meeting.

## Vienna Academy of Sciences

AT meetings of the Vienna Academy of Sciences held on May 30 and 31, Dr. Hans Molisch, emeritus professor of plant anatomy and physiology in the University of Vienna, was elected a vice-president, and Dr. Anton Eiselsberg, emeritus professor of surgery in the University of Vienna, was made an honorary member of the Academy. In addition to various Austrian members, the following foreign elections were made: Dr. Franz Kossmat, professor of geology in the University of Leipzig; Dr. E. B. Wilson, professor of biology at Columbia University; Dr. Michael Rostovtzeff, professor of ancient history and classical archaeology at Yale University; Dr. Hugo Obermaier, professor of ancient history at the University of Madrid, and Dr. Norbert Krebs, professor of geography at the University of Berlin, to be corresponding foreign members; and Dr. Friedrich Meinecke, professor of history at the University of Berlin; Dr. Eduard Schwartz, professor of classical philology at the University of Munich, and Dr. Jakob Wackernagel, professor of classical philology at the University of Basle, to be honorary foreign members. The following awards of prizes were also announced: The Ignaz L. Lieben prize, jointly to Dr. Georg Koller for his work on the acids of lichens and Dr. Alois Zincke for his researches on perylene; the Haitinger prize to Dr. Otto Redlich for his investigations on the constitution of water and aqueous solutions; the Hansgiring prize to Dr. Hans Krumpolz for his determinations of the positions of double stars and comets; the Rudolf Wegscheider prize to Dr. Fritz Wessely for his work on glucosides, flavones, and natural coumarins;



and the Fritz Pregl prize to Dr. Moriz Niessner for his micro-analytical investigations on alloys.

#### Imperial Academy of Japan

At a meeting of the Imperial Academy of Japan on May 10, annual medals and prizes were awarded to the following: Kyosuke Kindaichi for his studies on the Ainu epic "Yukar"; Kiyoo Wadati for his investigations on deep focus earthquakes; Ikutaro Hirai for his work on the cause of the meningitis-like disease frequently observed among Japanese suckling children; Tatuo Aida for genetical studies on the body colour of *Aplocheilus latipes*; Motojiro Matuyama for his geophysical investigations on gravity anomalies and magnetism of basaltic rocks; Shintaro Uda for research on ultra-short electro-magnetic waves. The Mendenhall Memorial Prize was awarded to Seishi Kikuchi for his studies on the diffraction of electron rays through thin mica plates.

#### Visceral Sense Organs

THE fourth Victor Horsley Memorial Lecture was delivered on July 20 in the Medical School of University College Hospital by Prof. E. D. Adrian, who discussed the "Visceral Sense Organs". The action of the sense organs in the lungs and in the great blood vessels can be studied by recording the nervous messages which they send to the brain stem, a method made possible by the use of valve amplification to magnify the electric changes in the sensory nerve fibres. The normal sensory discharges in the vagus and carotid sinus nerves were demonstrated by gramophone records in which the nerve impulses were converted into sounds varying in pitch with the frequency of the discharge. The sense organs in the lung resemble the muscle spindles, giving a rhythmic discharge of impulses so long as the tissues are stretched. In normal breathing the discharge only occurs at inspiration, but there are some endings which are excited by collapse of the lung, and these may be the cause of rapid breathing in pathological conditions. The sense organs in the aorta and sinus caroticus behave like those in the lung and give a faithful signal of the blood pressure. Both systems act as governors to keep the respiratory and vascular systems working within safe limits, and, as with all sense organs, their effect depends upon messages which are graded by changes in impulse frequency and in the number of units in action.

#### New Motor-Boat Record

ON July 18, Mr. Kaye Don, piloting Lord Wakefield's motor-boat *Miss England III*, twice broke the previous world's speed record for motor-boats. In his first attempt Mr. Don covered the measured mile in 35.4 sec. and 35.2 sec. (117.43 miles an hour), and in the second attempt his times were 34.4 sec. and 34.8 sec. (119.81 miles an hour). The previous record was set up by Mr. Garfield A. Wood, who achieved 111.71 miles an hour. Sir Henry Segrave's record on Lake Windermere when he was killed in 1930 was 98.96 miles an hour. *Miss England III* was designed and built by Messrs. John Thornycroft and Co., Ltd., at Hampton-on-Thames. It is a single-step vessel and

is fitted with two propellers. The boat is fitted with two Schneider Trophy type supercharged Rolls-Royce engines, developing 2200 h.p. and consuming about five gallons of fuel a minute. The length of the hull of the boat is 35 ft., and the maximum beam is 9 ft. 6 in.

#### High Speed and Flight

A SERIES of comprehensive experiments upon the possibilities of high-speed flight has been carried out in the Langley Field High Speed Wind Tunnel of the National Advisory Committee for Aeronautics in the U.S.A. Air speeds up to 800 miles an hour, which is faster than the speed of sound, have been reached. It has been definitely established that with the present conventional form of wing section there is so great an increase in drag at about 600 miles an hour that it will be impossible to carry sufficient power to overcome it, assuming the present methods of conversion of fuel to air thrust. This is confirmed by experience with high-speed propellers, the blade tips of which may easily be travelling at a peripheral speed approaching the velocity of sound. In such cases their outer portions may be actually exerting a negative effect. The delicate mechanisms of the human body do not appear to be susceptible to steady high speeds, but they react to accelerations at much lower figures. This case arises often during flight, when every turn is an angular acceleration. It has been established that the maximum speed that the human body can stand during an average sharp turn is about 300 miles per hour. The present speed record for flight in a straight line is an average 408.8 miles an hour, although speeds up to 415.2 miles an hour for short periods have been recorded.

#### Constitutional Tendencies in the Orient

AT a time when a bold experiment in the method of governing India is to be made and the details of the new federal constitution are being elaborated, a thoughtful paper by Sir Arnold Wilson, in the *English Review* for May, on the relative merits of government by means of an executive responsible to an elected body and by bureaucratic methods, should be read. As is well known, the application of the democratic principle to Eastern conditions is by no means new. It has already been attempted, not only in the management of local affairs in India itself, but also in a wider field in other countries, such as Turkey, Egypt, Persia, Iraq, Cyprus, Ceylon, and the Dutch East Indies. The results so far obtained are described in detail in the paper under review. They make very melancholy reading. In these very different localities, the introduction of the electoral principle has almost without exception either ended in complete failure or has been disappointing. On the other hand, in the overseas possessions of France and Italy, where the system adopted is a benevolent autocracy, the people are said to be contented and there is little or no unrest of the type now so common throughout India.

#### The Indian Problem

It is difficult to resist the conclusion that had the Indian problem been approached at the very outset by the methods familiar to the man of science, one of



the first tasks would have been a careful study of the literature of the subject and particularly of the results already obtained from the experiments in the art of ruling which have been made in other countries. This procedure, however, does not appear to have been followed. Even the Commission which recently worked under the able guidance of Sir John Simon was not empowered to study constitutional developments in other Asiatic countries, otherwise "they might well have hesitated before recommending even a moderate extension of the franchise". The matter, however, has gone too far for such studies to be undertaken. The new constitution will shortly be established: the results will soon be clear to all. If it succeeds, all criticism will be laid to rest by the one unanswerable argument—success. If it fails, a new Indian Civil Service, in which it is hoped that science will take its proper place, will have to be re-established.

#### A High-Efficiency Gaseous Lamp

MESSRS. Philips Lamps, Ltd., are introducing a new lamp which has an efficiency of about eight times that of a gas-filled lamp taking the same power. A description of the lamp is given in the *Electrical Times* for July 14. In the new lamp an electric discharge passes through a rare gas 'filling' with a small quantity of metallic sodium. There is an oxide cathode with one or two anodes. The bulb of the lamp is in the shape of a cylinder, which has to be heated up to a certain temperature sufficient to vaporise the sodium. The lamp is enclosed in a second cylinder, which accelerates the heating and keeps the temperature constant. The discharge and consequently the emission of light depend mainly on the sodium vapour. The colour of the light is yellow and practically monochromatic. This colour is favourable to good visibility and therefore the lamp is very suitable for street lighting. A photograph taken at night is shown of a long length of road in Holland illuminated by the new gaseous lamps. It has been noticed that drivers of fast cars when entering the newly lighted part of the road switched off their headlights unasked. Hence there is no 'dazzle', the elimination of which is one of the greatest problems of night driving. The candle-power of the lamps is 500-600 for the smallest size made, which take 100 watts. These lamps will be useful where colour is of minor importance. For domestic use a whiter light is more desirable.

#### Modern Developments in Precision Clocks

THE most accurate timekeepers of to-day are divided into two classes, depending on whether the restoring force of the oscillator is gravity, as in pendulum clocks, or elasticity, as in quartz crystal oscillators. In a monograph by A. L. Loomis and W. A. Marrison on precision clocks, published in the *Transactions of the American Institute of Electrical Engineers*, an account is given of the performance of a set of 100,000-cycle quartz oscillators built by the Bell Telephone Laboratories for use as a primary frequency standard. The frequency of quartz oscillators is practically independent of the amplitude. They are not affected by gravity or magnetic fields and can be easily shielded from electrostatic fields. They are practically unaffected by heavy traffic in

neighbouring roads or by the vibrations near earthquake zones. A crystal clock standard is more costly than a pendulum clock of the highest precision, but it can be used for many purposes. For example, an absolute comparison of crystal clocks can be made with an error of less than one hundred-thousandth part of a second, and can be maintained continuously. For short time comparisons an inaccuracy not greater than 1 in  $10^{10}$  has been obtained. The high accuracy of comparison is due chiefly to the fact that the number of vibrations is 200,000 times greater than with a 'seconds' pendulum. A comparison made of the data obtained by observing the difference in the rates of a crystal clock and three pendulum clocks revealed for the first time a lunar day variation. This is due to the fact that the crystal does not respond to variations in the gravitational effect of the moon, while the pendulum does. The difference in the rates of the clock and the crystal timekeeper thus contains a term depending on the period of the lunar day.

#### Jubilee of the Ferranti Works

THE late Dr. S. Z. de Ferranti at the age of eighteen was the principal founder of the original company of Ferranti, Thomson and Ince in Charterhouse Square, London, in 1882. It is a little difficult to realise that there was then a great demand for electric meters. Messrs. Ferranti, Ltd., now of Hollinwood, Manchester, held an exhibition at Bush House, London, during June to commemorate their jubilee. The fifty years' life-story of the firm shown by the historical exhibits is largely a history of the development of public electricity supply. A particularly interesting exhibit was the earliest models of Ferranti meters, some of which have only recently been taken out of service. The new methods of hardening the pivots and burnishing them so as to get the exact shape with the help of a micrometer jewel examiner with a powerful microscope were shown in action. New devices rendered necessary by the 132-kilovolt grid scheme in Great Britain were shown in action. An even more recent development is the manufacture of electric clocks, which are now made quite cheaply, of all sizes and shapes with cases of bakelite, wood, or metal. A prominent feature of the radio exhibit was a new seven-valve receiving set. A full range of water heaters and fires were shown. A working model of the Ferranti hot-water system for a house employing those heaters was shown. The 'Era' fire which Ferranti's make is said to be ideal for devices for hatching chickens (chicken brooders). The machines used at the Ferranti works in Hollinwood are of the most modern design, and employ more than five thousand workmen.

#### Tuberculosis in England and Wales

THE Report on Tuberculosis by Dr. A. S. MacNalty to the Ministry of Health (Reps. on Pub. Health and Med. Subjects, No. 64. H.M. Stationery Office. 3s. net.) may be regarded as an 'audit' of the present position of the tuberculosis question in Great Britain. Tuberculosis is a disease not only of medical interest but also of wide sociological and economic importance. Anti-tuberculosis measures cost the country a great deal; for example, some  $2\frac{1}{2}$  million



pounds are expended annually on the maintenance of residential institutions for treatment. During twenty years of anti-tuberculosis campaign, the decline in the mortality from the disease has been striking—from a total of 53,120 deaths in 1911 to 35,745 in 1930. One of the most interesting and important sections of this Report deals with the results of sanatorium treatment. This is very difficult to evaluate, for the ultimate result depends so much on a variety of factors, such as (1) the type of the disease—some cases progress to a fatal issue in spite of all treatment, (2) the social position and sex of the patients, (3) the stage of the disease when treatment is commenced, (4) the age of the patients—pulmonary tuberculosis in the young adult tends to shorten life much more markedly than when it occurs in or after middle life, (5) the circumstances of the patient after discharge—the character of his home surroundings, his own care of his health, the nature of his occupation, and the like. It is concluded that some fifty-seven per cent of male and sixty-seven per cent of female patients in the second stage of pulmonary tuberculosis survive, often with good working capacity, for five years or more; a result which fully justifies the provision of sanatorium treatment. Much important information is embodied in this Report upon such subjects as after-care and village settlements for the tuberculous, methods of diagnosis, and special forms of medical and surgical treatment.

#### Science in the 'Sixties

A pamphlet with this title by Sir Oliver Lodge forms one of a series edited by Mr. John Drinkwater and addressed to men of letters. In it Sir Oliver contrasts the indifference displayed by the public and the Press to scientific discoveries made in the 'sixties with the universal interest shown at the present time in such subjects as relativity and the constitution of the stars. For the science of the 'sixties, Sir Oliver confines himself almost entirely to the theory of the electromagnetic field brought forward by Maxwell as the mathematical interpretation of Faraday's lines of force. He uses the words 'juggled with' to describe the process by which Maxwell evolved the electromagnetic theory of light from his mathematical expressions. This seems to us an unfortunate choice of words, likely to produce a wrong impression on the minds of readers. The steady progress from Maxwell to present-day wireless is outlined, and Sir Oliver concludes by giving his opinions on current theories. The new doctrine of uncertainty he summarises in "the act of *observing* carries with it inevitably an act of *perturbing*", but he denies that this renders events unpredictable. By 'faith' only does he accept relativity, but wave mechanics "is a healthy infant of great promise".

#### Scientific Apparatus of Historical Importance

SEVERAL daily newspapers recently published a letter from the Institute of Physics over the signatures of Lord Rutherford and others asking for the co-operation of anyone possessing pieces of apparatus likely to be of historical importance. In 1925 the Institute of Physics appointed a committee to advise on the preservation of such apparatus. This committee

is anxious to trace any pieces with which fundamental research in physical science has been carried out, and to arrange for their preservation. The committee has also entered upon the task of drawing up a catalogue of such pieces. Several pieces of great historical importance have already been secured for the nation and are now housed in the Science Museum at South Kensington, and the response to the recent letter has brought to light several other important pieces. Articles describing and cataloguing such pieces are published from time to time in the *Journal of Scientific Instruments*. Many readers of NATURE may have such apparatus in their possession or under their charge; and the Secretary of the Institute of Physics, 1 Lowther Gardens, Exhibition Road, London, S.W.7, will be grateful for any information that will assist in tracing such pieces or in completing the catalogue. For the benefit of future historians of physical science it is desirable to have as complete a record as is possible of the work of British physicists, and it is to this end that this task has been undertaken.

#### Cremation and Population

MRS. ALEC-TWEEDIE'S address on "Cremation the World Over" at the Cremation Conference, which was held at Brighton on July 18-21, reinforced a strong appeal for the wider adoption of this method of disposal of the dead by reference to the distribution of the custom of burning the dead among peoples of antiquity and non-European races. She dwelt in particular on the practice of cremation among the Hindus, contrasting it in detail with the methods of burial among the Chinese, and pointing out how among the latter reverence for the last resting-places of the dead, where land enclosing burial mounds is under cultivation, hampers agriculture and is an increasing menace to food supply among a teeming population which already produces barely enough for its needs. The vastness of the population, it might be added, makes the practice increasingly detrimental from the point of view of hygiene. Although Mrs. Tweedie did not hesitate to make use of the appeal to the emotion which reflection on the conditions and consequences of inhumation never fails to arouse, a marked feature of her address was the emphasis with which she stressed the import of cremation as a factor in the world's population problem, linking it up with food supply and birth control in relation to over-population. As she put it in her closing words, "Without birth control and world cremation, what will the end be?" Mrs. Alec-Tweedie was the first and only woman on the council of the Cremation Society of England for more than ten years. She is the daughter of the late Dr. George Harley, F.R.S., of Harley Street, and her brother was Dr. Vaughan Harley. Her brother-in-law is Dr. Francis Goodbody, who has done much work for the centenary meeting of the British Medical Association.

#### Population of London

THE volume of the Census, 1931, which covers the County of London has been published (London: H.M. Stationery Office, 3s. net). The total population enumerated in the City of London and the twenty-



eight Metropolitan Boroughs comprising the Administrative County of London on the night of April 26/27, 1931, numbered 4,397,003 persons. The males and females were respectively 2,044,108 and 2,352,895, a ratio of 1151 females per 1000 males. For the third decennium in succession, the County population shows a decline, the loss during the past intercensal period being 87,520, a number comparable with the population of a good-sized town like Ipswich or Wigan. The number of private families has increased by 6.17 per cent, and the average size of the family has been reduced by 8.7 per cent, to 3.46 persons. With the reduction in the average size of the family, the average number of persons for each occupied room has declined from 1.05 in 1921 to 0.98 in 1931; that is to say, on an average there is less overcrowding. In Greater London, which occupies roughly a circle of 15 miles radius with Charing Cross as a centre, 8,203,942 persons were enumerated, or more than one-fifth of the total population of England and Wales.

#### Forecasting Mortality

IN a lecture to the Norwegian Actuarial Society printed in the *Skandinavisk Aktuarietidskrift*, Mr. Palin Elderton takes up the fascinating subject of forecasting mortality. Most medical statisticians and actuaries, if only for their private amusement, have tried their hands at prophecy. The most obvious line of approach, when rates of mortality in age groups are available over a long series of calendar years, is to take each group separately and to study the form of secular change, then, having more or less successfully represented the trend by some mathematical function, to extrapolate horizontally. As Mr. Elderton points out, this method would be inappropriate if changes in mortality at a later age are really determined by the experience through which the generation of which those at the later age are survivors have passed. In that case, one should consider not the horizontal but the diagonal progression of the table.

#### Prehistoric Chronology

AT the request of the editor of *Antiquity*, Mr. Miles C. Burkitt and Prof. V. Gordon Childe have prepared a chronological table of prehistory, which is published in the June number of that periodical. The progress of recent research in prehistory will secure a welcome for the chart among students, not least perhaps because of the decisive manner necessitated by its form in dealing with controversial points, which should at least be provocative of fruitful discussion. The compilers have found that a task which they anticipated would give rise to no great difficulty has proved of no little complexity. Failing the ideal method of distribution maps, it was found most practical to divide the map into several geographical areas, each of which heads a column in the list. Even so, the area of extent of specific cultures has sometimes been difficult to determine and represent. It has been found impracticable to give an absolute chronology much before 2000 B.C. In glacial chronology most of the Mousterian is taken as contemporary with Würm II, Acheulean with Riss-Würm, and Chellean with Mindel-Riss, while pre-Chellean is

definitely pre-Mindel. Even when allowance is made for local specialisation and retardation, and when a solar chronology becomes possible with the dated monuments of Egypt and Mesopotamia, difficulties have still to be overcome, as witness the correlations here put forward between Egypt and Mesopotamia, which, it is admitted, are not universally accepted. The chronological chart, with explanatory notes on each section and index, has been reprinted and is obtainable separately, price 2s. 6d., from the assistant editor of *Antiquity*, 24 Parkend Road, Gloucester.

#### Re-opening of the South African Museum

ON June 1 the Governor-General of the Union of South Africa, the Earl of Clarendon, opened the reconstructed South African Museum in Cape Town, and so marked the accomplishment of an instalment of the development scheme of the trustees. The Museum, founded as a Cape Government institution in 1885, was housed in a new building in 1897, but had seriously outgrown the accommodation there. The present additions permit of a running sequence in the exhibits of different sections, and have given new opportunities for the proper display of some of the treasures the Museum possesses. The additions, on two stories, consist of the old Art Gallery and an entirely new block on the opposite or Avenue side, forming two large halls, 90 feet long by about 35 feet wide. The lower of these is devoted to ethnology, and here the famous life-casts of native races have found a fitting place; the upper contains the big-game collection, and the opening is marked by the addition of a new group of springbok. The trustees and Dr. Leonard Gill have made a notable contribution to museum progress in the Union.

#### Albinism in Wild Animals

A VERY interesting specimen recently received at the London Zoological Gardens is a young albino reticulated python. Its eyes are pink, but the usual markings are present in orange-colour on the white skin. Albinism seems to be very rare in cold-blooded animals, but a few years ago the Gardens exhibited an albino cobra, and many years before that an albino common frog. The albino form of the axolotl, of which specimens can be seen in the aquarium, is bred in domestication like the ordinary black form, but all such specimens appear to have descended from one albino which came in the first consignment of live axolotls received in Europe during the last century. Albino or 'silver' goldfish are well known, and in the Zoological Society's aquarium can be seen white as well as golden specimens of common carp; but these, again, are domesticated. Neither white axolotls, white goldfish, nor white carp have pink eyes, and so fall short of complete albinism. It has been noticed in birds that an albino or lutino specimen, if pink-eyed, retains its abnormal hue, but if normal-eyed, is liable to revert to type on moulting.

#### Modifying Broadcasting Voices

IN a broadcast talk given in America by O. H. Caldwell, the editor of *Electronics*, a method of improving the voices of some of the political speakers was described. By using a suitable combination of



electrical devices in connexion with the microphone, it is possible to improve the broadcast voice by smoothing out rough and strengthening weak notes. Sounds sent over the radio can be varied by placing in the broadcasting circuit filters, compensators, and amplifiers so that the frequency and volume are permanently varied or are left to be varied at the discretion of the control engineer. High-pitched voices are transmitted much better than deep voices over the radio. It was suggested that by putting different compensators in various branches of the broadcasting networks it would be possible for a political candidate to talk with the appropriate accent in several States simultaneously.

#### Standardisation at the Ottawa Conference

THE question of industrial standardisation will again come before the Imperial Conference when it meets in Ottawa at the end of this month, and Mr. C. le Maistre, director of the British Standards Institution, has been appointed adviser to the delegation from Great Britain on British standards. It will be recalled that at the last two Imperial Conferences very great importance was attached to the development of inter-Empire standardisation, and to the preparation of national industrial specifications by national standardising bodies. In order to fulfil the recommendation of the last Imperial Conference, the British Engineering Standards Association recently widened its scope, and is now known as the British Standards Institution. Since last November, Mr. le Maistre has been touring the Dominions in connexion with the development of this work.

#### New Deposits of Tin in the U.S.S.R.

THE expedition of the Soviet Academy of Science under the direction of Dr. A. E. Fersman has discovered new deposits of tinstone in Tadjikistan, to the north-east of Stalinabad. The Soviet Union so far has not had its own supply of tin ore, the working of the two deposits in Transbaikalia having only just commenced. The discovery of new rich deposits of tinstone is of great importance to the national economy of the U.S.S.R., particularly in the manufacture of tins for preserved foods, in the motor tractor industry, in the production of steam engines, etc.

#### Announcements

THE REV. J. P. ROWLAND, *S.J.*, has been appointed director of the Stonyhurst College Observatory, in succession to the Rev. E. D. O'Connell, *S.J.*, who has been appointed rector of the College.

At the quarterly meeting of the Royal College of Surgeons held on July 14, Sir H. J. Waring was elected president of the College in succession to Lord Moynihan. The Lister Memorial lecture of the College will be delivered by Sir Charles Ballance on April 5, 1933.

THE following officers have been elected to the Council of the Institution of Electrical Engineers for the year 1932-33, to take office on Sept. 30:—*President*, Prof. E. W. Marchant; *Vice-President*, Mr. H. T. Young; *Hon. Treasurer*, Mr. P. Rosling; *Ordinary Members of Council*, Prof. J. K. Catterson-Smith,

Mr. A. P. M. Fleming, Mr. H. W. H. Richards, and Mr. W. S. Burge.

At the annual general meeting of the British Association of Research for the Cocoa, Chocolate, Sugar Confectionery, and Jam Trades, which was held on July 5, Mr. J. G. Mathieson was re-elected president and Mr. A. W. Beach and Mr. C. E. Southwell were re-elected vice-presidents.

It is announced that by the will of Mr. James M. G. Prophit, a sum of about £120,000 is to be divided equally for the purposes of cancer and tuberculosis research. The tuberculosis moiety has been allocated to various hospitals and colleges, including the Royal College of Physicians, and to two studentships. The cancer moiety has been allocated chiefly to the Royal College of Surgeons, the Radium Institute, the British Empire Cancer Campaign, and also to two studentships.

THE ninth Annual Conference of the Association of Special Libraries and Information Bureaux will be held at Somerville College, Oxford, on Sept. 23-26. The presidential address will be delivered by Sir Charles Sherrington on Sept. 23. Among the papers to be read at the Conference are: "The Relationship between Science and the Humanities", by Prof. J. L. Myers; "Classified Subject Indexes to Periodical Volumes", by Dr. S. C. Bradford and Prof. A. F. C. Pollard; and "History and Sources of Official Vital Statistics", by Prof. M. Greenwood. Particulars of the Conference can be obtained from the General Secretary, Association of Special Libraries and Information Bureaux, 16 Russell Square, London, W.C.1.

MESSRS. W. Heffer and Sons, Ltd., have issued a catalogue (No. 390) of publishers' 'overstocks', or 'remainders' as they are more generally termed. All books are new and are offered at about half the published price or less. We notice in the section of reference books sets of Millais' "Mammals of Great Britain and Ireland" and Thorburn's "British Mammals".

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A part-time lecturer in the Biology Department at the Plymouth and Devonport Technical College—The Secretary for Education, Education Offices, Rowe Street, Plymouth (July 23). A lecturer in mathematics at the Portsmouth Municipal College—The Registrar (July 29). A resident engineer in the Public Works Department, Hydro-Electric Branch, of the Government of the Punjab—The High Commissioner for India, General Department, India House, Aldwych, London, W.C.2 (Aug. 4). An assistant teacher of mechanical engineering and an assistant teacher in the Nautical College at the Central Technical School, Byrom Street, Liverpool—The Director of Education, 14 Sir Thomas Street, Liverpool (Aug. 8). A full-time secretary to the Museums Association—The Secretary, Museums Association, 39B Alfred Place, South Kensington, London (Aug. 10). A junior assistant in the Directorate of Ballistics Research, Research Department, Woolwich, S.E.18.—The Chief Superintendent. A physics laboratory assistant at the Radium Therapy Department, Duke of York Home, Bradford.



## Letters to the Editor

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, nor to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. No notice is taken of anonymous communications.]

### The Inheritance of Acquired Characters

IN making my final reply to Prof. Haldane, whose letter appeared in NATURE of July 2, I am actuated mainly by two motives, namely: (1) to try to dispel the mist of mental confusion in which Prof. Haldane is enveloped with regard to 'selection', and (2) to prove to readers of NATURE the baselessness of Prof. Haldane's attempts to discredit the evidence for the inheritance of habit given in my Royal Institution discourse.

I think that my first object can best be attained by referring to a somewhat similar controversy which I conducted some years ago with Prof. Julian Huxley, for whom, as a zoologist, I have a great respect, although I differ widely from some of his conclusions. I then stated the case for the inheritance of habit somewhat as follows: the ordinary routine experiment practised by Mendelians of crossing the races of domestic animals, such as mice and guinea-pigs, is one which requires no particular skill to carry out. If continued to all eternity it would throw no light whatever on the inheritance of habit: to test this, a special form of experiment is necessary, infinitely more difficult to carry out than the Mendelian one and requiring far more time for its execution. We must discover a species of animal sufficiently plastic in its constitution to respond within the period of its lifetime to a change in environment by some observable change in structure or behaviour: we must then breed from the altered individuals and examine whether some trace of the alteration is transmitted to the next generation, in spite of the fact that this generation has been returned to the typical environment. But Prof. Haldane objects that if we do this we are 'selecting'; yet what else can we do? The question at issue is whether an acquired habit is inherited. How can we test this except by breeding from animals which have acquired the habit? Perhaps Prof. Haldane means that not all of the individuals exposed to the new environment respond equally to it, and that those which do respond owe their power to something queer 'turning up' by accident in their constitution. It is in general true that whenever we expose animals to any set of new conditions we do not get a uniform response on the part of all, but a series of responses graded in intensity. This has been noticed by all workers in this field. Long ago Kammerer observed that only his most vigorous salamanders responded adequately to the colour of the background. This variation in response, however, is not due to mysterious 'genes' turning up, but solely to differences in vigour.

Coming now to my second object, I maintain that Prof. Haldane's assertion that all that Dürken obtained was gained by the selection of a race of green pupæ from a mixed population is without foundation. The 'green pupæ' are merely the end terms in a graded series of pigment reduction which occurs as a reaction to orange light, and the population is not mixed. The critical question is whether this reaction affects the reactions of their descendants—and this Dürken has proved up to the hilt. From 33 to 50 per cent of the next generation retain the lack of pigment in spite of an exposure to ordinary daylight. As I mentioned in my previous

letter, Dürken in one of his later experiments obtained practically a 100 per cent response from a population exposed to an orange light, but this is rare. To all those, however, who wish to follow up this subject further, I recommend a perusal of the relevant passages in Dürken's book, "Grundriss der Entwicklungsmechanik". They will there find the questions of 'mixed populations' and 'selection' considered and decided in the negative, and they will be in a position to judge of the exact value of Prof. Haldane's statements.

We now come to the experiments of Metalnikoff. In my Royal Institution discourse I quoted from a review of Metalnikoff's work in a French scientific journal. Since then, however, we have taken up seriously the question of repeating Metalnikoff's experiments in my laboratory: we have obtained all Metalnikoff's publications, including the book in which he describes his experiments not only with the cholera bacillus but also with a number of other bacilli, and there is not a shadow of a doubt that Metalnikoff did not breed from the survivors of the individuals inoculated with the bacillus but from those immunised with the vaccine. Refreshing my memory the other day, I find that in one culture in the tenth generation of immunised insects 77 per cent of the individuals inoculated with the bacillus survived.

Here I should like to put on record my deep feelings of gratitude to Dr. Ledingham and his colleagues of the Lister Institute who have helped us by supplying standardised cultures of bacilli every time we wish to make an experiment. So far as I could discover, Dr. Ledingham and his colleagues were the only people in London who knew of and appreciated Metalnikoff's work. Whether we shall succeed in obtaining the same results as Metalnikoff remains to be seen.

I now come to Prof. Haldane's comments upon Prof. Heslop Harrison's experiments with the sawfly *Pontania salicis*. He suggested in his discourse that Harrison's strain of sawflies had become contaminated with a strain adapted to the new willow: that these individuals survived, and that so a false appearance of the artificial production of a new habit was created. To this I replied that the "new willow" was a rare hybrid; and that the idea of the sawflies becoming contaminated with a strain adapted to this willow was mere hypothesis. It must have been obvious to all readers that I had obtained these facts from Prof. Harrison, but in his letter Prof. Haldane directly challenges them, which seems a rash proceeding, considering that Prof. Harrison occupies a chair of botany and is unrivalled for his knowledge of the systematics and ecology of the British flora. Prof. Haldane asserts that the so-called rare hybrid is economically important and is cultivated in 69 vice-counties, whereas the unimportant original host-plant only grew in 34 vice-counties. I referred the matter to Prof. Harrison, and received from him a reply which disposes completely of Prof. Haldane's objections.

As I gave a list of eminent authorities who had become converted to Lamarckism, Prof. Haldane quotes against me the Royal Society motto, "Nullius in verba". As I am a fellow of that Society of twenty-seven years' standing, this was a superfluous attention on the part of Prof. Haldane. Of course, I accept it. Opinions *qua* opinions prove nothing, but this is not a fair way of stating the case. In a subject of the vast extent of zoology, the life-long efforts of one investigator can only enable him to cultivate *in detail* one limited part of the field, and yet it is precisely on this *detailed* study that the solution of all the major problems of the science depend. In my discourse I referred to three types of such detailed studies, namely, systematics, embryology, and palæontology. Nineteenth century morphology was only suggestive, not



demonstrative, because the comparisons on which it rested were of too sketchy and remote a character and the gaps bridged by hypothesis were too wide, and so morphology was led in many cases to wild and ridiculous conclusions. But the opinion of an expert in systematics is not to be dismissed as mere "verba". It is really a deduction from thousands of relevant facts which the critic has neither the time nor experience to be able to consider.

Prof. Haldane concludes with a disquisition on the subject of mutations, into which I will not follow him. As I said in my previous letter, it would have been an easy matter to have gone over the whole of his discourse and applied destructive criticism to every part of it, but I determined to confine myself to meeting his objections to the evidence adduced by me. But I shall conclude by placing on record my view of the nature of mutations and trusting to the future to vindicate it.

Johannsen, who invented the term 'gene', later publicly expressed his regret that he had ever done so, and defined mutations (or genes) as "superficial disturbances of the chromosomes". They have nothing to do with the characters of the natural races of animals (or plants). With this opinion I fully agree. Mutations begin differently and are inherited differently from true racial characters. This is the opinion of the best systematists whom I know, and surely in the long run the opinion of those who really understand what species, sub-species, and biological races are will ultimately prevail.

E. W. MACBRIDE.

43 Elm Park Gardens,  
Chelsea, S.W.10,  
July 2.

PROF. J. B. S. HALDANE, in his reply (NATURE, July 2) to Prof. E. W. MacBride's letter, once more returns to the subject of my experiments with the sawfly *Pontania salicis* and its transference from the foodplant *Salix Andersoniana* to *S. rubra*. As this portion of his letter is misleading, and might appear convincing to anyone not acquainted with the facts, it seems that a statement from me is necessary.

Actually, owing to Prof. Haldane's lack of knowledge of the geographical distribution of the two willows in question, not one of his remarks is relevant to the subject. It still remains a fact that *S. rubra* is a rare hybrid between *S. purpurea* and *S. viminalis*, and to challenge this on the ground that Druce records it from sixty-nine vice-counties shows a lack of appreciation of the basis of such a list, and of the numbers of individuals which represent such a hybrid in Nature. Moreover, the introduction of a reference to the value of *S. rubra* as an osier only makes matters worse; osiers are not cultivated here.

Again, when Prof. Haldane quotes Druce as recording *Salix Andersoniana* from thirty-four vice-counties, scientific accuracy should have caused him to state that these thirty-four (except for an outlier in Glamorgan) lie north of a line drawn across the country from N.E. Yorks to Lancashire. The probability of *S. Andersoniana* coming into contact with osier beds is thus very remote. Further, his statements imply that he does not realise that, in those northern and Scottish counties where both plants occur, the favoured habitats of *S. Andersoniana* differ widely from those of *S. viminalis*, *S. purpurea*, and, consequently, of their hybrid. In Durham, for example, *S. Andersoniana* is a plant which grows in profusion on the sea banks on the magnesium limestone and then jumps to subalpine areas well inland, whilst *S. viminalis*, *S. purpurea*, and *S. rubra* occupy the intervening zone. Very rarely indeed do *S. Andersoniana* and *S. rubra*

overlap; in fact, in spite of very careful exploration to settle this very point, I cannot point to one locality which they possess in common!

Prof. Haldane ought to have realised that before I commenced the experiments I should take the elementary precautions of making sure (1) that the small patch of *S. rubra* selected for the work was free from *Pontania* galls, (2) that no other species of willows near carried the same species, and (3) that the colony of *S. Andersoniana* from which the transference was made was in a district remote from contact with *S. rubra*.

J. W. HESLOP HARRISON.

Armstrong College,  
Newcastle-upon-Tyne,  
July 4.

#### Filtration of Plant Viruses

THE preparation of graded collodion membranes has been greatly improved of recent years by W. J. Elford, who has developed a technique with which he can produce membranes of highly uniform structure and easily determinable average pore size. These he has used in an investigation of the probable sizes of bacteriophage and various animal viruses. We have examined a number of plant viruses with membranes prepared according to Elford's methods and with his generous help and advice; and a short statement of some of our experiences and results may be of interest in themselves and of value to others.

First as to the method of preparation of the membranes. In our hands it has not proved easy to obtain consistent results. The eventual pore size is dependent on the rate of evaporation from the surface of the liquid and is also enormously affected by the presence of traces of water; and very small local or general differences in atmospheric humidity, slight currents of air, and the like affect the final product to a surprising extent. There may be marked difference of pore size between the central area of a membrane and the portions lying nearer the rim. Such difficulties are not insuperable, but the most painstaking attention to detail is essential, and at present we find it advisable to standardise every membrane individually before use. Standardisation leaves room for some degree of latitude in the data, and, leaving aside theoretical considerations as to the applicability of the formula used to membranes of this structure, in our hands repeated standardisation of the same individual membrane has shown a progressive diminution in average pore size. These difficulties are gradually disappearing, but we mention them as a warning of the necessity of checking one's results with the greatest care.

The virus material we have used consists of juice extracted from diseased plants. This juice is very complex and may contain tannins, resins, and other readily precipitated materials which do not occur in animal tissues. As a consequence there is a rapid clogging of the pores, especially of the finer membranes, in spite of very thorough preliminary clarification by passage first through paper pulp and then through a coarse (0.6 $\mu$  or 0.7 $\mu$ ) membrane. With some plants, for example, tomatoes, especially if more than a very few weeks old, this plugging is so thorough as to make the results quite useless as a guide to the size of the particles. With tobacco and certain other plants it is much less serious, but it is always present to some extent. To this is perhaps to be attributed the fact that we do not get a sharp endpoint. We do not find that the virus passes undiminished in quantity through the series of membranes down to a definite pore size, at which it no longer passes: there is a progressive reduction in amount all the way down. To take one example (where the quantity of virus



present was estimated by the number of spots developing on the leaves of *N. glutinosa*), after passage of paper pulp the number of spots was 407 per leaf; after 0.8 $\mu$  membrane, the number was 220; after 0.49 $\mu$ , 38; after 0.25 $\mu$  it was 6, and after 0.1 $\mu$  or less, there were no spots. It may be necessary to remove this clogging material before passage of the membranes, and experiments are in progress for this purpose.

With all qualifications made, the results obtained are of interest and significance. As is the case with animal viruses, we find that the plant viruses differ greatly in size among themselves. The virus of tobacco mosaic (Johnson No. 1) passes the 0.51 $\mu$  membrane, though in reduced quantity (only 4 plants infected out of 8), and passes the 0.154 $\mu$  easily. The virus of yellow tobacco mosaic (Johnson No. 6) is of the same size, passing 0.051 $\mu$  (2 plants positive of 8). Aucuba mosaic virus passes 0.120 $\mu$  and 0.112 $\mu$  but does not pass 0.10 $\mu$ , 0.06 $\mu$ , or 0.051 $\mu$ . The virus of a *Hyoscyamus* disease found by Dr. Marion Hamilton passes 0.30 $\mu$  but not 0.234 $\mu$  or any smaller membrane: and this is a point of some interest since (as she shows in a paper now in the press) this virus does not pass through a L.3. Pasteur-Chamberland porcelain candle, although its pore size is about 2.5 $\mu$ .

By Elford's method of calculation, these figures would indicate a particle size of 15 $\mu\mu$  for the tobacco and yellow mosaic viruses, about 40-50 $\mu\mu$  for aucuba mosaic, and 150 $\mu\mu$  for the *Hyoscyamus* virus. The value found for tobacco mosaic comes midway between Duggar's estimate of 30-40 $\mu\mu$  and the recent estimate of 5 $\mu\mu$  by Waugh and Vinson.

It is possible by the use of these membranes to separate two viruses occurring together in nature in the same plant. Dr. Hamilton's *Hyoscyamus* virus was passed through a series of membranes. It passed 0.64 $\mu$  and 0.30 $\mu$  with characters unchanged; after passage through 0.234 $\mu$ , 0.209 $\mu$ , and 0.120 $\mu$  the disease produced was of different type, and further investigation has shown that the virus passing the smaller membranes is entirely different in its properties from the other larger virus it accompanied, and it is possible to separate the two by other methods than filtration.

D. MACCLEMENT.

J. HENDERSON SMITH.

Rothamsted Experimental Station,  
Harpenden, Herts.

### Constitution of Tantalum and Niobium

THESE two elements of the vanadium group have properties very unfavourable to mass-spectrum analysis and all attempts previously reported have been completely unsuccessful. I have now been able to obtain their mass lines, owing to the kindness of Dr. P. Kronenberg of Berlin, who has prepared for me specimens of the pentafluorides. These solids are slightly volatile but their great chemical activity makes them troublesome to deal with. If, however, they are volatilised in the discharge tube itself, it is possible to obtain, at least intermittently, a discharge which contains the metallic ions. Under these conditions the data are not complete, but one result is beyond doubt, and this is, that notwithstanding their fractional chemical atomic weights, both elements are essentially simple.

Tantalum, which was investigated first, gave a strong line at 181 followed by a diminishing series 200, 219... due to TaF, TaF<sub>2</sub>... Neither the expected isotope 183 nor any other could be detected even to one-fiftieth of the main line. The packing fraction of tantalum was estimated from the position of the line 200 among the mercury group to be -4. Owing to

certain experimental difficulties, this is only to be regarded as a rough provisional value, but it eliminates any possibility of an abnormally high mass. Correcting to the chemical scale, this value gives

Atomic weight of tantalum = 180.89  $\pm$  0.07.

Niobium behaved in exactly the same way, giving a single line at 93 and fluorides at 102, 121... It has not been possible to measure the packing fraction of niobium with accuracy, but direct comparison of the line 93 with line 85 (SiF<sub>3</sub>) suggests a large negative value, about -8. This gives on the chemical scale

Atomic weight of niobium = 92.90  $\pm$  0.05.

The atomic weights of these elements given by chemical methods have always been regarded as unsatisfactory, and these results suggest that the present international values, 181.4 and 93.3, are considerably too high.

F. W. ASTON.

Cavendish Laboratory,  
Cambridge, July 11.

### Vibrations in Solid Rods

IN connexion with the study of vibrating metal rods, a method of investigation has been devised which promises to lead to a number of new and interesting results. The experiment consists in tapping

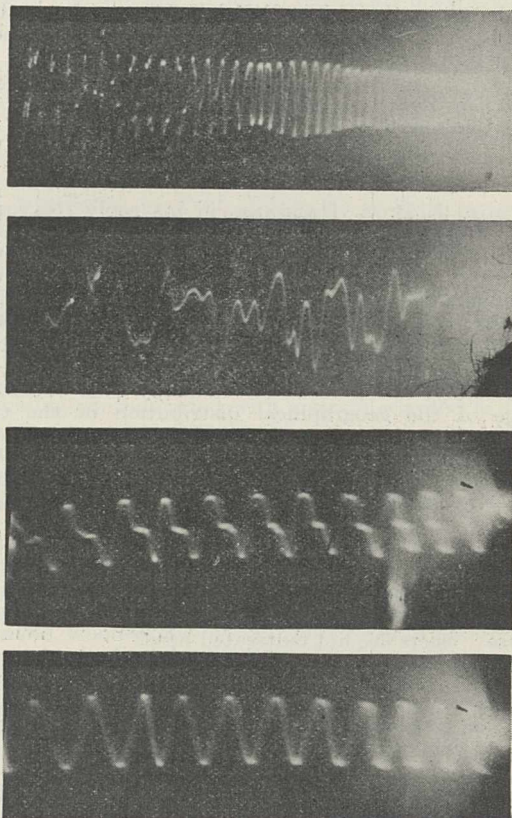


FIG. 1.

a rod at one end with a small hammer, and then making visible the train of waves which occur as a result of the impact. This is accomplished in the following manner.

To the end of the rod opposite that which is tapped is cemented a piece of piezo-electric crystal, for example, quartz or tourmaline, which converts the vibrations at that point to an alternating voltage.



This voltage is amplified and impressed on a cathode ray oscillograph, which has in connexion with it a properly synchronised time-axis device. The hammer is driven by a synchronous motor and strikes the end of the rod ten times a second. By proper adjustment throughout, each train of waves occurs on the oscillograph screen exactly superposed on the preceding train, so that a steady picture is obtained representative of the periodic displacements of the end of the rod with time. This graph, as it really is, may be photographed if desired.

It has been found that in most cases the waves are quite complex, being combinations of longitudinal, flexural, and possibly other modes of vibration. In order to separate these component frequencies, the voltage from the amplifier may be passed through a tuned circuit and the selected frequency then impressed on the oscillograph. It is thus possible to pick out vibrations of different types.

In Fig. 1 are shown several examples of waves which occur in duralumin rods when they are struck with a hammer. The fourth curve shows the predominating frequency present in the wave immediately above it, this analysis being obtained with the use of the tuned circuit previously mentioned.

By measuring the decrement of any desired wave, the coefficient of solid viscosity corresponding to that frequency may be calculated, and it is believed that considerably greater accuracy may be obtained in this way than has been possible with previous, more indirect methods. From the fourth curve in Fig. 1, which corresponds to the fundamental mode of longitudinal vibration for a certain duralumin rod, the logarithmic decrement was found to be 0.016, giving a value for the coefficient of solid viscosity of  $4.6 \times 10^4$ . Although this rod was of duralumin, it is interesting to note that in 1922 Dr. R. W. Boyle<sup>1</sup> suggested that when the coefficient was accurately determined for steel (in many respects similar to duralumin), its order would probably be not greater than  $10^5$ . The variation of this coefficient with frequency and amplitude of vibration remains to be determined, but when this matter is examined in greater detail, it is probable that a clearer understanding of the nature of solid viscosity, including hysteresis, may be forthcoming.

GEORGE S. FIELD.

National Research Laboratories,  
Ottawa, June 8.

<sup>1</sup> *Trans. Roy. Soc. Can., Sect. III., p. 293; 1932.*

### Mean Lives of the Lowest Metastable States in Neutral Oxygen, and Intensities of Lines Arising therefrom

Transitions from the lowest metastable levels in the OI spectrum are of interest as occurring in nebular and auroral spectra. The red lines  $^3P_{2,1} - ^1D_2$  ( $\lambda\lambda 6300, 6364$ ), which have been produced in the laboratory by Hopfield,<sup>1</sup> have been identified by Paschen<sup>2</sup> as occurring in the spectra of some of the nebulae, and by Sommer<sup>3</sup> as occurring in the spectrum of the night sky, while the line  $^1D_2 - ^1S_0$  ( $\lambda 5577$ ) is the well-known auroral green line first identified by McLennan. A theoretical calculation of the intensities of such transitions and the mean lives of the metastable states is therefore of interest.

These 'forbidden' transitions are evidently due to quadrupole radiation, for the Zeeman effect in the auroral green line has been shown by Frerichs and Campbell<sup>4</sup> to be in agreement with the supposition of quadrupole radiation, but inconsistent with the hypothesis of perturbed dipole radiation. In a forthcoming paper in the *Proceedings of the Royal Society*, I have made the corresponding calculations

for OIII with reference to nebular lines, on the assumption of quadrupole radiation.<sup>5</sup> The final results are expressed in terms of integrals of radial wave functions, thus depending only on the central field of force adopted, and these integrals can be calculated from a comparison of calculated and observed separations between the levels. Now, Heisenberg<sup>6</sup> has shown recently that the wave equation for the lowest levels of an atom in which there are  $n$  electrons outside closed shells only differs, in first approximation, from that of an atom in which there are  $n$  'holes' (that is, a closed shell is incomplete by  $n$  electrons) in that a different central field of force must be adopted. This enables the method outlined above for OIII to be applied immediately to the case in hand, thus yielding the following results for the  $2p^4$  terms in OI:

Line.	Relative Intensity (per atom).
$^3P_2 - ^1D_2$ ( $\lambda 6300$ )	3
$^3P_1 - ^1D_2$ ( $\lambda 6364$ )	1
$^3P_0 - ^1D_2$ ( $\lambda 6391$ )	$4 \times 10^{-4}$
$^1D_2 - ^1S_0$ ( $\lambda 5577$ )	1
$^3P_2 - ^1S_0$ (not observed)	$10^{-7}$
$^3P_1 - ^1S_0$ "	$2 \times 10^{-3}$
$^3P_0 - ^1S_0$ "	0

Relative intensity of  $^1D_2 - ^1S_0$  to  $^3P_2 - ^1D_2 = 1400 : 1$   
Mean life of  $^1S_0$  state = 0.02 sec.

" "  $^1D_2$  " = 100 sec.

The results are, of course, only approximate, the figures for  $^1D_2 - ^1S_0$  and the mean life of the  $^1S_0$  state being less accurate than the others. The only direct comparison with observation is in the relative intensity of lines with  $^1D_2$  as initial state. The relative intensity of  $^3P_{2,1} - ^1D_2$  is about 4 : 1 according to Hopfield,<sup>1</sup> while for the nebula N.G.C. 7027 the ratio is about 5 : 2 according to Wright.<sup>2</sup> The line  $^3P_0 - ^1D_2$  ( $\lambda 6391$ ) is not observed in the nebulae, but was weakly observed in the laboratory according to Paschen.<sup>2</sup> These results are in satisfactory agreement with the above. In a subsequent paper, however, Paschen<sup>7</sup> gives the relative intensity of  $^3P_{2,1,0} - ^1D_2$  as 5 : 3 : 1. If this were really the case, it would, of course, be in serious disagreement with the theory.

The figures for the mean lives throw some light on conditions in the nebulae and the auroral regions. If it becomes definitely established that the red lines ( $\lambda\lambda 6300, 6364$ ) occur in the auroral spectrum, the observed relative intensity of  $\lambda 5577$  to  $\lambda 6300$ , combined with the above calculated relative intensity *per atom*, would furnish the relative number of atoms in the  $^1S_0$  and  $^1D_2$  states, which would be of interest in connexion with possible processes of excitation in the upper atmosphere.

I wish to thank Mr. M. F. Crawford for valuable discussion of the experimental data.

A. F. STEVENSON.

Department of Applied Mathematics,  
University of Toronto,  
May 26.

<sup>1</sup> Hopfield, *Phys. Rev.*, **37**, 100; 1931.

<sup>2</sup> Paschen, *Naturwiss.*, **18**, 752; 1930.

<sup>3</sup> Sommer, *ibid.* Cf. Grottrian, *Naturwiss.*, **20**, 85; 1932.

<sup>4</sup> Frerichs and Campbell, *Phys. Rev.*, **36**, 1460; 1931.

<sup>5</sup> Cf. also Bartlett, *Phys. Rev.*, **34**, 1247; 1929.

<sup>6</sup> Heisenberg, *Ann. Phys.*, **10**, 888; 1931.

<sup>7</sup> Paschen, *Z. Physik*, **65**, 1; 1930.

### Layer-chain Structures of Thallium Di-Alkyl Halides

DURING the last year we have been studying the crystal structures of a series of compounds  $R_2TlX$ , which prove to be of some interest in view of the recent work on the rotation of molecules in crystals. The dimethyl thallium halides are tetragonal and the others orthorhombic, pseudo-tetragonal, and all show



a sodium chloride-like structure. Layers of TIX parallel to the *ab* plane are spaced out at distances depending on the length of the alkyl chains, which are attached to the thallium ions perpendicularly to these layers. The *a* and *b* cell dimensions are almost independent of the alkyl group and vary between 4.29 Å. (chloride) and 4.76 Å. (iodide). These spacings, which, except in the case of the iodide, are much lower than the values 4.85 Å. (Müller)<sup>1</sup> and 4.76 Å. (Bernal)<sup>2</sup> found for the distance between rotating chains, are in agreement with other indications that the chains in these compounds do not rotate.

There is evidence that the chains are not of the usual zigzag pattern, but are like Müller and Shearer's<sup>3</sup> suggested type 3, and the two covalencies of the central thallium atom in the chain are at 180°.

We have also studied the double refraction of these compounds, which combine the characteristics of both chain and layer structures. The following table shows that the sign of the double refraction may be either positive or negative according as the influence of the chain or layer character is the greater (cf. Bernal's observation, loc. cit., of negative double refraction in an alkyl ammonium chloride).

SIGN OF DOUBLE REFRACTION

X	TlMe <sub>2</sub> X	TlEt <sub>2</sub> X	TlPr <sub>2</sub> X
I	-	-	-
Br	-	+	-
Cl	+	+	+

The variations can be satisfactorily explained by a simple extension of the method of Wooster,<sup>4</sup> by taking into account the relative importance of the various atoms in their contribution to the refraction.

A detailed account is in preparation.

H. M. POWELL.  
D. M. CROWFOOT.

Department of Mineralogy,  
University Museum,  
Oxford.

<sup>1</sup> NATURE, 129, 436, March 19, 1932.

<sup>2</sup> NATURE, 129, 870, June 11, 1932.

<sup>3</sup> J.C.S., 123, 3156; 1923.

<sup>4</sup> Z. Krist., 80, 495; 1931.

### A Metagalactic Cloud between Perseus and Pegasus

DURING the course of an investigation concerning the occurrence of bright metagalactic clusters, I have found between the constellations Perseus and Pegasus a number of clusters of anagalactic nebulae which seem to form subsystems of an extended metagalactic cloud. This cosmical unit can be traced in Herschel's G.C. and is very conspicuous in the N.G.C. and I.C. material. On the whole, the supersystem is composed of fifteen or nineteen larger and smaller metagalactic clusters, situated between  $\alpha = 23^{\text{h}}$ ,  $\delta = +20^{\circ}$  and  $\alpha = 3^{\text{h}} 20^{\text{m}}$ ,  $\delta = +48^{\circ}$ . All the subsystems are arranged in a zone reminding one of a region of the galaxy. The well-known Perseus cluster, discovered by M. Wolf, is involved on the north-following boundary, and the Pisces group (E. P. Hubble) near the central region of the cloud. A connexion between the metagalactic cloud in question and the Pegasus cluster is suggested.

450 N.G.C. objects are situated in the general field of the cloud, and the main bulk of these objects seem to be physical members of the cloud. The density of nebulae in this part of the sky is remarkable. Thus we count 117 N.G.C. objects in the central region, but only 8 and 3 respectively in equal large areas, situated

north and south of the said region. Translating the literal symbols of magnitudes given in N.G.C. into numerical values of total magnitudes, we obtain for 312 nebulae, obviously belonging to the cloud, a frequency-curve of total magnitudes remarkably similar to the corresponding curve for the objects in the bright Virgo cloud, discovered and studied by H. Shapley. Thus the curve also shows the 'hump' in its ascending branch, earlier found by W. Baade in the case of the Ursa Major cluster.

The distance of the bright metagalactic supercluster (or cloud of galaxies) can be assigned the preliminary value of  $10 \times 10^6$  light-years, the extension and depth of the cloud to about  $30 \times 10^6$  light-years in accordance with the distances found for the known clusters of faint nebulae involved in the metagalactic cloud here considered.

Observatory, Lund,  
April 25.

W. E. BERNHEIMER.

### Energy of Dissociation of Nitrogen

IN NATURE of June 11, page 870, A. K. Datta gives the energy of dissociation of nitrogen as deduced from his measurements of the absorption spectrum of nitrous oxide.

The value -18.1 appears to have been used for the heat of formation of the latter gas. This value is so suspect that a redetermination has been made in this department,<sup>1</sup> and similar work is in progress at the National Physical Laboratory.<sup>2</sup> Using the value<sup>1</sup> -20.6, Datta's figure becomes 9.0<sub>0</sub> volts or 208 kilocalories.

The following table includes the more recent values obtained by various methods, and shows that the energy of dissociation of nitrogen is now comparatively well known:

Birge . . . .	9.04 ± 0.2 volts	NATURE, 122, 842; 1928 <i>T. Faraday Soc.</i> , 25, 713; 1929
Kaplan . . . .	9.0 volts	<i>Proc. Nat. Acad.</i> , 15, 226; 1929
Tate and Lozier	8.4 ± 0.5 volts	<i>Phys. Rev.</i> , 39, 224; 1932
Datta (corrected)	9.0 volts	NATURE, 129, 870; 1932

T. C. SUTTON.

Research Department,  
Woolwich,  
June 12.

<sup>1</sup> T. C. Sutton, *Phil. Mag.*, 1932 (in press).

<sup>2</sup> Annual Reports, 1931, 13 and 75.

### Fatuoids or False Wild Oats

MR. E. T. JONES's observations<sup>1</sup> are, as he remarks, highly important in their bearing on the problem of the origin of fatuoids or false wild oats. The conclusions to be drawn from these observations are, however, in my opinion, precisely opposite to those drawn by Mr. Jones. His data, showing that two or more genes are concerned in the production of the fatuoid complex in diploid × tetraploid oat hybrids surely support my assumption that the fatuoid complex of hexaploids is determined by a number of linked genes. Therefore, for fatuoids to arise by gene mutation, as he considers they do, it is necessary to assume mutation occurring simultaneously in all these genes—a rather improbable assumption. The change in dominance, stressed by Mr. Jones, has in other cases been shown to be directly attributable to polyploidy.

As for the absence of crossing-over in fatuoids, this is a characteristic of chromosome aberrations in



general, now very widely established. I must confess inability to see how it can support the gene mutation theory of the origin of fatuoids, but on the chromosome aberration theory it is expected, since chromosomes *B* and *C* are not complete homologues. They are considered to be homologous along parts of their length, but not in the region bearing the fatuoid genes. Hence, complete linkage or absence of crossing-over is expected *in this region*.

In a paper<sup>2</sup> on the analogous speltoid mutations of wheat, I stated that the formulæ for fatuoids and speltoids there presented, and quoted now by Mr. Jones, were provisional and would probably have to be modified. Five years' further cyto-genetic work, with greatly improved cytological technique, has demonstrated the need for modification, but not for any fundamental changes in the original hypotheses and formulæ. Instead of duplication of whole chromosomes, it is now clear that only parts of chromosomes are duplicated in some mutant strains. The hypothesis that fatuoids arise through chromosome aberrations is, I consider, now so well established for most strains I have studied (including strains of Series *A*) that it appears to me unnecessary at present to resort to the alternative gene mutation hypothesis for those cases in which the evidence of aberration is not yet so clear.

It is, however, impossible here to summarise adequately the voluminous data upon which this opinion is based. They will be assembled for publication after the present season's work is completed. The object of the present note is to answer Mr. Jones's criticisms by indicating the very different interpretation which it is possible to place upon his observations. The observations themselves are certainly very important, for their bearing not only on this problem but also on the wider problem of the origin of cultivated oats.

C. LEONARD HUSKINS.

McGill University,  
Montreal.

<sup>1</sup> NATURE, 129, 617, April 23, 1932.

<sup>2</sup> J. Genetics, 20; 1928.

In a letter recently contributed to these columns,<sup>1</sup> Mr. J. Philp makes certain statements and arrives at certain conclusions in respect of the subject-matter of a communication made by me to this journal<sup>2</sup> which require consideration.

In reading through Mr. Philp's letter it appears to me that he has not clearly apprehended the facts stated in my communication. From my *descriptive* statement that "Segregates have appeared in this cross [*A. barbata* × *A. brevis*] in which the basal articulation and basal pubescence characters of the *A. barbata* parent occur in association with the awn and grain-apex of *A. brevis* type . . ." he concludes that I maintain that grain-apex, as well as awn, is linked with the fatuoid complex, although in an earlier part of the same paragraph I definitely refer to the fatuoid complex as consisting of the characters *articulation*, *basal pubescence*, and *awn*. I have expressed no view as to whether the grain-apex is or is not linked with the fatuoid complex. The cross-over types in question, so far as the fatuoid problem is concerned, relate to the appearance of a weak awn (of *A. brevis* type) in association with a horse-shoe shaped base and dense basal pubescence (a combination of characters not hitherto recorded); and conversely, the twisted geniculate awn (of *A. barbata* type) in association with a 'cultivated' type of base.

The other misapprehension, and a very fundamental one, relates to a statement (a presumption on Mr. Philp's part) that my observations are based upon a triploid hybrid. In the second paragraph of my com-

munication it is clearly indicated that the cross-over types under consideration are  $F_3$  segregates possessing the diploid chromosome number.

As Mr. Philp's letter is based almost entirely upon these two main issues, his criticisms and conclusions require no further comment.

Prof. C. L. Huskins puts forward the view that it is possible to explain the observed cross-over types as evidence in support of the chromosome aberration hypothesis.

The cross-over types in question exhibit a break-up of the fatuoid complex into two parts. We have, therefore, on the basis of the present evidence, to examine the case for the probability or improbability of simultaneous mutations occurring in these two 'units'. On the basis of the modified gene-mutation hypothesis, the mutations are considered to occur not in the *B* chromosome but in *C*. This is a point of importance when making comparisons of the expectations of crossing-over, or of gene mutations, in Series-*A* hexaploid fatuoids with the 'diploid' cross-over types of the diploid-tetraploid cross. In the latter, the cross-over affects both the *B* and *C* chromosomes. The necessity for assuming that the occurrence of simultaneous mutation in both 'units' of the gene complex in Series-*A* fatuoids depends, therefore, upon whether the linkage in the corresponding epistatic genes in the *C* chromosome is of the same degree as that between the genes of the *B* chromosome, which are fundamental in the determination of the fatuoid characteristics; and whether the epistatic genes in *C* are numerically similar to those in *B*. There is evidence, however, that all mutations occurring in *C* are not of the same degree of complexity, and as examples of the divergent mutant types thus produced, I may mention the already recorded strongly awned Types *A*, *B*, and *C*, and the fatuoid of Golden Rain.<sup>3</sup> From these observations it may be inferred that simultaneous mutation does take place, but not always in the same degree. On its extent, therefore, depends the appearance of fatuoids, sub-fatuoids, semi-fatuoids, or simply strongly awned types, and their relative frequency must depend upon the extent to which one gene or set of genes mutates in relation to the others. Probability, therefore, is not so very remote.

With regard to the homology and genic identity of the *B* and *C* chromosomes, that is, assuming for the moment that we are dealing with a case of whole chromosome aberration as originally postulated by Prof. Huskins, I know of no positive evidence which proves that the *B* and *C* chromosomes carry identical genes throughout the whole of their length, excepting, of course, those which determine the fatuoid complex. There is, however, on the contrary, evidence to show that in some oat varieties genes affecting spikelet number are present and also genes affecting the morphological character of the awn.<sup>3</sup> As Prof. Huskins has himself put forward the view that the *B* and *C* chromosomes have had a separate specific origin, their identity in gene constitution is on this account scarcely to be expected. On the basis of the chromosome aberration formulæ, it has to be assumed that the *B* and *C* chromosomes are identical and interchangeable without any apparent phenotypical changes other than those appertaining to the fatuoid complex. If, however, Prof. Huskins wishes to maintain, as now appears to be the case, that in most strains what we have is not whole chromosome aberration but a duplication of only parts of the chromosome, then surely some fundamental modification of the formulæ is necessary. This, in his letter, he does not permit. As, however, the critical details of the application of this modified interpretation of the chromosome aberration hypothesis have not yet been



published, to comment upon this aspect of the problem would be purely hypothetical.

Genetical data showing the inadequacy of the chromosome aberration hypothesis to explain Series-A fatuoid phenomena have already been published.<sup>3</sup> Recently, on the basis of cytological investigations of material supplied by Prof. Huskins, Nishiyama<sup>4</sup> has corroborated my conclusions in respect of Series-A fatuoids, namely, that they arise by mutations occurring in the C chromosome.

The validity of the chromosome aberration hypothesis as such does not necessarily arise in these discussions; the point at issue is its applicability as an explanation of the origin and behaviour of Series-A fatuoids, sub-fatuoids, and semi-fatuoid types which show regular and simple Mendelian segregation and possess normal ( $2n = 42$ ) chromosome numbers.

A theoretical case for opposite conclusions can very probably be made out, based upon the assumption of some form of chromosome duplication, but until the occurrence of the latter is substantiated, there are no convincing reasons why we should depart from the principle of complex gene mutation as first postulated by Nilsson-Ehle.<sup>5</sup>

E. T. JONES.

Welsh Plant Breeding Station,  
University College of Wales,  
Aberystwyth, June 24.

<sup>1</sup> Philp, J., NATURE, 129, 796, May 28, 1932.

<sup>2</sup> Jones, E. T., NATURE, 129, 617, April 23, 1932.

<sup>3</sup> Jones, E. T., J. Genetics, 23, 1930.

<sup>4</sup> Nishiyama, I., Japanese J. Genetics, 7, 1931.

<sup>5</sup> Nilsson-Ehle, H., Hereditas, 11, 401, 1921.

#### Inheritance of Fluorescence in Rye-Grass

I AM engaged on the cytology and genetics of perennial rye-grass (*Lolium perenne* L.) and Italian rye-grass (*L. multiflorum* Lam.). It is commonly believed that many plants intermediate between these two species are a result of hybridisation, and it was the object of the work to investigate this hybridism. In the course of the investigations, the inheritance of fluorescence of roots under ultra-violet light<sup>1</sup> has been studied. The fluorescent character which is found in Italian rye-grass and strains of 'false' perennial but not in true perennial rye-grass offered an opportunity for rapid classification of types.

Twenty-eight parent plants were tested for fluorescence after allowing tillers to grow roots on filter paper. Sixteen of these were 'non-fluorescent' and twelve were 'fluorescent'. These plants were self-pollinated by using cellophane bags, and the work was carried out under controlled conditions in the glasshouse. The seedlings resulting from the self-pollination were examined for fluorescence. Of 1459 seedlings tested from the 'non-fluorescent' plants, all except one (probably a contamination) were 'non-fluorescent'. Nine of the 'fluorescent' plants gave 100 per cent 'fluorescent' seedlings, the total number tested from these plants being 885. The remaining three 'fluorescent' plants produced both 'fluorescent' and 'non-fluorescent' seedlings. One of these gave 191 'fluorescent' and 65 'non-fluorescent' (a ratio of 2.94 : 1), another 126 and 40 (a ratio of 3.15 : 1), and a third 8 'fluorescent' and one 'non-fluorescent'. Insufficient seeds to give a significant result were obtained from this plant. The first two results, however, appear to indicate that fluorescence depends on a single Mendelian factor, and that the two parent plants are heterozygous for this factor.

The relationship between fluorescence and some botanical characters of the plants is of interest. The flowering glumes of the 'non-fluorescent' plants were awnless and the leaves conduplicate in the bud. The

flowering glumes of the plants which produced 100 per cent 'fluorescent' seedlings were awned and the leaves convolute in the bud, although, as is usual in *L. multiflorum*, the basal flowering glumes of the lower spikelets were often awnless. The three parent plants which produced both 'fluorescent' and 'non-fluorescent' seedlings differed from one another in awn characters. One was awnless, in the second there were a few flowering glumes with very short awns, while in the third some of the flowering glumes produced either short or well-developed awns. They were similar, however, in that in each case the leaves in the bud were conduplicate.

This work is being continued.

L. CORKILL  
(Macmillan Brown Agriculture  
Research Scholar).

Botanical Department,  
Massey Agricultural College,  
Palmerston North,  
New Zealand,  
May 16.

<sup>1</sup> Gentner, "Prak. Bla. f. Pflanzenbau und Pflanzenschutz", 1929; Linehan and Mercer, *Sci. Proc. Roy. Dublin Soc.*, 1931; Foy, *N.Z.J. Agr.*, 1931.

#### A New Method for Mitochondria

I HAVE recently found that quinone (parabenzquinone) has an intense fixative action upon mitochondria. It is best to treat tissues for an hour with quinone dissolved in saline first, and then to transfer them to any fixative one may choose. I have found this much preferable to using quinone-saline alone or mixing it with any other fixative. The quinone may be at any concentration from 0.05 per cent for delicate tissues (such as kidney) to 0.5 per cent for liver. Plenty of fluid should be used. The saline should be roughly isotonic with the blood of the animal used, but if the quinone is used at 0.5 per cent, it is as well to make the saline 0.1 per cent less concentrated than usual, so as to avoid having the fluid hypertonic. Surprisingly enough, Carnoy's fluid is one of the best fixatives to use after quinone. I have used the formula without chloroform.

It is remarkable that one hour's treatment with such a weak solution as 0.05 per cent of quinone should render the mitochondria insoluble in the fixative which is regarded as the most destructive of them. Bouin's fluid is also excellent after quinone-saline. One may stain with iron hæmatoxylin, or by Altmann's or Benda's method. In using Altmann's method, a convenient differentiator is one part of absolute alcohol saturated with picric acid to seven parts of 30 per cent alcohol, used cold. If one uses Carnoy's fluid and follows with Altmann's method, one may fix one's tissue in the morning and have finished slides of mitochondria in the evening. No special mordantage is required for subsequent staining in Benda's alizarin and crystal violet, which gives good results after Carnoy's fluid.

The technique has been worked out mostly with the liver of the newt and the liver and kidney of the guinea-pig. No advantage has been found in substituting other quinones for parabenzquinone.

Full details of the technique, with an account of the research leading up to it, will be published in the *Quarterly Journal of Microscopical Science*.

I wish to thank Prof. E. S. Goodrich and Dr. H. M. Carleton for helpful criticism of my slides, and Mr. C. E. J. Crawford for chemical advice.

JOHN R. BAKER.  
Department of Zoology and Comparative  
Anatomy,  
University Museum, Oxford, May 30.



## Research Items

**Indian Village Godlings.**—In an account of the cult of Bāro Bhāiyā, a form of 'demon worship' prevalent in Eastern Bengal (*J. and Proc. Asiatic Society of Bengal*, N.S., vol. 26, No. 1), Mr. Chintaharan Chakravarti points out that no trace of the religious rites of the village folk of India, often very interesting, is found in any scriptural text, though the people retain palpable traces of undoubtedly ancient rites. In the cult of Bāro Bhāiyā, or the Twelve Brothers, as observed in Kotālipādā in the district of Faridpur, the objects of worship are twelve brothers and their sister or mother. It is known also popularly as the cult of Vanadurgā (the mother of the twelve brothers) or Nisānātha. The brothers are described as demons and terrible in appearance. Any displeasure on their part brings disease and calamity. Vanadurgā has been described as a tree goddess, as her worship takes place under a tree and she has no separate image. There is no fixed time for the worship of these deities; but it usually takes place on Tuesdays and Saturdays and in the day-time. Generally no images are made; but there is an effigy of one of the brothers in a house in the village of Unasiā. At Kotālipādā the worship is performed at the base of a big Aśvattha tree, the place being known as Nisāi-kholā, or the place of worship of Nisāi. There is no provision for daily worship as in the temples. The rites of worship follow those laid down in the scriptures with regard to worship in general, except that the heads of the sacrificed animals are not taken back, but are left in the hollow of a tree. The mantras used are all in Sanskrit, and the whole worship has been made to conform to the Tantra form, the deities being given Sivaite implements and attributes, showing how a purely popular cult has been affiliated to Aryandom.

**Fortifications at Tell el-Ajjūl.**—Lieut.-Col. N. P. Clarke offers a reconstruction of the defences of Tell el-Ajjūl, Southern Palestine, so far as revealed by excavation to date, in *Ancient Egypt*, pt. 1, 1932. On the south-west side the tell is protected by the Wady Ghazze; on the remaining three sides by the Great Fosse, from which the earth was thrown out on the hill to form a slope of 35°; while the slope of the counterscarp is 1 in 4. The dominance of the site over the neighbourhood and its strength were due entirely to artificial works. On the north-east the ground was undulating and probably afforded cover to an attacking enemy. As might be expected, there appears to have been a work in this direction to deny this ground to an enemy. A pit has been discovered, the earth from which, contrary to normal practice, has been thrown *outwards* to form a bank. This was a self-contained outpost, the great depth of which gave perfect cover from archery. A tunnel leads from near the main entrance on the north-east side to the work, which holds, possibly, one hundred men. A sunken road also leads from the tell to the pit. A similar pit, which was probably also connected with the tell by a tunnel, lies several hundred yards to the north. These belong to the earliest system of defence, and there is evidence to suggest that they are of the copper age (3500–3000 B.C.) or shortly after. The northern trenched enclosure includes the pit outpost and must be later. A different system of trenches runs off the north-east corner; but instead of the irregular lines of the pits, the trenches run in long straight lines. They strengthen the entrance of the tell itself by outflanking any attack on the gates.

**The Trunk of a Mammoth.**—Some eight years ago a Tungus hunter found a well-preserved mammoth's trunk in the Bolshaya Baraniha River in Siberia, the first proboscis-tip to have been seen since the days of the palaeolithic age (Science Service, Washington, D.C.). After various wanderings, the proboscis-tip reached the Museum in Leningrad, and it has now been described by Dr. G. Flerof. In general, there is a resemblance to the trunk-tip of the Indian elephant, but the 'lip' is much longer and wider than that of any modern elephant and gives the entire tip a bilobed appearance. Its adaptation is towards the efficient plucking of large bunches of grass or moss, at which it would be more adept than Indian or African elephants, which feed largely upon the leaves of trees and shrubs. An interesting point, the report states, is that European cave drawings sometimes represent the mammoth as having a bilobed trunk-tip, and the recent discovery of the frozen specimen shows again how keen was the perception of the artists of the old stone age, and how accurate were their drawings.

**Bibliography of the Sardines.**—The sardine is of enormous commercial importance in both Europe and America. But throughout their entire existence the sardine fishing, curing, and canning industries have always suffered from disconcerting fluctuations in the stocks of the various sardine species. On both sides of the Atlantic much research has therefore been undertaken in an as yet more or less unsuccessful attempt to elucidate the life histories of these fishes and to understand the causes underlying their erratic habits. A vast and scattered literature has therefore grown up around them. In order to facilitate reference to all the published works on *Sardina pilchardus* (Europe), *S. melanosticta* (Japan), *S. ocellata* (South Africa), *S. saxax* (west coast of South America), and *S. caerulea* (west coast of North America), a bibliography has been compiled and is now published as *Fish Bulletin* No. 36 of the Bureau of Commercial Fisheries, California. With few exceptions, the compiler, or her associates, has consulted every paper or publication listed, and a brief summary of the contents of each is appended immediately following the title. The usual system of listing the authors alphabetically and the papers of each author chronologically has been adopted. This carefully compiled and very full bibliography should prove of immense benefit to all students of the sardine in the spheres of both natural history and of commerce. Copies are offered free of charge to interested persons and in exchange for the publications of other bodies engaged in marine research. Address: California State Fisheries Laboratory, Terminal Island, California.

**Indian Fungi.**—Dr. E. J. Butler and Dr. G. R. Bisby have recently published a book which attempts to collect together our knowledge of the fungi of India (The Imperial Council for Agricultural Research, Scientific Monograph No. 1: "The Fungi of India". Government of India Central Publication Branch, Calcutta, 1931, pp. 237, 11s.). The authors have consulted more than five hundred scientific papers, and have compiled a descriptive list which should help the student of mycology in the large area under review. The introduction is perhaps the most interesting part for the general student. Comparisons of the fungus floras of India and Europe are made, and show that more than twenty-three per cent of the total number of species are also represented in Europe. This is more than the proportion of phanerogams, for only six per cent of the number of species of flowering



plants occur also in Europe. There are other interesting comparisons of distribution which should interest the ecologist as well as the student of mycology. An extensive list of synonyms is given and will go far towards clearing up many difficulties of nomenclature.

**Twisted Trees.**—Recent observations of trees the trunks of which have a clockwise or counter-clockwise twist appear to show that this is not produced either by the wind or by any reaction to the movement of the sun. Mr. F. Knorr (*J. Heredity*, vol. 23, No. 2) has made a number of further observations on conifers in California. In 1926, search disclosed 486 twisted trees, in 44 per cent of which the twist was clockwise, 56 per cent the reverse. The following year, with still larger numbers belonging to six species, 27 per cent of the trees were found to be twisted, 52 per cent of them clockwise. In later years it was found that only part of the species in a particular area would show twisting. In the giant redwood and in certain deciduous trees, secondary growths showed the same twist as the parent trees. Examination of conifer seedlings showed that the twisting begins with the woody thickening both in stem and root, while in older trees the branches and twigs show the same twist as the main trunk, although the intensity of twist may vary to some extent. These observations all suggest that twisting of the wood may be a genetic character, and if this is the case, the habit of western lumbermen in leaving twisted trees for seeding purposes because they are of less economic value will be very unfortunate in its effects.

**Microscopic Determination of Ore Minerals.**—The optical and microchemical study of opaque minerals is now reaching a mature stage in its development. The most recent work on the subject in English (*U.S. Geol. Surv., Bull.* 825, 1931, pp. 204) has been written by M. N. Short, who has himself been occupied with the investigation of improved methods during the last four years. From a research point of view, the book is noteworthy because, for the first time, full determinative tables are given incorporating the effects of polarised light on polished surfaces of ore minerals. A far-reaching and critical study of qualitative microchemical tests for elements forms the basis of another and equally useful set of determinative tables. A combination of these two methods with the etching processes devised by Davy and Farnham, Murdoch, and others brings the whole technique up to the level of reliability attained by the better known petrographic methods involving the use of transmitted light. The work concludes with a list of specific tests for minerals, the latter being arranged alphabetically. It is obtainable from the Superintendent of Documents, Washington, D.C., at a cost of 60 cents.

**Boring for Oil in Egypt.**—The third section of the Report on "Boring for Oil in Egypt" (Cairo: Government Press, 1931) deals with the eastern desert and adjoining islands. Mr. T. Sutton Bowman gives a full and detailed account of his investigations of the samples from various wells drilled in this territory, and the report is of note as being one of the few lengthy expositions on the use of sedimentary petrography ('heavy' minerals, etc.) in oilfield (subsurface) problems, published outside America. The specialist in this subject will profit by reading Mr. Bowman's account of his methods and findings, and while some of the former are open to criticism, there is little doubt that this region has provided yet another case of the value of intensive petrological work in competent hands. The stratigrapher will find that the problem of the Nubian Sandstone has been re-attacked, and, although admittedly the evidence is at present

of local significance and based on work which is incomplete, the sharp petrographic distinction established between the Cenomanian on one hand, and the Turonian and Santonian and true Nubian Sandstone on the other, is indicative of at least a promising means of analysing this composite lithology in other regions of Egypt.

**Greenland Weather.**—The weather of Greenland has importance in the institution of a great circle flying route between Great Britain and North America, and was investigated by the recent British Arctic Air-Route Expedition. Some results are given in a paper by Mr. S. T. A. Mirrlees in the *Geographical Journal* for July. During summer, visibility on the east coast was good when once the low fog belt over the pack ice was left behind, and during winter, apart from the short hours of daylight, it was fairly good. Winds on the east coast were light in summer, but gales were very frequent in winter and of great violence. They were, however, local and might possibly be avoided if choice of landing places were available. The observations from the ice cap station are, however, the most important and cover a period of about eight months. Poor visibility showed a frequency of 44 per cent, but probably drifting snow accounted for fully half of these occasions, and since the drift layer is shallow, it would not affect aviation. Strong northerly winds were frequent and calms rare, but gales were less common than on the coast. The average temperature of the air on the ice cap varied from 2° F. in September to -33° in February, and the variation of temperature was great from day to day and depended on the direction and force of the wind. Inversion of temperature at heights of 1000-1500 ft. was found to be common, and the lowest temperature recorded at those heights was -14° F., but there are no records for June, July, October, and November. Cloudiness at the ice cap station was small. Flight-Lieut. D'Aeth concludes that a summer flying route over Greenland would be entirely practicable, but that winter flying would be difficult and necessitate an efficient ground organisation.

**Structure of Atomic Nuclei.**—Now that neutrons have been detected as probable products of the artificial disintegration of light elements, it will be necessary to accommodate them in some way in the scheme of nuclear structures. An attempt at this has been made by F. Perrin (*J. Physique*, May, p. 96, S.). In his first scheme, the particles employed for the light elements are helium nuclei ( $\alpha$ ), neutrons ( $\omega$ ) and protons ( $\pi$ ). The scheme explains nicely the strong emission of neutrons, without protons, in the artificial disintegration of beryllium, the structure of which becomes  $2\alpha 1\omega$ , and is otherwise fairly satisfactory, except in the case of nitrogen, which, written as  $3\alpha 1\omega 1\pi$ , should apparently be capable of giving neutrons as well as protons, whereas the former are not emitted. Largely on this account, a second scheme, which is highly suggestive, has also been proposed, in which the protons are supposed linked up with neutrons to give 'demihelions' ( $\eta$ ), particles of mass 2 and unit charge, which are in fact known now through the discovery of the heavy 'hydrogen' isotope spectroscopically. On this scheme beryllium remains the same as before, but nitrogen becomes  $3\alpha 1\eta$ . The important implication of this second scheme is that the particles produced in artificial disintegration which have been generally supposed to be protons may actually be demihelions. The experimental evidence already extant should be adequate to decide this point, but it is noted that it could at least account for certain features of Blackett's photographs of the artificial disintegration of nitrogen. Perrin also gives



schemes for the nuclear structure of the elements from neon to potassium, analogous to his second scheme for the lighter elements, but with the modification that the maximum number of  $\alpha$ -particles which could occur on purely numerical grounds is not employed, to obtain agreement with the results of disintegration experiments. It is interesting to note that there is some indication from this of why potassium (41) should have a natural radioactivity.

**The Bleaching of Cellulose Materials.**—In 1927, Clibbens and Ridge, of the Shirley Institute, carried out some important work on the action of chlorous bleach liquors on cotton, and revealed the surprising fact that in such cases the degradation of the cellulose was most rapid at a pH value of about 7, that is, at the neutral point. Subsequent work by Kauffmann, Weiss, and others, along different lines, has led to the same conclusions, although none of the theories advanced in explanation is entirely satisfactory, since they ignore the effects of variations in the concentration of cellulose. The problem has now been

attacked from the point of view of the bleaching of wood cellulose by F. H. Yorston, of the Canadian Forest Products Laboratory (*Proc. of the Canadian Pulp and Paper Assoc.*, p. 31; 1932), who has found that an experimental bleaching mixture may be buffered to a pH value of 8.8-9.2 by addition of light magnesia, increase in acidity by neutralisation of the free lime by carbon dioxide being thereby avoided. In addition, it was possible to follow the rate of reduction, at pH 9, of hypochlorite by pulps which had already consumed various amounts of bleach, and to show that this reaction is monomolecular with respect to hypochlorite. It is concluded that the proportion of those substances present in the pulp in relatively high concentrations (for example, celluloses and pentosans) is probably little changed by the action of the hypochlorite, especially if allowances are made for the effect of the oxidation of soluble lignins on the apparent rate of reduction of hypochlorite and for the autodecomposition of the hypochlorite itself. An additional observation of interest is the superior colour of pulps bleached in an alkaline medium.

**Astronomical Topics**

**Comets.**—It is now established that there was a nebulous object near Newman's comet on the evenings of June 25 and 29. *U.A.I.Circ.* 392 contains a letter from Dr. Schmitt stating that he observed the object visually on June 29 with the Algiers equatorial, and also found it on his plates; he then examined the two exposures made on June 25, and found two images that indicated nearly the same motion as that of Newman's comet, which was registered on the same plate. On the first four days of July, observers at Bergedorf, Neubabelsberg, Heidelberg, Norwood, Yerkes failed to find any companions to Newman's comet, but on July 6 and 7, M. Delporte photographed two companion bodies at Uccle. Computations by Dr. M. Davidson make it unlikely that either of these is identical with the object of June 25 and 29.

A plausible conjecture is that Newman's comet has been expelling a series of vaporous masses, which have remained visible for a few days and then dissipated. The following table gives the distances of the three objects from Newman's comet:—First Object, June 25, E.100.43<sup>sec</sup>, N.11' 44.8"; June 29, E.114.42<sup>sec</sup>, N.7' 29.9"; Second Object, July 6, E.49.17<sup>sec</sup>, S.3' 34.9"; July 7, E.47.09<sup>sec</sup>, S.1' 45.4"; Third Object, July 6, W.65<sup>sec</sup>, N.7'; July 7, W.68<sup>sec</sup>, N.5'. It will be recalled that the great comet of 1882 expelled several portions. A sketch by C. L. Prince on Oct. 23 showed 4 nuclei (see Chambers' "The Story of the Comets", page 152, which also records that "on one occasion the comet seems to have thrown off a mass of matter which became, and for several days was observed as, a distinct comet").

*Harvard Cards* No. 224, 225, 227 give the following positions of comet 1932 g (Geddes). They are for the equinox of 1932-0. The observers at Cordoba were Dr. Bobone and Mr. Tretter; at La Plata, M. Dartayet. The magnitude was 9.

U.T.	R.A.	S.Decl.	Place.
June 25-9666	10 <sup>h</sup> 43 <sup>m</sup> 13.5 <sup>s</sup>	81° 43' 38"	La Plata.
27-0366	10 55 16.7	80 53 25	Cordoba.
27-9847	11 4 30.4	80 7 46	Cordoba.
29-0740	11 13 28.3	79 14 40	La Plata.

An erroneous position was given in *Card* 226; it is corrected in *Card* 227.

**Hydrogen Content of the Stars.**—Sir Arthur Eddington pointed out some years ago that the discordance between the calculated and observed brightness of

the stars (the calculated one being about ten times too bright) could be removed by supposing a larger proportion of hydrogen in the stars than at that time seemed probable. He now gives reasons for believing that the proportion of hydrogen is actually large enough to remove the discrepancy (*Mon. Not. R.A.S.*, April). He shows that there are two solutions for the percentage of hydrogen, one 33 per cent, the other 99.5 per cent. He regards the smaller value as more probable, but does not absolutely rule out the larger one; five cases are worked out: the sun, Capella, Krueger 60, Algol, V Puppis. The agreement is close except in the case of the last star; it is suggested that the proportion of hydrogen may be greater in very massive stars.

Sir Arthur notes that a paper by Dr. B. Strömgren, which he did not receive until his own was nearly finished, deals with the same problem and reaches results in very good agreement with his. The existence of the second solution with the very high percentage of hydrogen was noticed by both investigators. Incidentally, Sir Arthur notes that he has changed his adopted value of the sun's absolute bolometric magnitude from 4.85 to 4.60.

**A Hebrew Zodiac.**—Mr. Moses B. Cotsworth, the well-known advocate of calendar reform, reproduces in his Pamphlet *W*, issued last year, a photograph of a zodiac, executed in mosaic work, which was discovered in 1929 under the ancient synagogue of Beth Alpha, in the valley of Jezreel; the date is conjectured to be the reign of the Emperor Justin, A.D. 518-527. Several of the figures depart considerably from the usual types. The Lion has its head towards the Virgin, the Scorpion towards the Archer, the Scales are in a man's hand (possibly to correct the anomaly that the Scales, being an inanimate object, break the circle of living things). The Hebrew names of the constellations are inserted, and several of them are distinctly legible in the reproduction: Shor the Bull, Ariyah the Lion, Bethulah the Virgin, Aqrab the Scorpion, Qesheth the Bow; the others are indistinct. Mr. Cotsworth states that a similar zodiac has since been discovered near Jericho. The late Mr. E. W. Maunder, in his "Astronomy of the Bible", collected several passages in the Old Testament that might be allusions to the signs of the zodiac; but this is the first distinctly Hebrew zodiac that has come under the notice of the writer of this note.



## Annual Conference of the Museums Association

THE forty-third Annual Conference of the Museums Association was held at Birmingham on June 27–July 2, by invitation of the Lord Mayor and Corporation. This is the first time that the Association has visited the City. The University authorities very kindly placed lecture and office accommodation in Mason College, Edmund Street, at the disposal of the delegates, and here some two hundred members of the Association met under the presidency of Sir Henry Miers.

Owing to the prevailing financial conditions, the number of delegates was somewhat smaller than usual, but the Conference was noteworthy in that the social side was reduced to a minimum, and the numerous papers provoked animated, if not always appropriate, discussion.

In his presidential address, Sir Henry Miers gave an encouraging account of the past year's work. With the assistance of the Carnegie United Kingdom Trustees, grants have been made to certain municipal museums for the reorganisation of their collections, and short training courses for curators were held in London and Edinburgh. With the generous co-operation of the Carnegie Corporation of New York, surveys of museums in Canada and Africa were carried out by Sir Henry Miers and Mr. S. F. Markham, in the Mediterranean by the honorary treasurer and honorary secretary of the Association, and of the museums of Montreal by Dr. Cyril Fox, director of the National Museum of Wales. As a result of these surveys, directories of museums in Canada and Africa are in preparation which will contain data hitherto impossible to obtain even from the statistical departments of the appropriate governments.

Other matters of importance concerning museums which Sir Henry dealt with were co-operation between the national and provincial museums, and the expressed desire on the part of the national museums to assist so far as possible the small museums; the Board of Education pamphlet on "Museums and the Schools"; the work of the federations and the recent formation of a new federation, the South-Western Group of Museums and Art Galleries; co-operation with the British Broadcasting Corporation; and the improved status of the curator which is likely to result from the adoption of the diploma scheme. Sir Henry also commented on the increased usefulness of the *Museums Journal*, and reported that the membership of the Association had increased during the year from 516 to nearly 800.

At the conclusion of the address, the honorary treasurer (Alderman Charles Squire) presented Sir Henry with two bronze pieces of sculpture by Allan Howes, as a mark of the Association's appreciation of his services as president during the last four years.

Following the presidential address, Dr. G. F. Hill, director and principal librarian of the British Museum, opened a discussion on "Co-operation between National and Provincial Museums". He deplored the splitting up of collections and their subsequent distribution to different centres, as well as the retention locally of unique or historical specimens which fit properly into the series of our great national museums but obviously are out of place, unsafe, and lack true appreciation in the local museum. He also dealt with loan collections and the presentation of duplicates or casts and electrotypes to smaller museums by the larger institutions.

Subsequent speakers from the London museums elaborated these points, and their views appeared to

meet with approval from their provincial colleagues. The remainder of the morning was occupied by Miss M. H. Keating's description of a travelling exhibition which she has prepared to illustrate child welfare work, and later in the day the delegates were able to inspect part of Miss Keating's exhibition.

Wednesday provided a varied programme of great interest. Dr. Alexander Scott described the work and methods of the British Museum laboratory in cleaning and restoring metal objects, and the results obtained, as illustrated by lantern-slides, aroused the enthusiasm of the audience and provoked numerous inquiries. Mr. S. L. Davison, of Port Sunlight, described the objects and methods of the Regional Federations of Museums, basing his remarks on his experience with the Lancashire and Cheshire Federation. "Modern Methods of Examining Pictures" was the subject of a delightful and practical exposition by Prof. A. P. Laurie, who made difficulties seem easy and constantly captured the admiration of his hearers by his wide knowledge of the history of pictures and artists. In the afternoon, Dr. L. J. Spencer explained how he illuminated the cases and specimens in the Mineral Department of the British Museum, and thus provoked a discussion of primary importance to the delegates. From the consideration of the lighting of museum cases to that of the illumination of a child's mind is no mean step, but the audience accomplished the transition safely and pleasantly under the guidance of Miss M. Champness, who described her work in the Newbury Museum.

From the subsequent discussion it appears that most curators are agreed that the handling of specimens by the child is of primary importance, while the 'once upon a time' method of telling a story, the provision of seats for the small listeners, and, if possible, the use of a special room away from adult interference, all contribute to the success of the instructional classes.

Most of Thursday morning was devoted to the annual business meeting, but the Association welcomed Mr. R. A. Rendall, of the B.B.C., who inaugurated a discussion on broadcasting and museums. Mr. Rendall outlined the educational policy of the Corporation, and hoped that the art galleries and museums might assist the broadcast of talks by arranging cognate exhibits, or by installing a loud-speaker in the institution for the benefit of organised discussion groups.

The morning of the last day of the Conference was devoted to a summary, by Mr. G. H. Hill, of publicity methods and extension work as at present practised by museums, and to Mr. D. Payler's description of his work in the Birmingham Museum in preparing economic and other exhibits. Dr. Cyril Fox, as chairman of the Education Committee, outlined the newly prepared scheme for a diploma to be awarded to curators after examination. Space does not permit the explanation here of the detailed proposals, but the scheme found favour, as it is definitely practicable and is based on a high enough standard to ensure the recognition of the diploma as a sound educational and curatorial qualification.

An official visit was paid by the Conference to the Museum and Art Gallery, where the delegates enjoyed the magnificent art collection and the pleasing habitat groups of birds and mammals under the guidance of Mr. S. C. Kaines Smith, the keeper, and Mr. Donald Payler, respectively. An unusually large trade exhibition was also staged in the Art Gallery.



## Chemical Societies and Co-operation

IN his presidential address to the Society of Chemical Industry at Nottingham on July 13 under the title "Ourselves and Kindred Societies", Prof. G. T. Morgan discussed various aspects of the problem of reunion or co-operation among societies concerned with the furtherance of the professional and scientific welfare of chemists. The original territorial organisation of the Society of Chemical Industry in local sections holding their own meetings and other activities has in recent years been supplemented by the inception of subject groups, commencing with the Chemical Engineering Group in 1918.

Two such groups, the Food Group and the Plastics Group, have been formed during the past year, and this development alone is one which induces consideration of the relations of the Society with certain specialist societies and the possibility of such fusions or federations as was witnessed in 1882, when the Newcastle Chemical Society threw in its lot with the Society of Chemical Industry, and again this year, between the Food Group and the Society of the Food Industry.

An analysis of fourteen out of the sixteen separate societies concerned with the scientific and professional interests of chemists shows that the societies in 1930 had a total membership of 23,605 and a combined income from subscriptions of £46,557. Ignoring the fact that many individuals were members of several societies, the average annual subscription is thus about £2, the expenditure of which is divided as follows: 32.5 per cent for scientific literature, 6.5 per cent on social amenities, 6 per cent on library facilities, and 55 per cent on administration. This latter high proportion is attributed to the reluctance of chemists to assume such functions, and while paying tribute to the efficiency of administration of the societies generally, Prof. Morgan suggested that an important means of reducing this proportion of expenditure would be found in the societies drawing closer together and centralising or simplifying office appointments as losses from the staffs occurred through retirement, resignation, or other causes.

So far as the publication of scientific literature is

concerned, the main burden is shared by the Chemical Society and the Society of Chemical Industry, and the formation of the Bureau of Chemical Abstracts already represents a measure of co-operation between the two Societies which, by eliminating duplication, adoption of a single format and index, etc., has enabled them to deal with the increasing volume of literature which requires abstracting. Attempts to organise an Anglo-American scheme have so far fallen through, but if the fourteen societies could collaborate in technical publication and pool their financial resources, there appears to be every prospect of the Bureau being able to deal effectively with the steadily increasing number of original memoirs in all branches of chemistry, unembarrassed by financial anxiety.

Following this step of co-operation in abstracting, Prof. Morgan suggested that the publication of joint in place of individual transactions would be a further economy. The steps recently taken by the Faraday Society and the Chemical Society for publishing ordinary contributions to the Faraday Society and physico-chemical papers of the Chemical Society as a new joint journal is an example that might well be followed. Similarly, the possibility of a joint chemical newspaper which would replace the more ephemeral part of *Chemistry and Industry* might also be well worth exploring. This journal would be able to present a wide survey of current topics of personal interest to English-speaking chemists, as well as including progress reports and summaries of scientific researches, and affording a suitable medium for the publication of the jubilee lectures or the lectures now arranged by the Institute of Chemistry on modern developments in the main branches of chemistry.

Improvement of library facilities, research facilities, and vocational education in chemistry are other matters that might be expected to follow the reunion or rationalisation of the profession. Effective action can, however, only be expected when, as Prof. Morgan pointed out, the members of the individual societies face the problem from the point of view of the well-being of the profession as a whole and not of the interests of an individual society.

## Sunset Glows and the Andean Eruptions

ATTENTION was directed in NATURE of June 25, p. 932, to a report from Johannesburg of sunset afterglows in South Africa following the eruptions in the Andes last April. Two other correspondents have been kind enough to send further extracts from letters from the same place. Mr. A. Stanley Pye-Smith, 51 Wickham Road, Beckenham, Kent, sends the following extract from a letter dated May 3: "We are having very wonderful sunrises and sunsets, as a result of the volcanic dust from South America. The sky glows red long after the sun is visible, while there are no clouds at all to catch the light, as far as one can see. It is a pleasant change to have prolonged light in this latitude where darkness falls so quickly." Miss Cecilia F. O'Connor, 402 Milton Road, Cambridge, has sent extracts from a letter, dated May 4, received from her brother, Mr. E. R. O'Connor, Germiston, Transvaal, which give more precise details, stating that "at sunset the colours are magnificent, but it is about an hour later when they are best. Normally at that time it is pitch dark. But now the western sky is lit a flaming red light to the zenith—as though there were a huge volcano belching out

volumes of fiery smoke. The red light is so powerful that everything catches a reflected tint, but yet you can see stars shining through, even to the west! What clouds there are, are etched in flame, and, towards the zenith, the red shades through purple to the ink blue of night." The same writer in a further letter, dated May 18, describes the sunsets as appearing to get finer, possibly because of the unsettled weather.

A letter, dated May 20, since received from Dr. E. Kidson, director of the Meteorological Office, Wellington, New Zealand, suggests that the volcanic dust had travelled on with the prevailing westerlies to New Zealand early in that month; it is probable therefore that the complete circuit of the southern temperate zone has long since been completed. Dr. Kidson describes the sunset afterglows that began about the end of the first week in May as very beautiful, ranging in colour from pale pink to yellowish pink in the western sky, the appearance showing a certain amount of structure suggestive of thin high smoke. Several reports of unusual manifestations of halo or corona have been received by his Department.



A particularly interesting point to which Dr. Kidson directs attention is that daily determinations of the intensity of the solar radiation at noon, made with the aid of an Ångström pyrheliometer, showed a sudden decrease of about ten per cent on May 5 and a slight recovery since. As an effect of this kind is likely to be general over the region affected by volcanic dust at high levels, it appears probable that the excess of solar radiation now being received by the earth's surface over the northern as compared with the southern hemisphere, on account of the season, is distinctly greater than usual. Although some effect on the weather is probable, it would be unsafe to refer abnormal weather at a particular place to this source, and there are not enough meteorological observatories at present to allow of a comparison between average weather conditions in the two hemispheres before and since the eruptions, in order to trace their effects.

E. V. N.

### The Laboratory for Fresh Water Biological Research on Windermere

IN Great Britain, research on fresh water biological problems has, for many years, suffered from the lack of adequate laboratory facilities—a curious fact since so much valuable pioneer work has been done in the British Isles, particularly on the lakes. The opening, last September, of a laboratory under the control of the Fresh Water Biological Association of the British Empire has removed this drawback, and investigators wishing to pursue the various branches of fresh water research can now be assured of obtaining the requisite facilities.

The laboratory is situated in Wray Castle, about three miles from Ambleside and on the north-west shore of Windermere. The lake reaches its maximum depth, just over seventy metres, about a quarter of a mile from the boat-house, and different types of inflowing streams and of shore lines are within a convenient distance. There is also a large number of streams and of smaller bodies of standing water within a short distance of the laboratory, these including examples of very diverse types, while almost the whole range of British fresh water habitats can be found within a distance of fifteen miles. There is thus abundant scope for biologists interested in plants or animals of special groups or in their habitat conditions.

The laboratory is equipped for most of the usual types of biological research. It contains ample facilities for microscopical and for experimental work, both purely physiological and also chemical. Gas for heating purposes is provided from a petrol-air installation. There is a large range of basement cellars which are used for aquaria or for storage purposes, while dark rooms are also available. The usual equipment for plankton investigation is provided, and for this and other forms of lake work a motor launch is available, as well as a smaller boat. This launch is a twenty-four-foot sea-going pinnace, fitted with gears so that very low speeds can be maintained for dredging operations. It also has a derrick and a winch driven by the motor for lifting heavy apparatus. The launch is provided with electric light and navigation lights for night work.

Persons working in the laboratory can obtain a variety of accommodation in Ambleside, and simple accommodation is available in the Castle itself, rooms having now been fitted up for this purpose. Inquiries about working places and research facilities may be made to the Naturalist-in-charge, Wray Castle, Ambleside, Westmoreland, or to the Honorary Director, Dr. W. H. Pearsall, The University, Leeds.

### The Neutron

A GROUP of three important papers on the production and properties of neutrons has appeared in the June number of the *Proceedings* of the Royal Society. The first, by J. Chadwick, is an account of his own experiments and a general discussion of the problems involved.

The experiments are in principle quite simple. Beryllium or boron is exposed to the  $\alpha$ -particles of polonium, and the resulting penetrating radiation, probably a mixture of  $\gamma$ -rays with neutrons, examined with an electrical particle counter. The neutron has the property, otherwise only associated with radiation quanta, of being recorded by the secondary ionising action of some particle with which it has collided—in this case usually, if not invariably, the nucleus of an atom. Apart from the use of one of the new forms of electrical counters, the main point of the experiments seems to be that a very strong preparation of polonium is required.

Amongst the interesting questions which are touched upon in Dr. Chadwick's survey are the effective collision area which various nuclei offer to a neutron and the allied problem of the nature of the interaction. Dr. Chadwick finds by direct experiment that both for light and heavy nuclei the effective area is not much different from the usually quoted values for the size of the nucleus, and since experiments with lead indicate that neutrons are scattered about equally well in all directions, he suggests that the interaction may occur well inside the nucleus, which is in accord with the very limited region throughout which a neutron would be expected to have an appreciable field.

The other papers, by N. Feather and P. I. Dee, are concerned with the application of the Wilson cloud chamber to the problem. Dr. Feather has obtained a number of photographs of the collisions between neutrons and nitrogen nuclei, in which, on account of its negligible interaction with electrons, the neutron itself does not give a trail. The collisions appear to be of several types. In some, presumably elastic, there appears only the short, heavily ionised trail of the fast nitrogen nucleus which has been set in motion. The inelastic collisions were of two main types, in the first of which the neutron is captured and an  $\alpha$ -particle liberated, whilst in the second the neutron is not captured but probably a proton liberated.

Mr. Dee's contribution is a search for visible evidence of the interaction of neutrons with the electrons of molecules in the air, using a most carefully adjusted Wilson chamber. This was not found, and the quantitative formulation of his results shows that the probability of interaction of a neutron with an electron, with the production of a recoil electron track, is less than one per cent of the probability of similar interaction with a nitrogen nucleus. The ionisation along the path of a neutron is given as less than one ion pair in three metres of air.

### University and Educational Intelligence

ABERDEEN.—The University Court has decided that in future the professor of surgery shall devote the greater part of his time to the duties of the chair, and that his private practice will be limited to cases seen and treated in Aberdeen—with rare exceptions. It is understood that preference will be given to those candidates of wide experience of clinical surgery and acknowledged power of teaching who, by their special training and record, have given evidence of their capacity for and interest in research. The appointment to the chair is made by the Crown on the recommendation of His Majesty's Secretary of State for Scotland.



THE following appointments have been made at Armstrong College, Newcastle: Dr. H. L. Riley to be professor of inorganic and physical chemistry; Prof. G. R. Clemo to be director of the Department of Chemistry.

A CHELSEA Polytechnic Old Students' Association is to be inaugurated at a meeting to be held on Nov. 4, on the occasion of the opening of the Polytechnic extension by the Parliamentary Secretary to the Board of Education, Mr. H. Ramsbotham, M.P. Old students wishing to be present at the meeting, or who desire particulars of the Association, should address communications to the Honorary Secretary, Chelsea Polytechnic Old Students' Association, Manresa Road, Chelsea, S.W.3.

DR. C. B. MARSON has been appointed head of the Chemistry Department of the Hull Municipal Technical College. Dr. Marson received his early training as an analytical chemist with Capt. J. A. Foster of Hull, and was for some time in the laboratories of the British Thomson-Houston Company at Rugby. After War service, he took a course in fuel and metallurgy at the University of Leeds, leading up to the B.Sc. degree, and for two years held the gas research fellowship of the Institution of Gas Engineers, working on the influence of inorganic constituents on the properties of coke. He was then appointed on the staff of the Joint Research Committee of the University of Leeds and the Institution of Gas Engineers, from which he proceeded to the position of chief chemist to the Northern Coke Research Committee.

SCHOOL buildings obviously condition the efficiency of school work just as factory buildings condition industrial efficiency in ways that admit of exact measurement, and the methods of investigation which the National Institute of Industrial Psychology has applied with notable success in the latter field are now being applied, on the initiative of the National Union of Teachers, in the former. The N.U.T. has issued a pamphlet containing a report, presented at a recent conference of local education authorities, on the progress of the enterprise. The problems dealt with include lighting, ventilation, heating, seating, staff rooms, workshops, playgrounds, cloakrooms, and blackboards, but the report is concerned chiefly with lighting. Exact measurements have demonstrated the supreme importance of good illumination, owing to its twofold influence in decreasing the time required for perception and in decreasing nervous and ocular strain, with consequent improvement in both quantity and quality of work. The value of window cleaning (so justly emphasised in a less enlightened age by that underrated educationist, Dr. Squeers) assumes a new importance when exhibited in graphs and percentages, and surprisingly good results are shown to be obtainable by attention to the amount of light reflected from furniture and walls. Some of the diagrams used are reproduced from "Seeing", by M. Luckeish, director of the Lighting Research Laboratory, Cleveland, U.S.A.

A SCIENTIFIC basis for national development was the aim of Senator Morrill, the promoter of the remarkable movement which, seventy years ago, brought into existence the 'land-grant' universities and colleges of the United States of America. In a summary—published as *Bulletin* No. 20, 1931, of the Office of Education, Washington—of an exhaustive report on these institutions, it is claimed that this aim has been achieved, and that they not only have added enormously to the nation's wealth, but also have

helped to develop a new concept: government by science. By humanising scientific knowledge, they have, it is said, immeasurably improved the social life of millions of citizens who otherwise would tend to isolation from more favoured groups. The aggregate amount of their annual budgets exceeds one hundred million dollars, and their student enrolment exceeds three hundred thousand. Obviously they must have been and still are a potent factor in American culture, but as for the claim that they have achieved Morrill's object, this cannot easily be reconciled with Prof. John Dewey's contention in "Philosophy and Civilisation" (reviewed in *NATURE* of March 5) that the "disorder, confusion, and insecurity" characteristic of American social life are due to "our half-way and accidental use of science". In the same bulletin are summarised the results of another important national survey, that of negro colleges and universities, and a description is given of the purpose and organisation of three others now under way, those of secondary education, the education of teachers, and school finance.

### Calendar of Geographical Exploration

#### July 24, 1862.—Central Australia

J. M. Stuart reached the coast of north Australia at the mouth of the Adelaide River near Port Darwin, thus achieving his aim of a land journey from south to north of the continent. Stuart's explorations began in 1858 in the country north of Lake Gairdner; in 1860 he discovered the Alberga and Finke Rivers and the MacDonnell range of mountains.

#### July 26, 1529.—Discovery of Peru

Francisco Pizarro was appointed governor of the newly discovered regions in Peru (New Castile). Pizarro had accompanied Balboa in the discovery of the Pacific and had there heard of the gold of Peru. In 1524 he had sailed from Panama and after three years of hardship reached the River San Juan. From that river one of his officers, Bartolomé Ruiz, set out in a small ship, crossed the equator, and sighted Peru. He brought back glowing reports of its gold and silver, and this led Pizarro to return to Spain to obtain help from the Emperor, Charles V. He started his return journey from San Lucar in 1530 and at the beginning of 1531 was *en route* for Cajamarca. By the end of 1533, Pizarro, like Cortes, sent out numerous exploring parties, the marches of which opened up much of the interior of South America.

#### July 27, 1767.—Discovery of Tahiti

Capt. Samuel Wallis left Tahiti (Otaheite), which he had discovered and where he made a long stay, sending an exploring party to the interior which reported on its great fertility. Various other small islands were discovered by Wallis on this voyage, which lasted from 1766 until 1768.

#### July 30, 1774.—South Russia and Siberia

P. S. Pallas returned to St. Petersburg after a journey which had lasted since June 21, 1768. He first investigated South Russia and the Caspian region. Later he wintered at Tobolsk, and then carried out researches into the morphology of the Altai Mountains and the region of the Upper Irtish. In 1772 he crossed Lake Baikal and explored the Upper Amur, and in the following year worked in the region of the Lower Volga. His observations helped to elucidate the problem of the origin of mountain ranges; he also collected much information about the natural history and economic conditions of the regions he studied.



## Societies and Academies

LONDON

**Mineralogical Society, June 7.**—J. E. Drugman and Max H. Hey: Legrandite, a new zinc arsenate. A yellow transparent mineral on a single specimen of blende proved to be a new zinc arsenate. Chemical, optical, goniometric, and X-ray measurements were made, and the name legrandite is proposed for the new mineral, the formula of which is  $Zn_{14}(AsO_4)_9OH \cdot 12H_2O$ .—W. F. P. McIntock: The metamorphism produced by the combustion of hydrocarbons in the Tertiary sediments of south-west Persia. At various localities in south-west Persia, the escape and combustion of gas or oil have resulted in the brecciation, partial fusion, and crystallisation of calcareous marls with the formation of crystalline rocks consisting of pyroxene (diopside, ægirine-augite, and ægirine), wollastonite, pseudo-wollastonite, bytownite, melilite, and leucite, with glass, recrystallised calcite, and anhydrite. In the field, the rocks resemble vesicular igneous types, but microscopic examination and chemical analyses, accounts of which are given, prove them in all cases to be metamorphosed sediments.—F. A. Bannister: The determination of minerals in platinum concentrates from the Transvaal by X-ray methods (with chemical analyses and syntheses by M. H. Hey). X-ray rotation photographs have been used to distinguish and select for chemical analysis the various platinum- and palladium-bearing minerals present in the concentrates of Bushveld platinum ore. The name cooperite is retained for PtS, tetragonal, space-group  $D_{4h}^9$ . The face-centred unit cell with edges  $a=4.91$ ,  $c=6.10$  Å., contains 4PtS. The atomic co-ordinates for platinum in this cell are  $\frac{1}{4} \frac{1}{4} 0$ ;  $\frac{3}{4} \frac{3}{4} 0$ ;  $\frac{1}{4} \frac{3}{4} \frac{1}{2}$ ;  $\frac{3}{4} \frac{1}{4} \frac{1}{2}$ , and for sulphur:  $0 0 \frac{1}{2}$ ;  $0 0 \frac{3}{2}$ ;  $\frac{1}{2} \frac{1}{2} \frac{1}{4}$ ;  $\frac{1}{2} \frac{1}{2} \frac{3}{4}$ . The structure is a simple type of fourfold co-ordination built up from plane PtS<sub>4</sub> groups and tetrahedral SPt<sub>4</sub> groups, the Pt-S distance being 2.32 Å. Synthetic PtS has been prepared and is identical with the mineral cooperite. Laurite (RuS<sub>2</sub>) occurs in small pyritohedral-cubic crystals and has the pyrite structure with unit-cell edge  $a=5.59$  Å. The third mineral, PtPdS<sub>2</sub>, containing about five per cent Ni, is also tetragonal with unit-cell edges  $a=6.37$ ,  $c=6.58$  Å. The unit cell contains 4PtPdS<sub>2</sub> and the space group is  $D_{4h}^2$ . The name bragite is proposed for this mineral as being the first discovered by X-ray methods.—John Parry, Alpheus F. Williams, and F. E. Wright: Bultfonteinite, a new fluorine-bearing hydrous calcium silicate from South Africa. This new mineral was found in the Bultfontein and Dutoitspan diamond mines at Kimberley and in the Jagersfontein mine in Orange River Colony. It forms pale pink globular aggregates of radiating needles, and has much the appearance of natrolite. Analysis gives the formula  $2Ca(OH,F)_2 \cdot SiO_2$ . From the manner in which the mineral is decomposed by water and by dilute acids, a formula written as  $Ca(OH)_2SiO_2 \cdot Ca(OH,F)_2$  is suggested. Goniometric and optical examination of the minute crystals shows them to be triclinic, but much complicated by polysynthetic twinning. The mineral is related to awillite with the addition of  $Ca(OH)_2$  and  $CaF_2$ , and the nearest ally is eusterite [ $CaO \cdot Ca(OH,F)_2 \cdot SiO_2$ ].

**Geological Society, June 16.**—L. R. Wager: Geological work in East Greenland during the British Arctic Air-Route Expedition, 1930–31. The winter base of the expedition was in the Angmagssalik district and most of the geological work was carried out there and also in the course of two journeys. The first journey was northwards for 300 miles along the coast to Kangerdlugsuak, and the second along the edge of the ice-cap to Mount Forel. The Angmagssalik district

consists of gneisses and schists for which the name Metamorphic Complex is used, since the Archæan age of these rocks cannot be proved. The coastal zone between the ice-cap and the sea north of Angmagssalik consists of high mountains and includes Mount Forel, the highest mountain within the arctic. These mountains have been cut from a raised peneplain which passes without interruption from the Metamorphic Complex to the Tertiary basalts and plutonic intrusions. The peneplain has a gentle dip to the south-east or east-south-east, and to this is due the general trend of the coast and of one group of valleys and fjords. The inland ice has recently receded, and its present action may be studied side by side with its effects on the recently uncovered mountainous surface.

**Physical Society, July 8.**—J. J. Manley: On the determination of refractivity temperature coefficients for liquids. Attention is directed chiefly to the problems of measuring with precision the changes in the refractivity of a liquid for small alterations in temperature. An elaborated Jamin interferometer is described, with auxiliary apparatus necessary for setting up and maintaining differences in the temperature of the two interferometer tubes. Further, there is given a plan for measuring by means of platinum resistance thermometers differences in the temperatures of the two tubes.—N. W. McLachlan: (1) The axial sound-pressure due to diaphragms with nodal lines. A formula is found for the axial sound-pressure due to a disc having a nodal circle, and vibrating in an infinite rigid plane. Beyond a certain axial distance, when the nodal circle occurs at  $r=a/\sqrt{2}$  the pressure vanishes owing to interference caused by the inner and outer portions of the disc vibrating in opposite phase. The case of  $n$  nodal circles of arbitrary radii is treated by an approximate method. A rigid disc is imagined to be severed around each nodal circle, whilst contiguous annuli vibrate with equal amplitudes in opposite phase. Finally the pressure on the axis of a conical shell having nodal circles is treated as in the previous case. When the semi-apical angle of the cone is  $\frac{1}{2}\pi$  and there are no nodal circles, the formula reduces to that for a rigid disc.—(2) The accession to inertia of flexible discs vibrating in a fluid. Formulæ are obtained for the velocity-potential at the surface of a free-edge disc vibrating with nodal lines in a fluid. These formulæ are used to ascertain the accession to inertia due to the fluid when the disc is set in an infinite rigid plane. The equivalent mass and the mass coefficient of the disc vibrating *in vacuo* are also found; and the influence of the fluid on the frequency of vibration with (a) one nodal circle, (b) one nodal diameter, (c) stationary centre, is evaluated.—A. J. Bradley and A. H. Jay: A method for deducing accurate values of the lattice spacing from X-ray powder photographs taken by the Debye-Scherrer method. The usual circular type of camera is employed; and there are two stages in the procedure, (a) the calibration process, (b) the extrapolation process.—G. Millington: Ionisation charts of the upper atmosphere. Prof. Chapman's theory of the ionisation of the upper atmosphere by solar radiation has been applied to construct a set of charts giving contour lines of equal ionic density over the surface of the earth. A simple approximate method of solving the fundamental differential equation of the theory by a rapid arithmetical process is described.—A. S. Rao: Further investigations of the arc spectrum of arsenic. By photographing the spectrum of arsenic by the method of the hollow cathode discharge in helium and in neon about a hundred new lines have been recorded. The analysis of As I published by previous investigators has been considerably altered



and extended. New levels have been added and the higher members of the chief groups of the series of *ms* terms have been identified. A mean value of  $85,000 \text{ cm.}^{-1}$  has been suggested for the deepest term  $4p \text{ } ^4S_2$  which leads to a first ionisation potential of approximately 10.5 volts for arsenic.

## EDINBURGH

Royal Society of Edinburgh, June 6.—L. M. Davies: The genera *Dictyoconoides* Nuttall, *Lockhartia* nov., and *Rotalia* Lamarck. The original types of Carter's *Dictyoconoides* [*Conulites*] *cooki*, which have recently been found after having been lost for nearly thirty years, are described and figured; also the original types of Lamarck's *Rotalia trochidiformis*, from the DeFrance collection at Caen. The characters and relationships of these species are discussed; and a certain number of other species, hitherto referred to *Dictyoconoides*, are removed to a new genus *Lockhartia*.—E. B. Bailey and J. Weir: Submarine faulting of Kimmeridgian date. During Kimmeridgian times a submarine fault scarp was maintained by intermittent movement of the sea floor of the Helmsdale district of East Sutherland. Unconsolidated Mesozoic rocks on the upthrow side of the fault dissipated without yielding boulders, but Old Red Sandstone exposed in the fault scarp furnished repeated landslips, carrying boulders that in exceptional cases measured 100 feet in length. Earthquakes were frequent, for the landslips are almost always spread out into graded boulder beds in a manner indicating co-operation of tunamis ('tidal waves'). The Helmsdale movement can be brought into relation with the general history of contemporary Britain, more particularly with the fissuring of Kimmeridgian at Ethie on the Moray Firth and the development of the Camasunary fault in Skye.—T. Johnson: The Tertiary plants of Ireland and Scotland: a comparative account—(1) Thallophtya to Gymnospermae. The paper deals with collections of fossil plants from the north-east of Ireland, including those found at various depths (780-930 ft.) in the core of a bore made at Washing Bay at the south-west corner of Lough Neagh, and with collections of more or less contemporaneous plants from the Hebrides, including a small collection from the Isle of Canna and another from a site discovered by Mr. I. A. Inglis in the Isle of Skye.—Mary H. Latham: Scottish Carboniferous Ostracoda. The specimens come from one hundred and forty different localities in the Carboniferous of Scotland and England. Most of the species appear to have quite a long range, few of them being restricted to one horizon, although some occur only in the Upper Limestone Series of the Scottish Carboniferous and others are confined to the Lower Limestone Series.—Ian M. Robertson: A study of the tyrosinase of potato tubers. With *p*-cresol as substrate, the tyrosinase present in potato tubers produces a bright orange-red colour. The kinetics of the reaction have been studied by treating tuber sections with aqueous solutions of *p*-cresol in caustic soda and measuring the colour changes by means of Lovibond colour standards. The course of the reaction is monomolecular, with initial and final linear periods. The activity of the enzyme is independent of such factors as soil and environmental conditions of growth, season, and storage, but is dependent upon tuber maturity, disease, and variety. The test has been applied successfully towards the determination of the variety of healthy, mature tubers.

## PARIS

Academy of Sciences (vol. 194, pp. 1993-2092), June 6.—G. Urbain: An attempt at a co-ordinative theory of the constitution of organic compounds.—

C. Camichel, P. Dupin, and M. Teissié-Solier: The non-turbulent regime beyond the criterion of alternate vortices.—Lucien Daniel: New researches on the descent of certain grafted Compositae.—Ehresmann: The integral invariants and the topology of ruled projective space.—D. V. Jonesco: Certain curves which generalise conics.—Rud. Fueter: Hermite forms, Picard group, and the theory of quaternion ideals.—M. Ghermanesco: The problem of Riquier.—Arnau Denjoy: The characteristics of the torus.—Alex. Froda: The vertical measurability of functions of real variables.—J. Le Roux: The differential invariants of groups of relativity.—J. Haag: The general theory of the elastic suspension of pendulums.—G. Siadbei: The measurement of the resistance opposed by a viscous medium to the movement of bodies.—J. Rossignol: The problem concerning cylindrical vortices of finite section.—André Douillet: An apparatus with elastic coupling for measuring and recording graphically rotation couples.—Émile Belot: The original and present orientation of the orbits of the minor planets and of Jupiter in relation with the causes of the primitive eccentricities.—D. Eginitis: An error of Posidonius and its influence on the discovery of America.—L. Néel: The magnetic susceptibility of sulphur vapour. The diatomic molecule of sulphur is paramagnetic, and its properties are clearly different from those given by the theory applicable to oxygen.—J. Lecomte: An attempt at the co-ordination of the infra-red absorption bands of some hydrocarbons with nucleus.—Maurice Curie and Jean Saddy: Phosphorescent sulphides. Extinguishing action of the metals of the iron group. Traces of cobalt or iron reduce or prevent the phosphorescence of zinc sulphide. Lead is without influence.—Marcel Cau: The interpretation of a magneto-optical effect.—Jacques de Lassus Saint-Genies: A partial solution of integral photography.—W. Broniewski and K. Wesolowski: The gold-silver alloys as a type of continuous solid solutions. A study of 15 physical properties of gold-silver alloys as a function of the composition of the alloy. The results are given graphically.—A. Michel-Lévy and H. Muraour: Certain substances modifying the double refraction of the nitrocelluloses.—F. Bourion and Mlle. O. Hun: The cryoscopic study of ether and acetone in solutions of potassium chloride.—Desmaroux and Mathieu: Remarks on the structure of films of nitrocellulose with high nitrogen content.—Paul Renaud: A mineral india-rubber. Phosphorus chloronitrides of the constitution  $(\text{PNCl}_2)_n$  on heating in sealed tubes to  $270^\circ \text{C}$ . polymerise, giving rise to substances possessing some of the properties of india-rubber.—G. Darzens and André Lévy: A new synthesis of eudaline (methylisopropyl-naphthalene).—A. Hodaghian and R. Levaylant: The action of lithium hydride on benzoyl chloride. The main primary product is probably benzaldehyde, but this is polymerised, giving benzyl benzoate as the main product.—Marcel Godchot and Max Mousseron: 2-Aminocyclopentanol and its resolution into its optical antipodes.—Lucien Semichon and Michel Flanzy: The application of chromic acid oxidation to some diacids.—L. Palfray, S. Sabetay, and Mlle. Denise Sontag:  $\alpha$ -Vinyl-naphthalene and the polyvinyl-naphthalenic resins.—Charles Dufraisse and Robert Vieillefosse: The application of the anti-oxygen effect to the problem of fighting fire. The extinction of charcoal in the presence of oxygen. The vapours of carbon tetrachloride or phosphorus oxychloride have a real anti-oxygen effect on burning charcoal.—Georges Laude: The synthesis of cyanic acid and of urea by the ammoniacal oxidation of carbonaceous substances. A modification of the methods previously described, giving higher yields of urea and cyanic acid.—R. Bureau: Goniometric



researches on atmospherics.—**Pierre Gavaudan**: The identity of the metachromatic vacuome and of the leucosine of the Monadinæ and Chrysomonadinæ.—**A. Damiens and Mlle. S. Blaignan**: Normal bromine in plants: edible plants and fruits. Bromine is a normal constituent of plants, the amount in 100 grms. of dry material varying between 0.17 and 2.02 mgm. The amount in the fruits is less.—**Ph. Joyet-Lavergne**: The rôle of the chondriome in the manifestations of cytoplasmic sexualisation.—**A. Magnan and A. Sainte-Laguë**: Flight by wing beats at a fixed point.—**Philippe Fabre**: The exciting efficacy of condenser discharges below the rheobase.—**Mme. Phisalix**: The reciprocal vaccinating action of the poisons of the bee and *Vipera aspis*.—**R. Legroux, Kemal-Djemil, and Mme. Colette Jérôme**: The immunisation of guinea-pigs against glanders.—**J. Lignières**: Paradoxical phenomena of the immunising property of the aphthous virus. A local aphthous lesion does not always confer immunity.

## Forthcoming Events

TUESDAY, JULY 26

BRITISH MEDICAL ASSOCIATION—Centenary Meeting (Presidential Address at the Queen's Hall, Langham Place, London).—The Right Hon. Lord Dawson of Penn: "A Hundred Years and After", at 4 P.M.

FRIDAY, JULY 29

BRITISH MEDICAL ASSOCIATION—Centenary Meeting (Popular Lecture at University College, Gower Street, W.C.1).—Prof. Julian Huxley: "The Biology of Human Nature", at 8 P.M.

## Official Publications Received

### BRITISH

Department of Scientific and Industrial Research. Summary of Progress of the Geological Survey of Great Britain and the Museum of Practical Geology for the Year 1931. Part 1, with Report of the Geological Survey Board and Report of the Director. Pp. iii+81. (London: H.M. Stationery Office.) 1s. 6d. net.

Proceedings of the Royal Irish Academy. Vol. 41, Section B, Nos. 1 and 2: Some Derivatives of Dicomarin, by Dr. Joseph Algar, Anne E. O'Reilly and Mary Joy; Derivatives of Benzo-Difurane, by Dr. Joseph Algar, Vincent C. Barry and Tadhg F. Twomey. Pp. 14. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.) 6d.

University of Durham: Committee of Senate on Entrance Tests and Bachelors' Degrees. Report. Pp. 17. (Durham.)

British Standards Institution. No. 457, 1932: British Standard Specification for the Identification of Chemical Pipe Lines. Pp. 8. (London: British Standards Institution.) 2s. net.

Department of Scientific and Industrial Research. Building Science Abstracts. Vol. 5 (New Series), No. 5, May. Abstracts Nos. 747-983. Pp. 141-176. (London: H.M. Stationery Office.) 1s. net.

Madras Fisheries Department. Administration Report for the Year 1930-31. By Dr. B. Sundara Raj. (Report No. 1 of 1932, Madras Fisheries Bulletin, Vol. 26.) Pp. v+112. (Madras: Government Press.) 14 annas.

India: Meteorological Department. Scientific Notes, Vol. 4, No. 43: On the Extreme Dryness observed at Kodaikanal during the Winter Months. By S. L. Malurkar. Pp. 137-144+11 plates. (Calcutta: Government of India Central Publication Branch.) 1.8 rupees; 2s. 6d.

Proceedings of the Geologists' Association. Edited by G. S. Sweeting. Vol. 43, Part 2, 24th June. Pp. 97-200. (London: Edward Stanford, Ltd.) 5s.

The Kent Incorporated Society for Promoting Experiments in Horticulture. Annual Report (Nineteenth Year) 1931, East Malling Research Station, 1st January 1931 to 31st December 1931. Pp. 89+5 plates. (East Malling.)

Indian Journal of Physics, Vol. 7, Part 1, and Proceedings of the Indian Association for the Cultivation of Science, Vol. 16, Part 1. Conducted by Sir C. V. Raman. Pp. 106. (Calcutta.) 1.8 rupees; 2s.

Report by the Financial Commissioner (Lord Mayne) on certain Questions in Kenya. (Cmd. 4093.) Pp. vi+122. (London: H.M. Stationery Office.) 2s.

The London School of Economics and Political Science (University of London), Houghton Street, Aldwych, W.C.2. Department of Business Administration, Session 1932-33. Pp. 28. Training for Business Management. Pp. 11. (London.)

Air Ministry: Aeronautical Research Committee: Reports and Memoranda. No. 1440 (T. 3116, 3117): Stresses in a Wire Wheel with Non-Radial Spokes under Rim Loads. Part 1, by Prof. A. J. Sutton Pippard and Miss M. J. White; Part 2, by Prof. A. J. Sutton Pippard and W. E. Francis. Pp. 19+19 plates. 1s. 3d. net. No. 1455 (T. 3201): Sideslip and Performance of Multi-Engine Aircraft. By E. T. Jones. Pp. 6+4 plates. 6d. net. (London: H.M. Stationery Office.)

Experimental Researches and Reports published by the Department of Glass Technology, the University, Sheffield. Vol. 14, 1931. Pp. iii+174. (Sheffield.) 7s. 6d.

The North of Scotland College of Agriculture. Guide to Experiments and Demonstration Plots at Craibstone, 1932. Pp. xii+64. (Aberdeen.) City and Guilds of London Institute. Report of the Council to the Members of the Institute, 1932. Pp. xlix+75. (London: Gresham College.)

Committee on Bird Sanctuaries in Royal Parks (England). Report for 1931. Pp. 18. (London: H.M. Stationery Office.) 6d. net.

Mines Department. Tenth Annual Report of the Safety in Mines Research Board, including a Report of Matters dealt with by the Health Advisory Committee, 1931. Pp. 95+9 plates. (London: H.M. Stationery Office.) 2s. net.

Proceedings of the Royal Society of Victoria. Vol. 44 (New Series), Part 2. Pp. 103-326+plates 15-26. (Melbourne.)

Transactions of the Optical Society. Vol. 33, 1931-32, No. 3. Pp. ii+73-136. (London: Optical Society.) 10s.

Society of Biological Chemists, India. Biochemical and Allied Research in India in 1931. Pp. 42. (Bangalore: Indian Institute of Science.)

Proceedings of the Royal Irish Academy. Vol. 41, Section B, No. 3: Some Legendary and Historical References to Irish Woods, and their Significance. By A. C. Forbes. Pp. 15-36. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.) 6d.

### FOREIGN

Bulletin of the American Museum of Natural History. Vol. 64: The Distribution of Bird Life in Guatemala; a Contribution to a Study of the Origin of Central American Bird-Life. By Ludlow Griscom. Pp. ix+439. (New York City.)

U.S. Department of Agriculture. Technical Bulletin No. 294: The Biology and Morphology of the Braconid *Chelonus annulipes* Wesm. a Parasite of the European Corn Borer. By Arlo M. Vance. Pp. 48. (Washington, D.C.: Government Printing Office.)

University of California Publication. Bulletin of the Department of Geological Sciences, Vol. 21, No. 7: The Fossil Passerine Birds from the Pleistocene of Carpinteria, California. By Alden H. Miller. Pp. iii+169-194+plates 12-14. (Berkeley, Calif.: University of California Press.) 35 cents.

University of California Publications in Zoology. Vol. 38, No. 3: Type Localities of Birds described from California. By Joseph Grinnell. Pp. 243-324. 1 dollar. Vol. 38, No. 4: New Pocket Gophers from Nevada. By E. Raymond Hall. Pp. 325-333. 25 cents. Vol. 38, No. 5: Three New Rodents from Lava Beds of Southern New Mexico. By Seth B. Benson. Pp. 335-344+plates 3-4. 25 cents. (Berkeley, Calif.: University of California Press.)

New York Academy of Sciences. Scientific Survey of Porto Rico and the Virgin Islands. Vol. 12 (Supplementary Part): Insects of Porto Rico and the Virgin Islands. Supplementary Report on the Heterocera or Moths of Porto Rico. By W. T. M. Forbes. Pp. 56+6 plates. (New York City.)

Field Museum of Natural History. Zoological Series, Vol. 18, No. 7: Reptiles and Amphibians of the Mandel Venezuelan Expedition. By Karl P. Schmidt. (Publication 309.) Pp. 157-163. 25 cents. Zoological Series, Vol. 18, No. 8: Notes on New Guinean Crocodiles. By Karl P. Schmidt. (Results of the Crane Pacific Expedition.) (Publication 310.) Pp. 165-172+plates 6-7. 25 cents. Zoological Series, Vol. 19: The Birds of Chile. By Charles E. Hellmayr. (Publication 308.) Pp. 472. 2.50 dollars. (Chicago.)

Scientific Papers of the Institute of Physical and Chemical Research. Nos. 366-367: Hyperfine Structure of Mercury, V., by Kiyoshi Murakawa; Hyperfine Structure of Lead, by Kiyoshi Murakawa. Pp. 177-204. 30 sen. Nos. 368-369: Forest Fires and Weathers, by Torahiko Terada and Tsyokurō Utigasaki; Diffraction of Cathode Rays by Single Crystals, Part 1: P-Patterns, by Ken'ichi Shinohara. Pp. 205-236+plates 4-9. 45 sen. (Tōkyō: Iwanami Shoten.)

Smithsonian Institution: United States National Museum. Bulletin 162: Life Histories of North American Gallinaceous Birds, Orders Galliformes and Columbiformes. By Arthur Cleveland Bent. Pp. xi+490+93 plates. (Washington, D.C.: Government Printing Office.) 1 dollar.

Rubber Research Institute of Malaya. Annual Report, 1931. Pp. 134. (Kuala Lumpur.) 1 dollar.

U.S. Department of the Interior: Geological Survey. Water-Supply Paper 688-D: Quality of Water of the Colorado River in 1928-1930. By C. S. Howard. (Contributions to the Hydrology of the United States, 1931.) Pp. ii+145-162. Water-Supply Paper 685: Surface Water Supply of the United States, 1929. Part 3: Ohio River Basin. Pp. viii+272. Water-Supply Paper 692: Surface Water Supply of the United States, 1929. Part 12: North Pacific Slope Drainage Basins. A: Pacific Slope Basins in Washington and Upper Columbia River Basin. Pp. vii+190. 25 cents. Water-Supply Paper 696: Surface Water Supply of the United States, 1930. Part 1: North Atlantic Slope Drainage Basins. Pp. viii+280. Water-Supply Paper 701: Surface Water Supply of the United States, 1930. Part 6: Missouri River Basin. Pp. ix+302. 50 cents. Water-Supply Paper 702: Surface Water Supply of the United States, 1930. Part 7: Lower Mississippi River Basin. Pp. v+115. 20 cents. (Washington, D.C.: Government Printing Office.)

U.S. Department of the Interior: Geological Survey. Bulletin 833: Mineralogy of Drill Cores from the Potash Field of New Mexico and Texas. By Waldemar T. Schaller and Edward P. Henderson. Pp. viii+124+39 plates. 60 cents. Bulletin 838: Nitrate Deposits of the United States. By G. R. Mansfield and Leona Boardman. Pp. vi+107+11 plates. 40 cents. (Washington, D.C.: Government Printing Office.)

### CATALOGUES

Catalogue of B.D.H. Fine Chemical Products: including Organic and Inorganic Chemicals, Analytical Reagents, Indicators, Standard Stains. (July, 1932.) Pp. 151. (London: The British Drug Houses, Ltd.)

Telcon Metals: Induction Melted Electrical Resistance Alloys in Rod, Wire and Tapes. Pp. 16. (London: Wild-Barfield Electric Furnaces, Ltd.)