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## British Ordnance Maps and their Revision

ON May 28 of last year the Minister of Agriculture and Fisheries appointed a Departmental Committee on the Ordnance Survey, with the following terms of reference :

(a) to consider what measures are necessary to accelerate the revision of the Ordnance Survey Maps in order to bring them up-to-date and hereafter to maintain them at a high level of accuracy, while providing for such other public services as are undertaken by the Ordnance Survey Department ;

(b) to consider what immediate steps are possible in the meantime to revise Ordnance Survey maps to the extent necessary for the purpose of town and country planning schemes ;

(c) to review the scales and styles of Ordnance Survey maps placed on sale to the public and to recommend whether any changes are desirable ; and

(d) to review the conditions upon which the reproduction of Ordnance Survey maps is permitted.

Owing to the urgency of certain aspects of the inquiry, the Committee has issued an Interim Report\* referring only to matters forming the subject of paragraphs (b) and (d). The Minister considers these to be of pressing importance in view of the fact that many schemes under the Town and Country Planning Act 1932, and other Acts, are held up because of the absence of up-to-date maps which local authorities are required to submit with their planning projects.

Successive director-generals have repeatedly pointed out, but without avail, the state of disrepair into which the 25-in. plans have been allowed to lapse. In the period of the Great War, this could not be avoided, but since the War it certainly has been a wasteful policy to starve the

Ordnance Survey, especially in view of the great changes which have taken place on the face of the country causing the maps to become rapidly out of date. It should have been a period of survey activity, instead of the reverse. Numbers of Acts, culminating in the Town and Country Planning Act of 1932, have been passed in recent years, none of which could be effectively put into operation without really up-to-date maps, yet the means to provide them has been consistently withheld.

According to the Report, 1,400 plans, on the 25-in. scale, require substantial revision before they can be submitted by local authorities with schemes requiring the sanction of the Ministry of Health ; while with the existing staff of the Survey not more than two hundred plans could be revised, according to Ordnance Survey standard, before the end of 1937. In order to meet this situation, the Committee recommends that an interim edition of the plans be prepared for the special purpose of town planning schemes, showing only sufficient detail to enable them to be used to illustrate such schemes. They would show new field boundaries, buildings and other physical features but omit new bench-marks, names of new roads and streets and the numbers and areas of 'parcels' in which alterations have taken place since the last edition. These omissions would not impair the eventual completion of the plans according to Ordnance style. It is estimated that the time saved by adopting this method would be one year, and that the whole of the 1,400 plans could be revised by the existing staff sufficiently for town planning purposes by December 31, 1938.

The above plan presupposes the concentration of the whole of the present staff on the interim

\* Interim Report of the Departmental Committee on the Ordnance Survey. Pp. 16. (London : H.M. Stationery Office.) 3d. net.



plans, which would have the effect of "causing delay and complicate the normal revision still further". The Committee therefore recommends "that there should be an immediate increase in the establishment of the Ordnance Survey, if the production of plans for town planning purposes is to be accelerated, and normal revision resumed and expedited at the earliest possible moment". By this means the Director-General considers the earliest date by which the immediate demands of the town planning authorities could be satisfied would be June 1938, although some plans would be available before the end of 1936.

The Committee then goes on to consider the application of aerial photography as a means of accelerating map revision. It is satisfied that it is possible in this way to produce an accurate plan with sufficient detail for town planning purposes, as described above, and that the employment of air photography might lead to considerable acceleration in the output of maps.

Mention is made of a recent experiment in this connexion, carried out by contractors for the Ordnance Survey, and to the fact that the photographs failed to cover some portions of the area and that sufficient overlap was not always provided to enable the photographs to be submitted to stereoscopic examination. However, the results showed it is possible to produce from air photographs, without revision on the ground, a revised plan which would meet the requirements of town planning.

We think that in referring to the gaps in the work, and to the lack of necessary overlap in the photographs in the experiment in question, it should have been pointed out that these defects were largely due to the late date at which the contract was placed, whereby many excellent 'photographic days' were lost, and to the insistence on the employment of the auto-pilot, which has not yet reached a stage in development sufficiently advanced to meet the exacting requirements of photographic surveying; otherwise these faults could easily have been made good. We believe that if the next contract, recommended by the Committee, is given early enough in the season and is not hampered by restrictions, air photographs will provide all the information necessary to produce the plans required in a much shorter time than by ground methods.

The concluding portion of the Report deals with the conditions of reproduction of Ordnance Maps, which are Crown copyright, by the public. An appendix contains draft proposals on the subject.

We await with interest the final report of the Committee, especially as to whether the measures it recommends will lead to the adoption of a single projection for the 25-in. map, the basis of all other scales, as explained in NATURE of February 1, 1936, p. 165. We note with surprise that this Committee, which has to deal with highly technical matters, does not contain a single surveyor.

## Essays in the History of Science

### Osiris

Vol. 1: A Volume of Studies on the History of Mathematics and the History of Science. Presented to Prof. David Eugene Smith on his 76th Birthday (Jan. 21, 1936). Edited by George Sarton, with the cooperation of Prof. R. C. Archibald, Miss B. M. Frick, Dr. A. Pogo. Pp. 777. (Bruges: The Saint Catherine Press, Ltd., 1936.) 6 dollars (to members of the History of Science Society, 5 dollars).

THIS is the first volume of a new series intended to be supplementary to the well-known quarterly journal *Isis*, the organ of the History of Science Society and of the International Academy of the History of Science; the series is to contain the longer articles, each volume constituting a special number, while *Isis* will continue to be a quarterly journal containing the shorter

articles, reviews, notes and correspondence. The present large volume is, most appropriately, dedicated to Prof. David Eugene Smith, of Columbia University, New York, the veteran historian of mathematics and author of many other mathematical works. It is a pleasure to see so fitting and worthy a tribute paid to Prof. Smith on the occasion of his seventy-sixth birthday.

At the beginning of the volume, after the dedication by the editor to Prof. Smith, is a very remarkable bibliography of his critical, historical and pedagogic writings. These consist, first, of books, articles and pamphlets, introductions and reviews of which Prof. Smith is the author (508 items); secondly, of books, articles and committee reports edited or translated by him (45 items); and lastly a list of encyclopædias and periodicals



for which he acted as editor or associate-editor (eleven in all, including the "Encyclopaedia Britannica", fourteenth edition, for which he acted as editor of the Department of Mathematics, himself contributing eleven articles). There is added an account of Prof. Smith's very rich library, presented by him to the Columbia University and consisting of printed books, manuscripts, portraits and autographs of mathematicians, medals and medallions, and mathematical and astronomical instruments; it comprises some twenty thousand items in all, collected during more than forty years. To mention only one detail: the printed books comprise more than fifty "Euclids" printed before 1800, and among them are the first printed edition of the "Elements" (Erhard Ratdolt, Venice, 1482), the Pacioli edition of 1509, the Peletarius translation of 1557 and, naturally, the first English edition (the translation by Billingsley, 1570).

The rest of the volume contains thirty-five articles in different languages, English, French, German, Italian and Spanish. The first article, by R. C. Archibald, gives thirty hitherto unpublished letters of James Joseph Sylvester, preceded by a "curriculum" of his life, with dates of main incidents, details of publications relating to his life and works, particulars which have not so far been adequately treated, and finally an account of his poetry. To the letters are added notes containing all necessary information about persons or incidents referred to in the letters. Under the heading of Sylvester's poetry there is a full account of his book "The Laws of Verse . . . exemplified in Metrical Translations", 1870, and there are references to and citations from the poems. Among the titles may be mentioned "Rosalind", "Spring's Debut", "Sonnet to a high soprano accompanying herself on the piano", "Sonnet on being aroused out of an algebraical reverie by a lady", "Sonnet to a missing member of a family group of terms in an algebraical formula".

Of the other articles only a few can be mentioned here. Ettore Bartolotti gives in "L'algebra nella storia della scienza" an outline (as good as could be expected in forty-seven pages) of the history of the subject from its beginnings, including the geometrical algebra of the Greeks, Muhammad ibn Mūsā and Diophantus, down to Bombelli, but finishing with more detailed accounts of algebra in ancient Egypt and Babylonian algebra. This is followed by a very interesting paper of Julian L. Coolidge on "The Origin of Analytic Geometry". In a paper on Muhammad ibn Mūsā, S. Gandz contends that he owed nothing to the Greeks, that his geometry shows no traces of the influence of Euclid but was mensuration practically 'lifted' from an old Hebrew geometry, "Mishnat ha

Middot", compiled about A.D. 150, and that the source of his algebra was a native, Syriac-Persian, tradition going back to the Babylonians.

Benjamin Ginzburg writes on the "Scientific Value of the Copernican Induction". Astronomy is further represented by (1) S. A. Ionides on "Cæsar's Astronomy" (a manual of astronomy written by Peter Apian, Ingolstadt, 1540), so called because it was dedicated to "the Cæsars", Emperor Charles V of Rome and his brother, King Ferdinand of Spain; (2) "Thomas Digges and Modern Astronomy", by F. R. Johnson; (3) J. Millás on a forgotten astronomical tract by Juan Hispanus (twelfth century); (4) an article by Ernst Zinner on "Die Tafeln von Toledo (Tabulae Toletanae)". P. P. Wiener writes on "The Tradition behind Galileo's Methodology", J. A. Vollgraaf on "Snellius' Notes on the Reflection and Refraction of Rays", Helen M. Walker on an unpublished hydraulic experiment by Roberval, Frederick H. Setman on "Samuel Morey, a Pioneer of Science in America" (1762-1843), L. G. Simon on "Short Stories in Colonial Geometry", being the story of geometry teaching at Harvard College, Yale College, Columbia College and the University of Pennsylvania in the seventeenth and eighteenth centuries, and J. Pelseener contributes "une lettre inédite de Newton à Pepys", dated December 23, 1693, on a question in probabilities.

The historian of mathematics will no doubt turn with the greatest interest to the following: (1) Louis C. Karpinski on the first printed arithmetic of Spain, 1482; (2) Prof. Gino Loria on Chasles and the theory of conic sections; (3) a long article of forty pages by the editor, G. Sarton, on Montucla, the historian of mathematics (1725-99), his life and works, with portrait and facsimiles; (4) J. Tropicke on Archimedes' construction of a regular heptagon in a circle; (5) Quido Vetter, "Mathématiques Babyloniennes"; (6) Kurt Vogel, "Bemerkungen zu den quadratischen Gleichungen der babylonischen Mathematik". Tropicke's paper (4) gives a reproduction of a translation by Thābit from the Greek of a treatise which contains a number of interesting propositions relating to the triangle and, at the end, the construction of a regular heptagon in a circle; Thābit expressly describes the work as a book of Archimedes. This particular translation by Thābit was discovered in 1925 by C. Schoy, who died in the same year. The subject of Tropicke's article is therefore no longer new (the construction of the regular heptagon was given in "A Manual of Greek Mathematics", 1931), but it is convenient to have the whole of the treatise reproduced together.

K. Vogel's paper (6) is interesting because it represents a point of view rather different from that of Neugebauer and others who have discussed



the solutions of quadratic equations in Babylonian cuneiform texts of 2000 B.C. or thereabouts. These solutions refer to no rule of solution whatever; they only give the working, and this is consistent with the view of Neugebauer that they correspond to making the necessary substitution of the concrete numbers of the question for the algebraical symbols in our formula for the value of  $x$ . Vogel points out that the equations solved are generally simultaneous equations in  $x$  and  $y$  (called 'length' and 'breadth' in the texts) from which  $x$  and  $y$  are found. The solutions correspond to the two roots of a single equation in one unknown to which they can be reduced, but the working is also consistent with the view that the Babylonians had not carried the theory of the quadratic equation up to the form which it takes in our algebras,

but were still at a stage rather more elementary, corresponding to the solutions in Diophantus, and that they had not yet reached the full knowledge of the double solution of a single quadratic according to the sign taken with the radical. On the other hand, the Babylonians knew how to manipulate equations, and they would freely take the opportunity of making a change in a particular variable in order to reduce the equations to what was with them the normal form.

Lastly, we would refer to the article by U. G. Mitchell and Mary Strain on "The Number  $e$ ", distinguishing the stages in its history—the first approximations to its value, the definite recognition of its existence, and finally the proofs of its irrationality (Fourier, 1815) and transcendence (Hermite, 1873).

T. L. H.

## The Eskimos: their Past and Future

### The Eskimos

By Dr. Kaj Birket-Smith. Translated from the Danish by W. E. Calvert; the translation revised by Prof. C. Daryll Forde. Pp. xiv + 250 + 32 plates. (London: Methuen and Co., Ltd., 1936.) 15s. net.

**A**MONG primitive peoples a unique interest attaches to the Eskimos, because of the severity of the conditions under which they have survived and developed their culture. Unlike the shivering Tierra del Fuegians, they have continued to achieve the maximum of cheerful comfort in the most inhospitable of climates. Even the white man, when he explores their country, must adopt their snow huts, dog sledges, and if he is wise, the essentials of their food and clothing.

No other human race is so thoroughly adapted to the conditions under which it lives. Negroes from the tropics can live and multiply in a cool temperate climate, but to the Eskimo even the latitude of Great Slave Lake is much farther south than he cares to travel, and there is some evidence that he is physiologically adjusted against even a moderately warm temperature. This argues a long sojourn under arctic conditions, and favours the view of Boyd Dawkins and others that the Eskimo ice culture may really be a survival from Upper Palæolithic glacial times in Europe.

The author of this charmingly written volume has had ample contact with the Eskimos. After two expeditions to Greenland, he joined Rasmussen's Thule Expedition in 1921 and sledged across the Arctic to Bering Strait, living an Eskimo's life for two years and making a special study of the inland Caribou Eskimos west of

Hudson Bay. His book, while in no way lacking in scientific accuracy, is written simply and can be understood by anybody. It is no mere narrative of his own experiences, but a mature and philosophical account by one who is familiar with every aspect of these fascinating people, from personal contact and from a full knowledge of everything that has been written concerning them. A well-selected bibliography and an index add to its value.

Considering that the Eskimo tribes stretching along thousands of miles of coast-line from Eastern Greenland to Alaska number probably less than 30,000, they have received a quite disproportionate share of attention from anthropologists and others. This can be accounted for partly by the conditions of their life and partly by their temperament, which is lively and self-reliant, whereas the Amerindian is apt to be silent and morose, easily becoming dependent on the white man. The Loucheux Indians, however, on the Arctic Circle in the Mackenzie River basin, have a vivacious temperament like the Eskimos a little farther north, and it becomes an interesting question whether this temperament is a reaction to the arctic conditions or is derived from crossing with their Eskimo neighbours.

Birket-Smith's book is divided into ten chapters. The first deals with the country and its history, especially as regards Greenland, where the Norsemen made contact with the "Skraelings" in the tenth century. Eskimos extended from the Labrador coast into the Gulf of St. Lawrence as late as the seventeenth century, and these people obtained their oil lamps from a soapstone quarry in western Newfoundland. Chapter ii is a study of the physical characters and psychical qualities



of the Eskimos, with a brief reference to their blood groups. A short chapter on the general features of the language and its possible relationships shows how much remains to be done by the comparative philologist. Two chapters are devoted to the struggle for food, which is derived mainly from the reindeer in summer and the seal in winter and spring, although fish, walrus, whales, birds and even berries may on occasion supply their quota. Under the title "Fighting the Cold" the Eskimo clothing and housing are described, the latter including not only the winter igloo but also earth lodges supported by whale bones, as well as stone tents, some of which are prehistoric, and summer tents of reindeer skin.

"The Community" and "The View of Life" are chapters outlining the Eskimos' social and mental outlook. We learn something of their myths and shamanism, and their songs and dances when only the Northern Lights relieve the long darkness. Communism perhaps reaches its extreme form here under conditions in which the margin of safety is always narrow and a surfeit of the village from a successful seal hunt may be followed by a blizzard in which starvation stares at the hunters for a week. Homicide and infanticide are not uncommon.

The most serious chapter for the anthropologist is that on the origin and development of the Eskimo culture. The author accepts as a working hypothesis Steensby's theory that Eskimo culture originated between Hudson Bay and Coronation Gulf, spreading thence east and west, to reach its climax through whale hunting from kayaks in the subarctic regions of Greenland and Alaska. The

author postulates not only Palæo- and Neo-Eskimo layers of culture, but also a third, more recent, type derived from an eruption northwards of the Caribou Eskimos, whom he regards as a remnant of the original Proto-Eskimo people remaining in the tundra away from the sea and relying mainly on the caribou herds for their sustenance. The arctic and Palæolithic peoples of Europe and Asia as well as America are involved in this discussion, but no finality can yet be reached in these complex problems.

In a final chapter the present condition of the Eskimos is considered, and especially the serious effects of contact with whites. Eskimos in the Mackenzie delta have their fishing schooners with petrol engines and may even possess gramophone records and radio sets. Many of them are now of mixed blood. In the whole Canadian area the Mounted Police and the Hudson's Bay Company trading posts now reach even the most isolated tribes, trapping for furs has become an important occupation and the rifle has brought a serious lessening of game. It is hoped that the latter will be partly overcome by the recent introduction of reindeer, to multiply as they have already done with great success in Alaska under the rule of the United States. The Eskimos will thus be changed from nomadic hunters to pastoralists. The advantages and disadvantages of a trade monopoly under the Danish Government in Greenland are pointed out, as well as the dangers through which these hardy people, the Eskimos, have yet to pass before they can be regarded as safe from extinction.

R. RUGGLES GATES.

## Warp and Woof in the Theory of Functions

### An Introduction to the Theory of Functions of a Complex Variable

By Prof. E. T. Copson. Pp. viii+448. (Oxford: Clarendon Press; London: Oxford University Press, 1935.) 25s. net.

STEADILY the regions of mathematics of which we can be ignorant without shame increase in number and extent. With their own researches taking them further and further from common ground, what need the analyst know of central differences, the statistician of the correspondence principle, the geometer of ideals? But common ground remains, though without precise boundaries, and certainly we must all be familiar in some practical sense with the elements of function theory and know something of the most important functions of analysis.

At the beginning of the century, these requirements were distinct. To the theory of functions belonged general processes and comprehensive ideas; properties of algebraic functions and of doubly periodic functions were included, as theorems on integral functions are included to-day, but individual functions were studied in special treatises or special courses of lectures. It was Whittaker who brought the strands together, combining in one brilliant treatise the analytical foundations and somewhat more than the general reader needed to know of the principal transcendental functions. In succeeding editions under dual control, with the foundations strengthened and extended and with the number of individual functions increased, "Modern Analysis" has become more and more valuable to the analyst, but it has long ceased to be everybody's book, and



difficult problems of scope and standard give interest to any treatise that claims to be introductory. Gone are the days when we could suppose that our eyes do the work of our minds, and that somehow we can establish mathematical properties of a 'contour' without giving a mathematical meaning to the word; nevertheless, the ultimate analysis of Cauchy's theorem is a specialist's job. If few of us need Mathieu's functions, still fewer can do without Jacobi's.

Prof. Copson's opening pages do not inspire confidence. His book will never have a reader who has not learnt already the nature of the complex variable, and as Peano realised, the definition as a two-by-two matrix, in which the elements are not independent, needs defence. If it is the matrix that is presented as fundamental, the arbitrary restriction to a peculiar form seems the strangest basis for an algebra; the commutative law is an accident, unless the form of the matrix is deduced from it. That it is not the definition that matters, but the laws of combinations, is said plainly, but this is not an adequate excuse for a change which superficially has nothing in its favour.

After the unfortunate short first chapter, it is a pleasure to find an account of the first principles of the theory of functions that can be recommended enthusiastically. This part of the book is definitely the best introduction that the English reader has to the subject as it is now studied. The discussion of Cauchy's theorem is specially praiseworthy. For a polygonal contour, the arguments are of a kind which recurs perpetually in analysis; their careful application is part of our education, and the proof is in detail. For the extension to a curved boundary, the difficulty is stated and we are referred elsewhere for the investigation. Perhaps it would have been reasonable to attempt the extension to a contour formed of a finite number of straight segments and circular arcs; the relevant topological questions can be answered easily for such a contour, and most, if not all, of the contours used later in the book are of this kind.

The application of residues to the evaluation of integrals, fascinating to every generation of students, is a backwater which we are not allowed to mistake for the main stream. There is a chapter on integral functions, and then one on conformal representation which is in one respect the least satisfying in the book, since there only is there no indication of the nature of the mathematical proof of the underlying general theorem which is enunciated; however, at this stage it is the illustrations that are significant, and the construction of these does not depend on the unproved general theorem. The accounts of special functions, the gamma and hypergeometric functions, Legendre and Bessel functions, and

elliptic functions, are excellent in range and treatment; most welcome is the introduction of the Jacobian functions as the functions which, having two simple poles, call as naturally for investigation as the Weierstrassian function. The last chapter is on modular functions, and the book closes with the classical proof of Picard's theorem and Carathéodory's proof of Landau's allied result.

The arrangement of material needs explanation. The maximum modulus principle and Hadamard's three-circles theorem come into the chapter on integral functions; the idea of an asymptotic expansion is encountered as it were incidentally in the chapter on the gamma function, saddle-point integration in the chapter on Bessel functions; the linear differential equation is studied in the chapter on the hypergeometric function. On the other hand, the chapter on conformal representation includes an attempt to make the Schwarz-Christoffel representation of a rectangle on a half-plane intelligible before elliptic functions have been introduced. It is not that the author is at fault. In "Modern Analysis" the warp of general theory is displayed before it is crossed by the woof of applications; experience seems to show that this can not be done on the scale of an introductory treatise.

We are indebted to Prof. Copson for a book that is suitable for a very large number of students, and that has the rare merit of maintaining for the majority the standards that are demanded for the minority. An uncomfortable doubt persists that the book will seem to the learner to be an introduction only to the special functions, not to any general theory. He will see the power of a few processes of analysis; he will not catch a glimpse of regions where analytical processes are of subordinate importance. This may be because, dazzled by Whittaker's success, we have sometimes failed to perceive what it was that he really did. The strands which compose the warp of "Modern Analysis" are by no means all the strands of the theory of functions; there are other strands, the background of designs with which the ordinary transcendental functions have little to do. It was no part of Whittaker's purpose to display these other strands, nor was the title of his book misleading, but it is in a very narrow sense that a book which ignores them is an introduction to the theory of functions.

This is not a mere quibble about titles. An introduction has not the same right as an advanced treatise to be selective and to present a subject in the light only of contemporary activity in research. If we may maintain our metaphor, an introduction should serve not only those who will soon be weavers, but also those who have no ambition except to admire. A mathematical



design is no less beautiful because for the moment the weavers are busy elsewhere. More easily could we maintain that beauty, complete and imperishable, has once and again been achieved. But if beauty that has been perfectly achieved is for that reason never again to be enjoyed, then indeed even in mathematics little is safe from the devouring jaws of greedy time. E. H. N.

(1) **Metallurgical Abstracts (General and Non-Ferrous)**

Vol. 1 (New Series). Edited by G. Shaw Scott. Pp. vi+780. (London: Institute of Metals, 1935.) With Vols. 54 and 55 of the 'Journal', £4 net.

(2) **The Journal of the Institute of Metals**

Vol. 56. Pp. 306+31 plates. Vol. 57. Pp. 311+23 plates. Edited by G. Shaw Scott. (London: Institute of Metals, 1935, 1936.) 31s. 6d. net each.

(1) THE present volume of metallurgical abstracts constitutes the first of a new series, to be published annually as an entirely separate work with its own index. This replaces the earlier system of binding abstracts as a part of the *Journal* series, with an index covering both abstracts and the Institute's own publications. Some measure of discrimination has been introduced into this volume, in the form of symbols denoting papers describing the results of original research and those giving a critical review of a particular subject. The wide range of metallurgical literature has been covered in the usual comprehensive manner, but we again have to deplore the absence of a list of the journals abstracted.

(2) Twelve papers presented at the annual general meeting of the Institute are included in vol. 56 of the *Journal*, together with Prof. W. L. Bragg's May Lecture on "Atomic Arrangement in Metals and Alloys", in which he dealt with characteristic phase patterns in alloys and changes in orientation brought about by variations in temperature. The papers include the concluding part of a research on unsoundness in aluminium alloy sand castings, a paper dealing with the mechanical properties of wrought magnesium alloys, and a valuable study of type metal alloys. Corrosion and corrosion-fatigue are represented, while other papers deal with the constitution of cadmium-silver and cadmium-tin alloys.

Vol. 57 comprises the papers presented at the autumn meeting of the Institute in Newcastle, when the Autumn Lecture was delivered by Dr. H. W. Brownson, on "Metal Melting—its Effect on Quality". A particularly valuable paper in this volume is that by Dr. Maurice Cook, dealing with metal losses in melting brass and other copper alloys. Other contributions include the first part of a research on the interrelation of age-hardening and creep, a study of the properties of some special bronzes, and three papers dealing with the corrosion and protection of magnesium alloys.

**An Introduction to the Study of Physical Metallurgy** By Dr. Walter Rosenhain. Revised and partly re-written by Dr. John L. Haughton. Third edition. Pp. xvi+368+36 plates. (London: Constable and Co., Ltd., 1935.) 20s. net.

THE method adopted in the preparation of the present edition by Dr. Haughton has consisted in the retention of as much as possible of the character of previous editions. The earlier and more elementary part of the book required only slight modification. The chapter on the thermal study of metals and alloys, on the other hand, has been re-written; more attention has been given to ternary diagrams, and all the binary diagrams have been brought up to date. There has also been incorporated a section on the application of the methods of X-ray analysis, contributed by Mr. G. D. Preston. But the latter half of the book, dealing with mechanical testing, plastic deformation, thermal and mechanical treatment and defects and failures in metals, has been left very much as Rosenhain first compiled it in 1914. Very little attention has been given to modern work, while the amorphous metal concept has been retained in all its cumbrous details and assumptions.

**The Official Year-Book of the Scientific and Learned Societies of Great Britain and Ireland:**

with a Record of Publications issued during Session 1934-1935. Compiled from Official Sources. Fifty-second Annual Issue. Pp. vii+169. (London: Charles Griffin and Co., Ltd., 1935.) 10s.

THIS invaluable reference book has similar format and contents to those of previous issues. The number of societies has again increased during the past year, and these are arranged in fourteen sections according to the subject of their interests. Under each society is given its postal address, etc., list of officers, membership, time and place of meetings, publications and any other important information. All necessary details have been obtained from the officials of the societies and institutions concerned, and this makes the volume all the more authoritative and reliable. No university, research or technical library can afford to dispense with this compilation of useful information.

**A Manual of Practical Anatomy:**

A Guide to the Dissection of the Human Body. By Prof. Thomas Walmsley. Second edition. In 3 Parts. Part 1: The Upper and Lower Limbs. Pp. viii+376. (London, New York and Toronto: Longmans, Green and Co., Ltd., 1934.) 12s. 6d. net.

THE second edition of this manual of dissection maintains the standard of brevity combined with clarity which was the essential feature of the first edition by the distinguished professor of anatomy in the Queen's University of Belfast. The book has been slightly enlarged by the addition of some exercises in the making of measurements which are used in clinical practice, and by the growth of the sections dealing with surface markings in the living subject.

The illustrations are as simple as is compatible with accuracy, and the radiographs are chosen with extreme care.



## Sensitising Dyes and their Use in Scientific Photography\*

By Dr. C. E. K. Mees

ONE of the problems to be encountered in the early days of photography was that photographic materials were not sensitive to the spectrum in the same way that the eye is. Whereas the normal eye is sensitive to the colours of the spectrum from violet through blue, green, yellow and orange to red, the early photographic plates were sensitive only to the ultra-violet, violet and blue.

In 1873, H. Vogel, of Berlin, found that some collodion dry plates possessed sensitivity in the green portion of the spectrum, and he traced this green sensitivity to the presence in the emulsion of a yellow-red dye. Vogel got similar effects with other dyes which, on this account, were later called sensitising dyes or sensitisers, and he came to the conclusion that when a dye acted as a sensitiser in this way, the region of the spectrum for which it was effective corresponded approximately to the absorption band of the dye. Thus a dye which absorbed green light would render a photographic plate sensitive to green. This fundamental relationship underlies all work on sensitising, and it is worthy of attention that Vogel grasped this truth immediately in spite of the fact that his emulsions were very slow, his dyes probably impure and, at best, weak sensitisers, and his apparatus primitive.

Vogel recognised that the dyes which acted as sensitisers for silver bromide must not merely stain the collodion or gelatine in which the silver bromide was imbedded but must also actually be adsorbed on to the surface of the silver bromide particles. Thus the energy which they absorbed could be transmitted in some way to the silver bromide. Vogel's results were at first subjected to a great deal of adverse criticism, and even ridicule, many other workers being unable to confirm his results. But Becquerel in 1874, and then Waterhouse in 1875, were able to support his discovery.

The first sensitising dye to attain any general use was eosin, which sensitises collodion emulsion strongly for the yellow-green. After the introduction of gelatine dry plates, J. M. Eder suggested the use of erythrosin in the place of eosin, and this was generally adopted for the production of the so-called 'orthochromatic' plates, and was almost the only dye used in commercial manufacture before 1906.

Shortly after the beginning of this century, attention was directed to the dyes belonging to

the 'cyanine' group. In 1856, a dye known as 'cyanine' had been made by Williams from impure quinoline, but although it had a beautiful blue colour, it was very fugitive to light. Williams's cyanine had been used by Vogel in his early experiments and was considered a useful sensitiser for the orange-red, but it caused fog and spotty patches on the plates.

In 1883, another dye made from quinoline and related to cyanine was discovered, and in 1902 this dye, known as 'ethyl red', was tested by Miethe and Traube for sensitising power, and was found to give good green sensitivity without the tendency to fog characteristic of cyanine. Ethyl red belongs to a group of dyes known as the isocyanines, which are synthesised by the treatment of a mixture of quinaldine and quinoline quaternary salts with an alkali.

At the time that Miethe and Traube described the sensitising power of the simple isocyanine, ethyl red, E. König of the Hoechst Works of Meister, Lucius and Brüning, was synthesising a number of *iso*-cyanines, which were placed on the market under trade names, such as Pinachrome, Orthochrome *T*, Pinaverdol, etc., these being made from substituted quinolines and quinaldines, and by 1904 it was clear that the cyanine dyes of the new type were much more suitable for use in photographic sensitising, especially for the yellow-green and orange, than any dyes previously known.

In 1904 Homolka, one of König's colleagues, carried out the reaction used in the preparation of an isocyanine but with the addition of formaldehyde, and in the place of a red isocyanine he obtained a blue dye of which the structure was not elucidated at the time, but which proved to be a powerful sensitiser for the red, and was placed on the market under the name of Pinacyanol. It was later found that the quinoline nucleus does not form part of the dye molecule, and pinacyanol is at present made from the quinaldine salts using a compound such as iodoform or orthoformic ester, to supply the additional methine group.

Soon after the discovery of pinacyanol, the little firm of Wratten and Wainwright in Croydon applied the new dyes, especially pinachrome and pinacyanol, to the preparation of commercial plates, and in 1906 made plates containing both pinachrome and pinacyanol, which were placed on the market under the name of 'Wratten

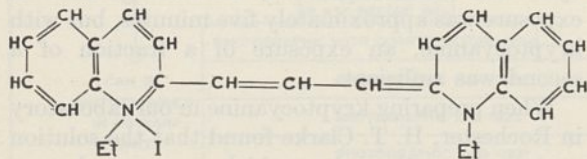
\* Friday Evening Discourse delivered at the Royal Institution on January 31.



Panchromatic' plates. These were the first panchromatic plates to be made on a commercial scale with the new type of dyes, and following the introduction of the plates and of a series of light filters adapted for use with them, the whole art of the photography of coloured objects developed rapidly as a practical commercial process.

The cyanine dyes are derived from organic bases containing nitrogen. Bases of this kind add on two atoms or groups to form quaternary salts. Thus quinoline adds on ethyl iodide and forms quinoline ethiodide. The bases from which the first cyanine dyes were derived were quinoline and quinaldine, in which the hydrogen attached to the carbon atom of quinoline next to the nitrogen has been replaced by a methyl group.

Our present knowledge of the structure of the cyanine dyes is due very largely to the work of Dr. W. H. Mills and his students at Cambridge, and of especial importance was the paper that he published with Dr. F. M. Hamer in 1920, on the structure of pinacyanol.



Pinacyanol ethiodide.

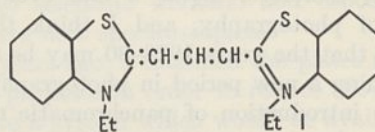
It will be seen that the two nitrogen atoms in the quinoline nuclei are connected by a chain of five carbon atoms with alternate double and single bonds between them. A system of this kind is known as a conjugate chain and is characteristic of the cyanine dye series.

Since the dyes in which one CH group derived from the base itself united the two nuclei are called cyanines, Mills and Pope called the dyes with three CH's in the chain carbocyanines, because it was necessary to supply one additional carbon atom. Later, Heilbron and his students at Liverpool made dyes with five CH's in the chain, and these he called dicarbocyanines. Very important dyes have been made containing seven CH's which are known as tricarbocyanines, while, as will be seen later, tetra- and pentacarbocyanines have been prepared with chains having nine and eleven CH's respectively.

It will be realised that there must be an enormous number of cyanine dyes, because we not only have the possibility of varying the number of CH's in the chain, but also we can substitute a hydrogen in the chain by another group, and we can prepare dyes from a great many different organic bases containing nitrogen.

More than fifty years ago, Hofmann made a violet dye from the quaternary salt of 1-methyl

benzthiazole, and Hofmann's dye was shown by Mills to be a thiocarbocyanine, the exact analogue of pinacyanol.



Thiocarbocyanine.

A very large number of dyes has now been made from substituted benzthiazoles, and many of these are excellent sensitisers.

The development of these new carbocyanines has during the last few years been of the greatest value for practical photography. The new dyes from the thiazole bases are far better sensitisers than pinacyanol and the other dyes derived from quinoline, and by making use of them new panchromatic materials have been prepared which are generally known as 'super-sensitive' or 'hyper-sensitive' materials.

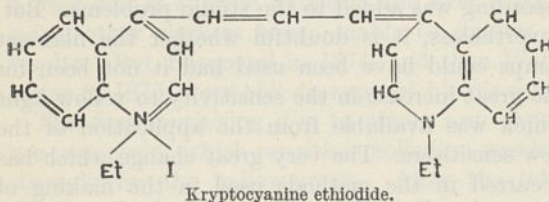
The great value of these new sensitisers is that they do not lower the general sensitivity of the emulsion, and that they show no tendency to fog, emulsions sensitised with them often being even less prone to fog than the unsensitised emulsions. As a result, the effective sensitivity of the new panchromatic materials is greater than that of the same emulsions unsensitised, and this is particularly true when the emulsion is of very fine grain and is consequently slow before sensitising, and where the exposures are made to a light source rich in the red and green rays of the spectrum. Just at the time that the new sensitisers became available, the motion picture industry adopted the use of filament lamps for the greater part of studio lighting in place of the arc lamps used previously. The filament lamps are more convenient in operation because they need much less attention and they have the advantage of being entirely silent, which was necessary when sound-recording was added to the studio problems. But, nevertheless, it is doubtful whether the filament lamps could have been used had it not been for the great increase in the sensitivity to yellow light which was available from the application of the new sensitisers. The very great change which has occurred in the methods used in the making of motion pictures is, therefore, directly traceable to the scientific work on the structure of the cyanine dyes which I have been discussing. In the same way, the use of panchromatic materials, and especially of panchromatic materials of exceptionally fine grain, stimulated the use of miniature cameras, and notably the use of those miniature cameras for photography indoors by artificial light which is often referred to as the use of the 'candid



camera', perhaps because the results are sometimes more candid than pleasing.

The introduction of the new panchromatic materials, therefore, marks a real event in the history of photography, and I think that it is probable that the years 1928-30 may be regarded as beginning a new period in photography dating from the introduction of panchromatic materials into everyday use as distinguished from their previous employment for the specific photography of coloured objects. For the scientific applications of photography, however, the increase of sensitivity obtained in the visible spectrum, while of value, was less significant. The effective sensitiveness of the new panchromatic materials, as compared with those available previously, may be three or four times, and this is of the greatest importance in motion picture work; but it is not sufficient to make any great change in the practice of astronomical or spectroscopic photography. A much more important matter was the development of sensitisers specifically adapted to use in the infra-red region of the spectrum.

The first sensitiser to give satisfactory results in the infra-red was dicyanine, which was made at Hoechst in 1906. This dye was a true sensitiser for the near infra-red, but it was very unsatisfactory in use, and although it enabled the photography of the infra-red spectrum to be carried out, it was only used by a few workers who had acquired the necessary skill, and it was not practicable to make ready-sensitised plates with it. In 1919 Adams and Haller, working at the United States Bureau of Chemistry, carried out the pinacyanol reaction, but instead of using quinaldine in which the methyl group is on the carbon next to the nitrogen, they used lepidine, which is identical with quinaldine except that the methyl group is removed from the nitrogen, being separated by another two carbon atoms. The synthesis occurs quite normally and yields a blue-green dye which Adams and Haller called kryptocyanine.



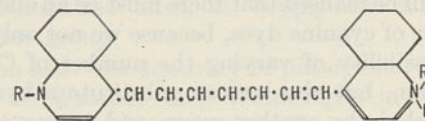
It will be seen that it is a carbocyanine like pinacyanol, but that in addition to the three CH's of the chain the nitrogen atoms are separated by three carbon atoms in each nucleus, so that the conjugate chain of kryptocyanine has four more links than that of pinacyanol. As we should expect, this shifts the absorption of kryptocyanine, and also its sensitising, towards the longer wave-

length, so that its maximum of sensitivity is in the near infra-red at  $\lambda$  7500 A.

Kryptocyanine is a very strong sensitiser, and by its use it was at once possible to take ordinary photographs using infra-red light. So long ago as 1910, Prof. R. W. Wood took photographs by light of longer wave-length than  $\lambda$  7000 A., using a strong filter to cut out all the shorter wave-lengths, and plates sensitised with pinacyanol; in these photographs the notable peculiarities of landscape pictures taken by infra-red light were manifest. The blue sky is almost black owing to the low scattering power of the upper atmosphere for the longer wave-lengths; clouds stand out in startling contrast to the black sky, and the chlorophyll of grass and trees reflects the infra-red so that foliage appears as if it was covered with snow. Moreover, because of the low scattering power of the atmosphere for the longer waves, pictures taken by infra-red light show a penetration of the distance greatly exceeding that shown by ordinary photographs or even that visible to the eye. For Wood's pictures, the average time of exposure was approximately five minutes, but with kryptocyanine, an exposure of a fraction of a second was sufficient.

When preparing kryptocyanine in our laboratory in Rochester, H. T. Clarke found that the solution contained another dye which we named xenocyanine, and which we now know to be of rather complicated structure, although it is still a cyanine dye. With this dye the maximum sensitivity was at  $\lambda$  8500 A., and by means of it the photography of the spectrum was extended easily as far as  $\lambda$  9000 A.

About 1930, the tricarbocyanine dyes were synthesised almost simultaneously by three groups of workers, and their very powerful sensitising and ready accessibility made it possible to sensitise throughout the infra-red spectrum as far as  $\lambda$  11000 A. Of the tricarbocyanines, the one having the furthest extension in the infra-red was xenocyanine, which is the tricarbocyanine from lepidine corresponding exactly to kryptocyanine, except that there are seven CH's in the chain and no less than thirteen CH's between the two nitrogen atoms, seven of them being in the chain and three in each of the nuclei. The maximum sensitising of xenocyanine is at  $\lambda$  9600 A.



Xenocyanine.

Using tricarbocyanines, a great many very remarkable photographs have been taken by infra-



red light. From aeroplanes, photographs can be taken which far exceed the range of the human eye, the record for distance still being held by that taken by Capt. A. W. Stevens in 1932 of Mount Shasta in California, the machine at the time flying over the Pacific 330 miles from Mount Shasta.

In addition to these long-distance photographs, of which many examples have been made during the last few years, photographs may be taken by infra-red light which is effectively invisible to the eye. So long ago as 1931, a photograph was taken of a large group of people who could see nothing whatever at the time, the room being lighted by tungsten lamps covered by filters of so great a depth that there was no visible light at all in the room.

possible to prepare photographic plates of high sensitivity to any special region in the spectrum, and such plates are, naturally, of the greatest interest to scientific workers, and especially to astronomers and spectroscopists.

A few years ago, I classified the plates required for these purposes in order to reduce the mass of material to a system which would be available for the scientific worker. In the first place there are various types of photographic emulsions which are useful in scientific work and we must have some method of indicating these. The fastest type of emulsion was called Type 1, this having the disadvantage of a somewhat grainy structure and being of only moderate contrast. Type 2 is a somewhat slower emulsion of greater contrast and less graininess, while Type 3 is a fine grained

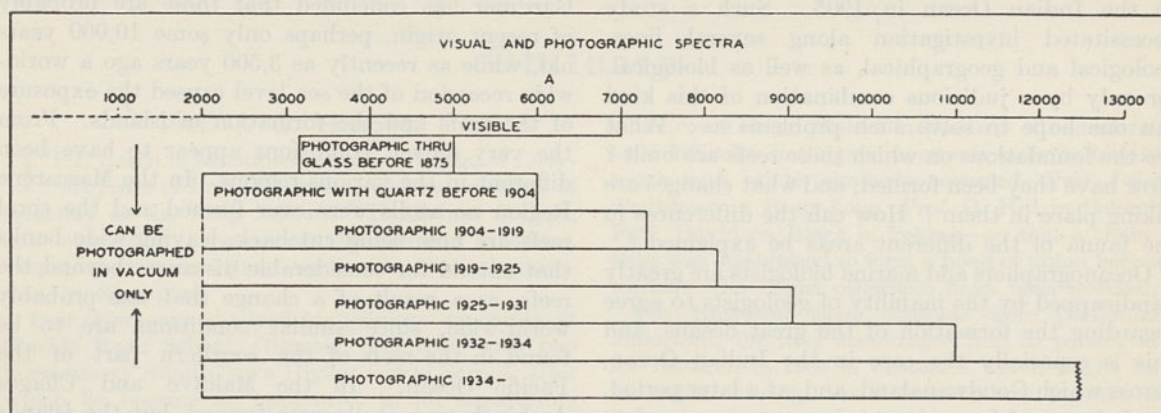


FIG. 1.

Within the last year, a still further extension of photography into the infra-red has become possible as a result of the development of tetra- and pentacarbocyanines. The method by which these long-chain dyes are prepared is due largely to Dr. W. König of Dresden. In this synthesis the chain of carbon atoms is supplied by taking a compound of what is known as a 'di-anilide' type and allowing this to react with the quaternary salt of the base. Aniline is split out and the dye is formed. By an extension of this system, tetra- and pentacarbocyanines have been prepared, of which the latter has no less than eleven carbon atoms in the chain, and these dyes have proved to be excellent sensitizers for the far infra-red. With them, Dr. Meggers of the Bureau of Standards has recorded an argon line at  $\lambda$  13008 A., and Dr. Babcock at Mount Wilson has photographed the solar spectrum to  $\lambda$  13000-14000 A.

There is thus a very wide range of cyanine dyes in which the absorption band and sensitising region ranges from extreme violet, or even ultra-violet in the case of such dyes as the oxocyanines, to a point in the infra-red approaching that where water vapour begins to absorb; this makes it

emulsion of high contrast. Type 4 was of extreme contrast and still less speed, and Type 5 a very slow emulsion of extremely fine grain. Now these different types of emulsion can be sensitised for different parts of the visible and infra-red spectrum, and the different sensitising are indicated by means of letters so that it is possible for an astronomer, for example, to decide that he could afford the exposure necessary for a Type 3 emulsion and that he wanted his maximum sensitivity in the orange with as high sensitivity as possible through the green but with no particular sensitivity in the red. Such a result is shown with the sensitising known as *D*, and the particular plate that he required would be classified as 3*D*.

The progress which the development of dyes has enabled us to make in the photography of the spectrum may be summed up in an approximate form in the accompanying chart (Fig. 1).

At the top of the chart is shown the visible spectrum and that portion of it which could be photographed on a collodion plate through glass apparatus before Vogel discovered the use of sensitising dyes. Vogel's discovery extended the



photographic spectrum to  $\lambda$  6000 A. The discovery of pinacyanol in 1904 extended the photographic spectrum to beyond  $\lambda$  7000 A. The effect of dicyanine has been ignored in the construction of the chart, though for a few workers its use extended the photographic spectrum to beyond  $\lambda$  8000 A. It was, however, only easy to reach

that wave-length after the discovery of kryptocyanine in 1919, while the production of neocyanine in 1925 extended the range to  $\lambda$  9000 A. Xenocyanine, made first in 1932, enabled  $\lambda$  11000 A. to be reached, and the pentacarbocyanine has now extended the photographic spectrum to beyond  $\lambda$  12000 A.

## Coral Reefs of the Western Indian Ocean

THREE papers recently published\* conclude the reports on the intensive study of the reefs of the Western Indian Ocean that was carried out by the Percy Sladen Trust Expedition to the Indian Ocean in 1905. Such a study necessitated investigation along several lines, geological and geographical, as well as biological, for only by a judicious combination of this kind can one hope to solve such problems as: What are the foundations on which these reefs are built? How have they been formed, and what changes are taking place in them? How can the differences in the fauna of the different areas be explained?

Oceanographers and marine biologists are greatly handicapped by the inability of geologists to agree regarding the formation of the great oceans, and this is especially the case in the Indian Ocean, across which Gondwanaland, and, at a later period, the isthmus of Lemuria, are by some supposed to have connected India and Africa and to have formed the bases on which present reefs have been built. Others believe with Wegener that the oceans were formed by the drifting apart of the continents, such isolated fragments as the Seychelles being detached and left behind during the process.

At the present day we are woefully ignorant regarding the nature of the rock of the sea-floor, and in this connexion Dr. Wiseman's study of the basal rock of Providence Island is of particular interest, as it shows that this is volcanic in origin, and is probably of Eocene-Oligocene age. The southern end of the great Seychelles Bank is volcanic, and the recent work of the John Murray Expedition has shown that the Carlsberg Ridge is, at least in part, also volcanic in structure. This raises the question whether all these areas may not have been formed simultaneously in the Eocene-Oligocene period as part of a widespread disturbance in East Africa, and perhaps con-

temporarily with the curved ridges of the Malay Archipelago. Whatever the origin of these foundations, many of them are to-day covered with coral reefs or atolls, and Prof. Stanley Gardiner has concluded that these are probably of recent origin, perhaps only some 10,000 years old, while as recently as 3,500 years ago a world-wide recession of the sea-level caused the exposure of the reefs and the formation of islands. From the very outset, conditions appear to have been different in the various regions. In the Mascarene Region no atolls were ever formed and the coral reefs are now being cut back, leaving wide banks that extend for considerable distances beyond the reefs, as a result of a change that was probably world-wide, since similar conditions are to be found in the reefs of the southern part of the Pacific Ocean. In the Maldivé and Chagos Archipelagoes, atolls were formed, but the islands and reefs are now being eroded away, though at different rates, so that while the Maldives are still in a comparatively stable condition, the Chagos group is composed mainly of submerged banks, the relics of former surface structures.

We are still uncertain as to the actual mode of formation of the reef and especially of the reef-rock that enables the reef to withstand the pounding of the seas, but Stanley Gardiner attributes this largely to the growth of *Lithothamnionæ*—"no bank reaches the surface to form a reef unless covered by *Lithothamnionæ*"—the upgrowing corals being firmly cemented together and converted into a reef by *Lithophyllum*. Thus any condition that may be detrimental to the growth of this alga would prevent the full development of the reef or, where such had been formed, its present maintenance; hence the necessity of a careful study both of the sea-water itself and of meteorological and other conditions.

Great differences are to be found in the fauna of the areas studied. The Seychelles appear to be inhabited by the remains of a fauna and flora of long standing, and this is explained by the erosion of a larger area into the smaller islands of the present time. The reef-fauna of the Maldivé,

\* *Proc. Linn. Soc.*, 1936. Reports of the Percy Sladen Trust Expedition to the Indian Ocean, 1905. The Reefs of the Western Indian Ocean. I. Chagos Archipelago. II. The Mascarene Region. By Prof. J. Stanley Gardiner. The Petrography and Significance of a Rock dredged from a depth of 744 fathoms, near to Providence Reef, Indian Ocean. By Dr. J. D. H. Wiseman. Concluding Remarks on the Distribution of the Land and Marine Fauna, with a List of the Water Temperature Observations. By Prof. J. Stanley Gardiner.



Chagos and Mascarene groups shows differences that can partly be explained by the differences in the reefs themselves, some reefs being stationary, while others are receding, and partly by different sources of origin dependent on their geographical situation. Throughout all the groups Stanley Gardiner found evidence of an invasion of species, probably by the dispersal of their larval stages along the great oceanic currents, from the East Indies, where there seems to have been a great outburst of new species in about Pleistocene times. One difficulty in accepting this explanation lies in the fact that we know too little about the length of time through which such a larva can survive, and, as Stanley Gardiner points out, the study

of the plankton catches at different depths around the Chagos and Maldivic Archipelagoes failed to reveal any larvæ that could be assigned to littoral animals. It has been suggested to me, however, that floating structures, such as tree-trunks or pieces of pumice, which after the explosion of Krakatoa drifted for years across the whole width of the Indian Ocean and were eventually flung up in thousands on all the coral banks of the Maldives, Laccadives and Chagos, may well have served as temporary rafts on which the larvæ might settle and develop to the adult stage, and thus provide a further succession of larvæ that might eventually reach even the farthest islands.

R. B. SEYMOUR SEWELL.

## Obituary

Prof. J. G. Harrower

THE death is announced at the early age of forty-six years of Prof. Harrower, who as professor of anatomy at the King Edward VII Medical College, and consulting surgeon at the General Hospital, Singapore, rendered great services to medical education in Singapore.

Prof. Harrower received his primary education at Shields Road School, Glasgow, and then with two bursaries at Allan Glen's Higher Grade School, after which he became an apprentice in an engineering shop. On the completion of his five years' apprenticeship he joined the staff of the electrical power station of the Glasgow Corporation Tramways as a shift engineer. During this time he attended classes in the Royal Technical College, Glasgow, and so acquired that facility in mathematics which was displayed in his biometrical research in craniology. He devoted particular attention to electrical engineering so as to equip himself for practice in X-ray work and radiology, but he did not pursue this aim.

The stimulating example of Prof. Le Gros Clark, who was inspired by his life in Sarawak to begin his important researches on "The Early Forerunners of Man", prompted Harrower to take advantage of living in the same city as the Raffles Museum and to study the comparative anatomy of the tree-shrews and *Nycticebus*, as well as human remains that came to light in the Malay States.

The work of departmental teaching involved the study of Chinese coolies and, in addition to recording anomalies such as the variations around the foramen magnum, which seem to attract the attention of most anatomists who work in Africa and Asia, Harrower devoted much attention to the intensive study of the Hokien and Tamil skull and the Hylam Chinese. How carefully he dealt with this difficult subject is revealed in the memoirs published in *Biometrika* (1929) and the *Transactions of the Royal Society of Edinburgh*, 1925-26. These researches,

which were accomplished in the face of considerable local difficulty in Singapore, served to bring him into touch with others similarly occupied—Prof. Joseph Shellshear in Hong-kong, Prof. O. Hill in Colombo, Prof. Davidson Black in Peking—so that a chain of links was established to form a bond of union between workers who might otherwise have been isolated.

For Harrower these contacts were particularly important, for they encouraged him to persist with his research in face of obstacles which might have been discouraging. As it was, he was a genial and happy man who was able to play his part in maintaining scientific effort in the south-eastern corner of Asia, and in so doing bring credit to his Alma Mater at Glasgow.

GRAFTON ELLIOT SMITH.

WE regret to learn that at the beginning of this year Dr. Kálmán Lambrecht, the palæontologist, died at Budapest from heart failure in his forty-seventh year. He was librarian to the Geological Survey of Hungary, and will be best remembered by his researches and writings on the fossil remains of birds. In 1921 he contributed the section on birds to the "Fossilium Catalogus", and in 1933 he published his exhaustive "Handbuch der Palæornithologie", which was reviewed in *NATURE* of January 19, 1935, p. 84. Dr. Lambrecht was also interested in biography, and at the time of his death he was occupied with a life of the late Baron Francis Nopcsa.

WE regret to announce the following deaths:

Sir Wilmot Herringham, C.B., K.C.M.G., consulting physician to St. Bartholomew's Hospital, vice-chancellor of the University of London in 1912-15, on April 23, aged eighty-one years.

Prof. Karl Pearson, F.R.S., emeritus professor and formerly Galton professor of eugenics in the University of London, on April 27, aged seventy-nine years.



## News and Views

### Mandates

MR. BALDWIN'S statement on the future of the mandated territories under Great Britain in the House of Commons on April 27 no doubt went as far as it is possible to go in the conditions which, as he explained, govern the allocation of these areas and their peoples. Ultimately, consent to any proposed transfer rests with the Council of the League of Nations. While Mr. Baldwin's assurance not only that the question of a transfer of mandated territory to another Power had not been under consideration by the British Government, but also that no decision or proposal would be made without full discussion by Parliament, may in some measure allay the growing feeling of anxiety, his statement was not such as to give absolute confidence to those who fear that the wishes of the inhabitants of the mandated territories, and more especially the indigenous inhabitants, will not be consulted. The case for Tanganyika and that for South-West Africa are being argued with no little point, because of the weighty European and South African interests involved; but for those who appreciate the efforts which are being made in such territories as Togoland and the Cameroons, for example, or in New Guinea, to advance the interests and status of the native in the light, more or less as the case may be, of a scientific approach to the problems of administration, too little is heard of their even stronger claims to consideration. Any change in such territories would be little short of disastrous. The same applies in almost an equal degree to the mandated territories in Africa under France and Belgium, where, whatever may be our opinion of the suitability of the measures adopted, they have at least been framed with the advantage of the native as their primary objective.

### Eskimo Origins

It is announced that the Danish Government has awarded the gold medal and prize of 1,000 kronen, open to international competition for the best study of Eskimo origins, to Henry B. Collins, jun., of the U.S. National Museum, Washington, D.C. The problem of Eskimo origins is one in which the Danish people by historical association are peculiarly interested. Their anthropologists have on the whole adhered to the view put forward by Steensby of an eastern source. K. Birket-Smith, for example, in his book, originally published in 1927, but recently appearing in an English translation (see p. 722 of this issue), holds that the distinctive Eskimo culture developed somewhere in the neighbourhood of Hudson Bay; and that one line of migration, which travelled to the west, acquired elements of the earlier culture of Alaska and pushed on to Siberia. In America the cumulative effect of Asiatic affinities in indigenous cultures, as well as the evidence of physical

anthropology, supporting an Asiatic source for American origins, has weighed against the acceptance of the eastern theory; while the archaeological evidence, which has accrued from the intensive investigations of recent years on ancient village sites in Alaska, has been interpreted in a like sense and as pointing to the extreme north-west, or even farther in Asia, as the area in which the beginnings of Eskimo culture must be sought. Mr. Collins, who himself has conducted excavations on St. Lawrence Island, Alaska, in his thesis puts forward the view that Eskimo culture is derivative from the earlier Archaic or Bering Sea and Punuk cultures, its characteristic and fundamental elements, the house with entrance passage, skin boots, sledge, etc., going back ultimately to Siberia; while the eastern Eskimo, so far from being original, represent a degeneration in culture which came about in the course of their migration from the west eastward.

### A. J. B. Parent-Duchatelet (1790-1835)

MAY 7 marks the centenary of the death of Dr. Alexandre Jean Baptiste Parent-Duchatelet, one of the most eminent hygienists of the nineteenth century. He was born on September 29, 1790, in Paris, where he qualified on August 13, 1814, with an inaugural thesis on cholera. After an unsuccessful attempt to establish a private practice, he devoted himself to public health. His numerous works included essays on the Paris sewers (1822), the influence of tobacco on the health of workmen in tobacco factories (1829), the effect of emanations from putrifying animal matter on food substances (1831), steeping of hemp in relation to public health (1832), sanitation of dissecting rooms (1835), and prostitution in the city of Paris in relation to public health, morality and administration (1836). This last publication, which appeared posthumously, is an epoch-making work and ranks as a medical classic. The second edition, which was published in 1837, contains an essay on his life and work by F. Leuret, physician to the Bicêtre infirmary. In 1829, Parent-Duchatelet was one of the founders of *Annales d'hygiène et de médecine légale*, which is still one of the most authoritative journals in the world on hygiene. He was physician to the Hôpital de la Pitié and member of the Conseil de Salubrité, of which he became vice-president three months before his death at the early age of forty-five years.

### A Close Approach to the Earth

THE closest celestial object to the earth is our own moon, the mean distance of which is roughly a quarter of a million miles. No other object is known to have approached nearly so closely to us without falling to the earth's surface. The record for a close approach had been held by an eighteenth-century



comet, discovered in 1770 by Lexell, which was distant only 1.40 million miles from the earth's surface. Some recently discovered minor planets have come fairly close to the earth; Amor, discovered in 1932, came within ten million miles, and 1932 HA within six million; but all records, cometary or planetary, have been broken by the minor planet 1936 CA discovered by Delporte at Uccle on February 12 of this year. This tiny object passed within 1.38 million miles of the earth on February 7. It has proved extremely difficult to determine the elements of this minor planet's orbit, and in particular, the period is hard to ascertain, so that it is difficult to predict the next approach. Since the object passes close to several major planets, large perturbations in its orbit may be expected. It is not impossible (though the possibility is remote) that the object may ultimately collide with the earth; there is a wide margin of safety at present. The view has been expressed that this object may belong to the same group as the great meteorites of Siberia and Arizona. On the other hand, far from colliding with a major planet, the object may eventually be thrown into a very long orbit with a very long period, or even ejected from the planetary system altogether. Should a collision occur, the damage will be very severe over an area having a diameter of a hundred miles or so, judging by the Siberian meteorite.

#### Snuff-Taking

At a meeting of the Society for the Study of Inebriety and Drug Addiction held on April 21, Dr. J. D. Rolleston read a paper on snuff-taking, which he said has increased enormously within the last five years as the result of letters to *The Times* by Sir Buckston Browne advocating the use of snuff as a protection against colds. On its first introduction into Europe in the middle of the sixteenth century by Jean Nicot, the French ambassador at Lisbon, snuff was used for the treatment of headaches and colds in the head. It soon, however, passed from being a drug to the rank of a luxury, and snuff-taking became general throughout Spain, Italy and France during the early part of the seventeenth century. Snuff-taking was introduced into Great Britain at the time of the Restoration by the courtiers and officers of Charles II in France, and its popularity increased considerably after the Great Plague. Henceforward until about the middle of the nineteenth century, the snuff box played an important part in the social life of the time, and medical and lay writers were equally extravagant in their praise or denunciation of the new habit. The most serious complication of snuff-taking, to which numerous references are to be found in the medical works of the last century, was the occurrence of plumbism due to the accidental adulteration of the snuff by lead in the packing. Numerous other adulterants which were not only detrimental to the revenue but also injurious to health were described by an Analytical Sanitary Commission in 1853. The Commission, however, was of opinion that the constitutional effects of snuff-taking were much less than in the

case of smoking and chewing tobacco, the effects in most cases being mainly local. In conclusion, Dr. Rolleston said that there is no recent information as to how far snuff-taking might become an addiction, but that most probably it should be ranked with other forms of consumption of tobacco, voluntary or enforced cessation of the habit causing considerable discomfort in some cases and little or none in others.

#### William Weston and Early American Engineering

At meetings of the Newcomen Society held almost simultaneously in London and New York on April 22, a paper by Prof. R. S. Kirby of Yale University was read entitled "William Weston and his Contribution to Early American Engineering". Weston was an Englishman, possibly born in Oxford in 1753, who before he was forty years of age had gained a reputation as a civil engineer sufficiently high for him to be engaged to go to the United States as engineer to the Schuylkill and Susquehanna Navigation Co., of Pennsylvania, which proposed to connect the Susquehanna by canal with the Schuylkill, and canalise the Schuylkill from Reading to Philadelphia. He sailed from Falmouth on November 23, 1792, and arrived at Philadelphia early in January 1793. The researches of Prof. Kirby have brought to light much information about Weston's connexion with the above schemes and with the Philadelphia and Lancaster Turnpike, the Middlesex canal connecting the Merrimack with Boston, the Potomac River Locks, the Western Inland Lock Navigation, the Schuylkill River Bridge and lastly the New York City water supply. Weston returned to England probably in 1799 or 1800. The only English work of his of which there is certain knowledge is the bridge over the Trent at Gainsborough, built in 1787-91; but strangely enough, practically nothing is at present known of his early career or of the activities of his later years. He inspired confidence in those with whom he came into contact in America and, says Prof. Kirby, he had a considerable influence on American engineering.

#### Exploration by Aeroplane

AN aerial survey over that part of Papua recently explored by Mr. Jack Hides, an assistant resident magistrate (see NATURE, Aug. 17, p. 251, Aug. 24, p. 290, 1935), by clearing up obscure points in the previous record, once more has illustrated the advantages of this aid to exploration in difficult country. Its assistance in giving speed and enlarging the range of vision was strikingly and conclusively demonstrated a few years ago by the aerial reconnaissance made by Dr. S. P. Morley of the Carnegie Institution, Washington, D.C., over the forest country of Central America, when in the course of a few hours flying, a large number of previously unknown ruins and archaeological sites were located in forest areas of Yucatan and Honduras, which it would have been possible to reach only after weeks or even months of travel, if at all, by the ordinary means of transport. In Papua, the country covered by Mr. Hides in eight months was traversed in flights lasting



only two days, while the limestone plateau on the approach to the Leonard Murray Mountains, the "cruel tract" of needle points and razor edges, which cost him eleven days arduous and painful travel, was crossed in fifteen minutes. No less significant was the accuracy with which it was possible to observe and distinguish the tracts and types of country described in the record of the original exploration. The account of the survey given by Mr. Lewis Lett (*The Times*, April 25) fully bears out Mr. Hides' description of the country as "a wonderland". In its isolation, it should prove the happy hunting ground of the future for the indomitable anthropologist.

#### Mummification in Egypt

AN interesting discovery, which it is thought may prove of considerable importance for the history of mummification in Egypt, is reported from Cairo. In a tomb near one of the pyramids opened by Prof. Selim Hassan, of the University of Cairo, has been found the body of a pregnant woman completely wrapped in bandages. She was the wife of Sechem Nefer, governor of a province under Chefren, the king of the Fourth Dynasty (2650 B.C.), who built the second pyramid at Gizeh. This, it is stated by the Cairo correspondent of *The Times* in the issue of April 21, is believed to be the oldest mummy known. In another tomb, that of Knum Baef, a son of Chefren, is a large white sarcophagus, not yet opened, upon which was found a gold necklace three feet long, with beading of carnelians, amethysts and turquoises, and ivory and gold finger sheaths. A third tomb was found to contain the mummy of a man completely wrapped in bandages with the exception of the head. The earliest date at which mummification was practised in Egypt is at present somewhat obscure. It is possible that even so far back as the First Dynasty some attempt was made to ensure preservation of the body; and in the Second Dynasty the corrosion of the linen bandages in which the bodies are wrapped has been thought to be due to a practice of smearing the corpse with natron. Similar effects have been observed in burials of the Third and Fourth Dynasties. The full process, involving removal of the internal organs of the body, appears in the Fifth Dynasty. Details of the process applied to the preservation of the body of the wife of Sechem Nefer consequently will be of the greatest interest.

#### Telephones for Use in Apartment Flats

THE problem of installing a system of telephones in a block of flats differs in one important respect from a private telephone installation such as is used by a large business organisation privately owned. Flat dwellers, although resident in one building and indirectly employing a common staff, are independent members of the public. Hence in those countries where the provision of telephone communication is a monopoly either of the State or of companies acting under charter, the establishment of a system which enables tenants of flats to communicate with each other would be illegal. A telephone system for flats

does not provide for intercommunication between tenants. The objects are to obtain immediate communication with the hall attendant and in some cases with the kitchen, garage and administrative office. In the *Osram G.E.C. Bulletin* of February, a telephone system is described in which the connexions are made to a 'reply panel' and not to a switchboard. It is designed to operate on the standard A.C. mains supply, a small power unit supplying direct current for speech and lamps so that no batteries are required. The 'buzzer' is also operated from the A.C. mains and hence the possibility of interference with radio sets in the building is removed. A picture is shown of a typical reply panel equipped for forty lines to flats. In addition, there are four service lines enabling the flat lines to be connected with all service lines, and ten 'tie lines' giving connexion when wanted to other panels. Each flat has a connecting plug associated with a calling lamp: there is also a buzzer on the panel giving an audible signal and thus relieving the attendant from the necessity of paying attention to the board except when his services are actually needed.

#### Electrical Communication in Japan

IN the February number of *Nippon Electrical Engineering*, published quarterly in English by the Institute of Telegraph and Telephone Engineers of Japan, the present status of Japanese broadcasting is discussed. It started ten years ago, and there are now 2,300,000 subscribers. Japan has a long and narrow configuration consisting of several islands the centres of which are covered with mountain ranges, so that conditions for broadcasting are very unfavourable. In this case it is much more effective to distribute a large number of low-power broadcasting stations over all the region than to erect a few high-power stations. The plans based upon a low-power many-station principle are being progressively realised. At the same time, in order to compete with other countries in international communications and to protect Japanese listeners against local interference, it has been decided to instal two high-power broadcasting stations, with 150 kilowatts of antenna power each, on the outskirts of Tokyo. It is computed that the field strength in Tokyo will be more than 200 millivolts per metre and will be ample to overcome any background of noise. All the equipment required for the stations can now be made locally. The Japan Broadcasting Corporation (B.C.J.) has built a special laboratory for studying radio technique. It has investigated apparatus for noise elimination and has made a direction finder for detecting the origin of noises. It is engaged in researches on television and is carrying out special experimental investigations on photo-electric tubes.

#### Applications of Photo-Electric Cells

AT a meeting of the Illuminating Engineering Society held on April 8, three papers were read on the uses and characteristics of photo-electric cells. R. C. Walker described the various types of light-



sensitive cells. He pointed out that the problems to which it is intended to apply them are often mainly optical, electrical or mechanical. Audible warnings are sometimes given of the opening or closing of lift gates and announcing the record of automatic weighing machines. They will also be used on automatic telephone exchanges for announcing the correct time. Great demands on photo-cells will soon be made in television transmission. They are used for transmitting pictures by wire and radio. Other uses described were in counting objects, like cigarettes, passing along a conveyor, in giving warning when the web fractures on high-speed printing machines, for burglar alarms, smoke detection in factory chimneys, regulating the speed of escalators and the timing of sporting events. L. H. McDermott described three different ways in which photo-cells have been used in connexion with problems of daylight illumination. The first was a relay to control the lighting of part of the National Portrait Gallery, the second was a device for the continuous recording of the amount of daylight illumination at Teddington and the third was used in the investigation now being carried out at the National Physical Laboratory into the lowest value of natural illumination which an office worker requires. In the third paper, W. H. B. Hall described an interesting device by which the automatic lighting and extinguishing of gas lamps at a London school was controlled by means of a photo-cell.

#### Technical Exhibition at Glasgow

A TECHNICAL exhibition was held in the Royal Technical College, Glasgow, on April 24-25. This exhibition was organised by the students of the College for two purposes: to provide the public with an opportunity of inspecting the College, and to provide past and present students and their friends with the opportunity of meeting one another socially. During these days each Department of the College was open for inspection, and was demonstrating the processes illustrating the various subjects studied in the College. In addition, the students obtained the co-operation of nearly forty outside firms, which sent numerous exhibits to supplement those on view in the Departments. The exhibition was officially opened by Mr. J. W. Peck, secretary of the Scottish Education Department; Mr. G. M. Smith being in the chair. The public was given the opportunity, for the first time, of viewing the wind tunnel recently installed in the Department of Mechanical Engineering for the purpose of aeronautical research, and also the distillation plant which was presented six months ago to the Technical Chemistry Department. Other exhibits of interest included a demonstration of television, glass-blowing, metal-spraying, spectrographic analysis, ultra-violet radiation, and many others that were of interest not only to the scientifically trained person, but also to the public. A Former Students' Association has been formed, and the inaugural meeting was held immediately after the opening ceremony, Mr. J. W. Peck being the chairman.

#### Fire and Vegetation

THIS very debatable subject has recently been discussed from a very statesmanlike point of view by a South African botanist, Prof. John F. V. Phillips (*J. South African Bot.*, 2, Part 1). It is pointed out that whilst such characteristic native vegetation as the beautiful 'fijnbos' (the macchia or maquis of the south-west Cape) may be irretrievably damaged by fire, and whilst there is every reason for excluding fire definitely from the water conservation areas, yet on the other hand there is also clear evidence that controlled firing, carried out at the proper season, may encourage the subsequent establishment of better pasture grasses. Further, it may be argued that absence of fires, coupled with overstocking, has contributed to a marked increase in the prevalence of the woody overgrowth, especially of species of *Acacia*, which has led to a deterioration in the pastoral value of much tree-and-grass savanna. There is thus evidence of a need for protection of certain land from any type of fire treatment, whilst in other localities an early application of controlled fire treatment is probably desirable. Such a problem requires action by a responsible body, and Prof. Phillips suggests that the Minister of Agriculture and Forestry should act as chairman of a special Commission of Conservation which should formulate a policy and co-ordinate the functions of the various Government departments involved in the carrying out of this policy. Important legal and administrative problems are concerned. The matter is regarded as urgent by Prof. Phillips, who concludes that uncontrolled firing is costing South Africa untold millions and "creating for posterity a most serious state of affairs, which no amount of money ever would be capable of putting right".

#### Seed Oats for Hill Districts

ALTHOUGH oats are still an important crop in Wales, a variety suitable to the particular conditions of the hill districts has been a long-felt want. Up to the present, *Avena strigosa* or Ceirch Llwyd has been grown on this type of land, and although it is essentially a variety for wet districts and poor land, it has the great disadvantage of not yielding a good sample, being heavily awned and consequently difficult to thresh. Breeding experiments with *Avena strigosa* carried out at the Welsh Plant Breeding Station have, however, resulted in the production of a new variety, Ceirch Llwyd Cwta S. 171, which is described in Leaflet Series S. No. 3, issued by the University College of Wales, Aberystwyth (price 1s.). The chief point of interest lies in the fact that it is awnless, but in addition it yields well or better than the older variety, the grain is heavier, the bushel weight higher and the protein content greater; finally, it shows a resistance to both loose and covered smut. The amount of seed available for sowing this spring (1936) is about five tons, the wholesale price being 20s. per cwt. Co-operative societies, merchants and farmers interested in the new variety are asked to communicate with the Station at the earliest opportunity, as unless accurate estimation of the demand is obtained,



it will be impossible to gauge the acreage that should be sown down this spring in order to meet the seed requirements of the succeeding year. At the end of the leaflet some account is given of the Association of Farmers for the Growing and Marketing of Seed Oats in Wales.

#### Recent Acquisitions at the Natural History Museum

IMPORTANT collections, mostly of large ungulate mammals, have been received as donations from Major P. H. G. and Mrs. Powell-Cotton and their daughters, collected by them in Tunisia, Italian Somaliland and Zululand. A collection of forty-six mammals from Uganda has been received as a gift from Captain C. R. S. Pitman, and the skin of a lion from British Somaliland has been presented by Mr. F. J. E. Manners Smith. Seventy-four photographs of mammals have been presented by exhibitors at the recent *Country Life* Exhibition of Nature Photography which was held in the Museum. Mr. F. N. Ashcroft has enriched the mineral collection by a further selection from his collection of Swiss minerals. The gift comprises 651 specimens from ninety-seven localities, and the minerals represented include datolite, rutile, sphene, apatite, smoky-quartz, rock-crystal and adularia. The Director of the Geological Survey of Uganda has presented a series of the ores and associated rocks from the Kilembe mine, Toro, Uganda. The Department has received by exchange two pieces and fragments, with the combined weight of 1,372 gm. (about 3 lb.), of the meteoric stone which was seen to fall in 1929 at Taug, 25 miles south of Kirkuk, Irak. The collection of precious stones has been strengthened by the purchase of cut specimens of rubellite, euclase, fluorite, amazonite, and rhodonite, with in some instances the corresponding rough material. A small suite of newly discovered minerals from Montana also has been purchased.

#### The New Commonwealth Society

THE annual report of the New Commonwealth Society for the year ended September 30, 1935, refers to the progress of the international section of the Society leading to the establishment of national sections in the British Empire, France and Germany, while groups are being formed in Holland, Hungary and Spain. The effective membership is now 1,659, drawn from 42 countries. Plans are being prepared for an intensive appeal campaign spread over three years to place the activities of the Society on a self-supporting basis. The research activities of the Society have now been taken over by the New Commonwealth Institute, with Prof. Ernst Jäckh as director. The Advisory Research Committee has been further strengthened during the year, and as a result of the response to a research memorandum which was circulated, three series of monographs have been issued, dealing, respectively, with principles of international relations, questions of international justice, law and equity and with problems of international security. Several issues of the *New Commonwealth Quarterly* have also been published

covering the whole field of research undertaken by the Institute, and the Institute participated in a study conference on "Collective Security" organised by the International Institute of Intellectual Cooperation.

#### Work of the Central Midwives' Board

THE recently issued Report on the Work of the Central Midwives' Board in Great Britain for the year ended March 31, 1935 (H.M. Stationery Office, 3d. net) is of general interest now that so much attention is being directed to the subject of maternal mortality, in view of the midwives' work for the safety and well-being of mothers. The Midwives' Roll contained the names of 58,964 women, of whom, however, only 15,434 are practising. Of 3,922 new candidates examined, 2,936 passed. Only 18 midwives were dealt with by the Board on account of malpractice, negligence or misconduct, a tribute to the general efficiency of the service. The Report contains replies to various questions submitted to the Board for adjudication, and revisions of certain of the rules. Attention is directed to the scarcity of midwifery cases for the training of medical students, and this important matter is now the subject of consideration in conjunction with the General Medical Council.

#### Tropical Medicine at Puerto Rico

THE Report of the Director, Dr. George Bachman, of the School of Tropical Medicine of the University of Puerto Rico, gives a summary of the teaching and research carried out in the School during the year ended June, 1935. Researches include important work on vitamins, tuberculosis, and parasitic diseases; a bibliography of published papers is attached. Reference is made to the regretted death of Prof. Bailey Ashford, professor of tropical medicine and mycology, best known, perhaps, for his work on sprue. The School works in collaboration with Columbia University, and full details of administration are given.

#### The Pan American Medical Association

HONORARY associate membership has been conferred by the Pan American Medical Association upon the following well-known non-medical men of science: Dr. William David Coolidge, director of the research laboratories of the General Electric Co. at Schenectady, N.Y.; Mr. Myron Weiss, associate editor of *Time Newsmagazine*, New York, N.Y. Dr. Coolidge, physical chemist, was recommended for his perfection of X-ray tubes. Coolidge tubes enable X-ray specialists to make positive diagnoses of many diseases of the internal organs musculature and skeleton of the human body. Coolidge tubes are also used to destroy certain kinds of cancer. Mr. Weiss, journalist, was recommended in recognition of his outstanding services in disseminating medical and scientific information to the lay public and of his diligent promotion of goodwill among the nations whose medical men compose the Pan American Medical Association.



## Sir Robert Mond

ON Thursday, April 23, Sir Robert Mond was the guest of honour at a luncheon held to congratulate him upon the rank of Commander of the Legion of Honour awarded to him by the French Government. Prof. A. Béhal, president of the Committee of the Maison de la Chimie, Paris, at which the luncheon was held, presented Sir Robert with the insignia of the Order and spoke in the highest terms of his services to science and the human race. He was followed by M. P. Lemoine, director of the Paris Natural History Museum, M. Dussaud, who represented archaeologists and M. Jean Vynaud, representing literature; and each speaker expressed appreciation of Sir Robert Mond's scientific work and influence. It is given to few Englishmen to be honoured in this way by French colleagues working in such varying fields of intellectual activity; and we add our congratulations to those expressed at the luncheon upon the distinction just conferred upon one who has long been a generous benefactor to many branches of science in different parts of the world, and has made notable contributions to several of them.

## Bust of Michael Faraday

A BRONZE bust of Michael Faraday, by Mrs. Feridah Forbes, has been presented by Sir Robert Hadfield to the Royal Society and now stands in the Society's rooms. It will be recalled that, about the time of the celebration in 1931 of the centenary of the discovery by Faraday of electromagnetic induction, Sir Robert produced a work entitled "Faraday and His Metallurgical Researches", which included an account of Faraday's life, of the conditions under which he worked and the men with whom he associated. The Royal Institution, the scene of most of Faraday's labours, has a bust and also a statue of Faraday, but the Royal Society had a portrait only. Sir Robert Hadfield therefore added to the debt which scientific workers already owe him for his memorial volume to Faraday by commissioning Mrs. Forbes to make a bronze bust, which has now been presented to the Royal Society.

## Announcements

DR. CLARENCE SMITH will deliver a lecture entitled "Modern Chemical Nomenclature" before the Chemical Society on May 14 at 8 p.m. The fifth Pedler Lecture, entitled "Synthesis in Biochemistry", will be delivered before the Society by Prof. R. Robinson on May 28 at 5.30 p.m. Both lectures will be given in the meeting hall of the Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W.1.

THE sixth Congress of German Entomologists will be held at Münden (Hanover) under the presidency of Prof. Hermann Erdmann on May 27-30. Further information can be obtained from Dr. Walther Horn, Entomologisches Institut, Gosslerstr. 20, Berlin-Dahlem.

THE Marcel Benoit prize of 30,000 francs for the advancement of scientific research has been awarded to Prof. M. Askanazy of Geneva for his pathological investigations on cancer.

DURING the last two years, the University of Angora has been allotted two million Turkish pounds, more than a quarter of which has been spent on books and instruments. At the present time, eighty-eight professors, of whom half are foreigners, are employed at the University, together with 102 lecturers and 140 assistants.

A COURSE of "Applied Helminthology" with special reference to the control of agricultural and horticultural pests and the internal parasites of farm animals, poultry and gamebirds will be given at the London School of Hygiene and Tropical Medicine, Keppel Street (Gower Street), London, W.C.1, on July 13-31. The lectures will be given by Prof. R. T. Leiper, Dr. T. Goodey, Dr. B. G. Peters and Dr. M. J. Triffitt. Further information can be obtained from the Secretary of the School.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:

A lecturer in electrical engineering in Cannock Chase Mining College—The Director of Education, County Education Offices, Stafford (May 9).

An assistant master in modern physics at the Dartford Technical College—Mr. F. L. Notley, 11 Essex Road, Dartford (May 9).

An assistant inspector of fisheries (male) in the Department of Agriculture, Dublin—The Secretary, Civil Service Commission, 45 Upper O'Connell Street, Dublin, C.8 (May 11).

A lecturer in anatomy in the University of Cape Town—The High Commissioner for the Union of South Africa, Trafalgar Square, W.C.2 (May 12).

An assistant lecturer in engineering in the Brighton Technical College—The Education Officer, 54 Old Steine, Brighton (May 12).

Scientific officers for food investigation at the Low Temperature Research Station for Research in Biochemistry and Biophysics, Cambridge; the Covent Garden Laboratory; the Torry Research Station, Aberdeen; and the Ditton Laboratory, East Malling—The Establishment Officer, Department of Scientific and Industrial Research, 16 Old Queen Street, Westminster, S.W.1 (May 14).

A professor of botany in the University of Cambridge—The Vice-Chancellor (May 15).

A temporary assistant (Grade III) in the Admiralty Chemical Pool—The Secretary of the Admiralty (C.E. Branch), Whitehall, S.W.1 (quote No. C.E. 5743/35) (May 15).

A mechanical and electrical engineer in the Public Works Department of the Government of the Gold Coast—The Crown Agents for the Colonies, 4 Millbank, London, S.W.1 (quote M/4166).

A woman lecturer in psychology, method, etc., in St. Mary's Training College, Poona—Sister Superior, St. Helen's School, Abingdon.



## Letters to the Editor

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

NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 746.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

### 'Spinifex' in Australia

In the review of "The Gramineæ" by Dr. Agnes Arber in NATURE of August 31, 1935, p. 318, *Spinifex paradoxus* is referred to as one of the dominant

original, I find the locality was Barrow Island off the north-west coast of Western Australia, a situation near the sea where *Spinifex hirsutus* may possibly occur, so perhaps Morris was wrong in considering

this an error. Morris's next quotations are much later, namely, 1887, 1890 and 1893. I have found three references in Captain Sturt's "Narrative of an Expedition into Central Australia", 1849, I; namely, p. 251: "The ridges were covered with spinifex, through which we found it difficult to force a way"; p. 354, "we passed over high ridges of sand, thickly covered with spinifex"; p. 407: "they [the natives] had even been amongst the spinifex gathering the seed of the mesembrianthemum" (probably *Portulaca*). Strange to say, *Spinifex paradoxus* was actually collected by Sturt on this expedition and was described in the appendix to vol. II, p. 89, by Robert Brown as *Neurachne paradoxa*. According to F. M.



FIG. 1. Camel team on the way to Ayers Rock, Centra Australia, June 1935. *Triodia* (porcupine grass, 'spinifex' of the explorers) in stalk on a red sandhill capped with *Acacia* bushes. Photograph by Prof. J. B. Cleland.

species in the Sturt Desert of Australia. *S. paradoxus*, though widely distributed in sandy patches in the central parts of Australia, cannot be considered a dominant species. The mistake has arisen through the use of the term 'spinifex' for various species of *Triodia*, which are dominant and very conspicuous features of many parts of Central Australia both on hills and mountain ranges and on sandy areas. Thus the 'spinifex' of the explorers is almost invariably one or other species of *Triodia*, the other popular name of which is porcupine grass.

The origin of this confusion is puzzling. Prof. Morris, in "Austral English" (1898), under "Spinifex" refers to this mistake and gives four quotations involving the error. The first was in 1846, J. L. Stokes, "Discoveries in Australia", vol. 2, p. 209: "In the valley was a little sandy soil, nourishing the spinifex". On consulting the

Bailey it was not transferred to the genus *Spinifex* until 1877 (Bentham in Hooker "Ic. pl."). Consequently there could not have been any confusion in Sturt's mind between the specimens of *S. paradoxus* he collected which were later described as *N. paradoxa*, and his 'spinifex' which rendered travelling

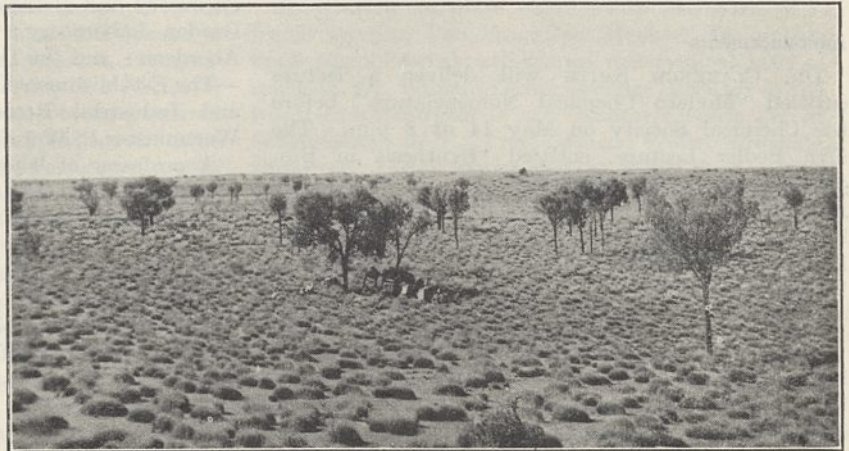


FIG. 2. Clumps of *Triodia* sp. with desert 'oaks' (*Casuarina Decaisneana*) on red sandhill near Ayers Rock. Midday halt, camels resting. Photograph by Prof. J. B. Cleland.



difficult. The name *spinifex* would, however, be especially suitable for plants of *Triodia* with their irritating prickly leaves like long sharp-pointed knitting needles bristling in all directions as the spines of a hedge-hog. *S. paradoxus* is not prickly and is sometimes spoken of as 'sandhills cane-grass'. Thus Sturt seems to have been the originator of the mistake and has been followed by most of the later explorers. How he came to make it is, however, still a puzzle.

I enclose two photographs (Figs. 1 and 2) taken on a recent camel trip to Ayers Rock, a very unget-at-able place. These illustrate well the abundance and appearance of *Triodia* in parts of Central Australia.

J. B. CLELAND.

University,  
Adelaide, South Australia.  
Jan. 10.

IN reply to Prof. Cleland's letter, which has been referred to me by the Editor of NATURE, I may say that I am quite cognisant of the use of the popular name 'spinifex' for most of the Australian species of *Triodia*, and am well aware of their dominance in the more arid regions of the interior. In referring to *Spinifex paradoxus*, however, I merely directed attention to an extremely interesting example of a xerophytic grass with rigid woody culms and male and female spikelets on different plants. The statement that *Spinifex paradoxus* is "one of the dominant species in the Sturt Desert of Australia" was not taken from the book under review, but was gleaned from the papers quoted below.

According to Prof. J. A. Prescott in his "Soils of Australia in relation to Vegetation and Climate" (Austral. Council Sci. Ind. Res. Bull, 52, p. 54; 1931), there are two extensive desert areas, consisting mostly of parallel sand-ridges bearing a desert grass association, the principal grasses being "spinifex" or "porcupine grass" (*Triodia pungens* and *T. irritans*), and "cane grass" (*Spinifex paradoxus*), the latter common in the more eastern desert-areas but the former more universal in their occurrence.

Prof. Cleland, himself, in a paper with J. M. Black and L. Reese on the flora of the north-east corner of South Australia (*Trans. Roy. Soc. S. Austral.*, 49, 103-120; 1925), states (p. 106) that the vegetation on the more or less shifting sandhills is meagre but very characteristic. Among the most striking plants on the higher sandhills are *Spinifex paradoxus* and *Triodia*, etc.

Prof. Cleland, of course, is a well-known authority on the vegetation of these desert-areas, having made several expeditions through them, and his statement that *Spinifex paradoxus* is not one of the really dominant grasses should be accepted as conclusive.

THE REVIEWER.

### A Unitary Model of the Galactic System

HOWEVER discordant the present views in astronomy are, they all concur in considering Milky Way clouds as real agglomerations of stars and regard the collection of stars surrounding the sun as one of these clouds ('local system'). To the common-sense evidence based on the apparently cloud-like character of the Milky Way one usually adds the following argument. The space density of stars in the direction of some galactic clouds first decreases and then increases again, thus indicating the existence

of separate stellar agglomerations. The general belief in the existence of the 'local system' is based on two facts: the well-known decrease in apparent star density with increasing distance from the sun, and the distribution of brighter early stars and diffuse nebulae along a circle inclined at several degrees to the galactic equator.

Recent discoveries have shown that our galactic system is quite comparable in size with a large extra-galactic nebula, and disposed of the comforting idea of transparent galactic space. They throw new light on this vexed problem, suggesting doubts as to the very existence of separate Milky Way clouds. Against the well-known arguments in favour of the existence of such clouds, we may now bring the following:

(1) Owing to the shearing effects of the galactic rotation, such galactic clouds would be dissipated in the course of a few revolutions, the period of which is considerably shorter than the shortest permissible cosmic time scale. Such a flattened system of clouds would be, moreover, very unstable even without shearing effects of rotation.

(2) A galaxy of such a complicated character would be quite an exceptional formation among extra-galactic nebulae, which never resemble an accumulation of separate clouds.

(3) It should be indicated that the above-mentioned results of earlier star counts are not substantiated by recent work by Schalén, who dealt with absolutely bright stars. In all the regions investigated from Cygnus to Auriga, no increase in density has been found as far as 3.5 kiloparsecs from the sun; only in the region of Scutum—20°–30° from the direction towards the galactic centre—do Schalén's curves indicate condensations of stars.

The arguments against the existence of a 'local system' can be summarised as follows:

(1) Not the slightest dynamical effects of this system has ever been found in stellar movements, which seem to be governed by the distant galactic centre in Sagittarius.

(2) An apparent arrangement of brighter *B* stars largely depends upon a rich but isolated star group in Orion, without which the 'secondary galaxy' would be lost in a general star field. The distribution of diffuse nebulae showing continuous spectra simply repeats the distribution of dark nebulae.

(3) The decrease in star density with the distance from the sun can be explained by cosmic absorption of 0.3–0.4 mag. per 10<sup>3</sup> parsecs in visual light; this value being substantiated by independent evidence. Two diametrically opposite regions of obscuration cross the 'local system': one in Ophiuchus (galactic long. 330°–30°), in low northern latitudes, the other in Taurus (galactic long. 100°–150°) in low southern latitudes. Both run seemingly parallel to each other and perpendicular to the corresponding galactic radius vector. The direction toward the 'centre' of the 'local system' in Carina is also perpendicular to the galactic radius vector of the sun (between both regions of obscurations); it corresponds to the minimum of cosmic absorption.

There are several other well-attested examples of heavy obscurations in the galactic belt; some authorities even admit that the major bifurcation of the Milky Way represents an apparent effect of very distant dark nebulae. Now having in view the above-mentioned difficulties connected with the existence of individual galactic clouds, it seems natural to make one step further and to reach a new rather radical conclusion. If such an important







### Thermal Conductivity of Deuterium

THE thermal conductivity of deuterium extracted from heavy water containing 99.2 per cent D has been determined.

To prepare the deuterium gas a measured small quantity of the heavy water was first converted into NaOD by adding it to the requisite amount of sodium peroxide (gentle heating dispelling the oxygen gas). The deuterium was then obtained by heating the NaOD with sodium oxalate in molecular proportions and the purification of the gas accomplished by the usual procedure of passing it directly into the evacuated conductivity apparatus through the wall of a heated 'degassed' palladium tube.

A series of determinations of the thermal conductivity at 0° C. were made over the pressure range 44–15 cm. Hg, the maximum mean temperature of the gas in the series being 1.6° C. Over this range of pressures the conductivity was constant within the limits of experimental error, the mean of seven determinations being

$$k_D = (32.94 \pm 0.04) \times 10^{-5} \text{ cal. cm.}^{-1} \text{ sec.}^{-1} \text{ deg.}^{-1},$$

as compared with the value of  $k_H = 41.3 \times 10^{-5}$  for hydrogen.

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March 17.

### Measurement of the Thermal Conductivity of Gases

DR. KANNULUIK used in the above measurement a method<sup>1</sup> which was devised a few years ago for measuring the thermal conductivity of a gas and was used by him and Dr. Martin to measure its value for a number of gases. In it a thick electrically heated wire co-axial with a vertical metal tube, which contains the gas, is used. A wire of very pure platinum and an accurately lapped stainless steel tube were used in the experiment on deuterium described in the previous letter.

The advantages of this method seem to have escaped attention, and I take this opportunity of directing attention to them. To do this it is necessary to recall the characteristics of other methods. Dr. Hercus and I devised an electrically heated parallel plate method, in which the horizontal layer of gas is heated at its upper surface (which prevents convection); in a recent development of this method radiation is eliminated by using two thicknesses of gas. Now, when heat crosses the interface between a gas and a solid, there is a discontinuity of temperature, but in the parallel plate method its effect is negligible. Although the plate method is very simple in principle, in practice considerable skill and time is needed to attain the steady temperatures, which are assumed in the theory of these steady state processes, and a large volume of gas is required.

An electrically heated *thin* wire has been extensively used for measuring the conductivities of gases. Steady temperatures are readily attained, and only a small quantity of gas is required. The gradient of temperature near a thin wire is, however, necessarily large, and this in turn means the effect of the temperature discontinuity at the surface of the wire is large. There is difficulty, too, in eliminating convection by reducing the pressure of the gas, for molecular conduction may set in before convection is eliminated. The method has other difficulties.

Dr. Kannuluik introduced the use of a *thick* wire and gave the mathematical theory needed to enable such a wire to be used. Prof. T. M. Cherry has added to this theory, which now appears to be complete.

Using a thick wire the effect of temperature discontinuity at the wire surface is almost negligible, and can be calculated. Convection of heat can be eliminated before molecular conduction sets in. Kannuluik and Martin have shown that the method gives for the thermal conductivity of air a value which agrees with that found by careful observations with the parallel plate method<sup>2</sup> to the accuracy of such measurements. It agrees, too, with Weber's value for air obtained with a thin wire, but it should be added other recent determinations<sup>3</sup> made with thin wires are about 2 per cent higher than the values found with a thick wire and with the parallel plate methods. I believe this difference is not significant as showing a systematic difference between the methods, and that it arises from experimental errors such as those arising in eliminating temperature discontinuity and in measuring the diameter of the wire used, etc.

T. H. LABY.

London.

April 8.

<sup>1</sup> G. W. Kannuluik, *Proc. Roy. Soc., A*, **131**, 320 (1931), and G. W. Kannuluik and L. H. Martin, *Ibid.*, **A**, **141**, 144 (1933) and **A**, **144**, 496 (1934).

<sup>2</sup> T. H. Laby, *Ibid.*, **A**, **144**, 494 (1934), and Hercus and Sutherland, *Ibid.*, **A**, **145**, 599 (1934).

<sup>3</sup> Awbery: article on Heat in "Reports on Progress in Physics" vol. 2, 195 (1936).

### Effect of Œstrogenic Hormones on Lactation in the Cow

THERE is evidence<sup>1</sup> that administration of Œstrogenic hormones to lactating animals causes inhibition of milk secretion. In the case of the work cited, largely owing to the difficulty of making accurate measurements of milk secretion rate and of changes in milk composition in experiments on small animals, the evidence that inhibition occurs is not so conclusive as might be desired, nor have accompanying changes in milk composition been studied. The above difficulties are obviated by use of the lactating cow as experimental animal.

In the course of studies of the hormonal control of lactation now in progress at this Institute, the effect of the administration of massive doses of Œstrogenic hormones to the lactating cow has been investigated\*. Fig. 1 shows the most interesting of the results obtained when a lactating Guernsey cow was given, by intramuscular injections spread over three days, a total of 500 mgm. Œstrone and 50 mgm. Œstradiol benzoate. Injection into a control cow of equal amounts of the oil in which the hormones were dissolved showed this to be without effect on lactation.

It will be seen that while Œstrogenic hormone caused a marked diminution in the daily milk yield (an inhibition of approximately 20 per cent) the non-fatty solids content of the milk was raised by more than 10 per cent. This finding, taken in conjunction with the fact that thyroxine administration leads to an increase in milk non-fatty solids content<sup>2</sup>, gives reason to hope that in the near future the factors controlling the level of non-fatty solids in milk will be further elucidated, and a method of treatment

\* This work has been made possible by the kindness of Messrs. Organon Laboratories and Messrs. Schering Ltd., who have given generous supplies of Œstrone and Œstradiol benzoate respectively.



based on physiological principles, applicable to cows secreting milk poor in non-fatty solids, may be evolved.

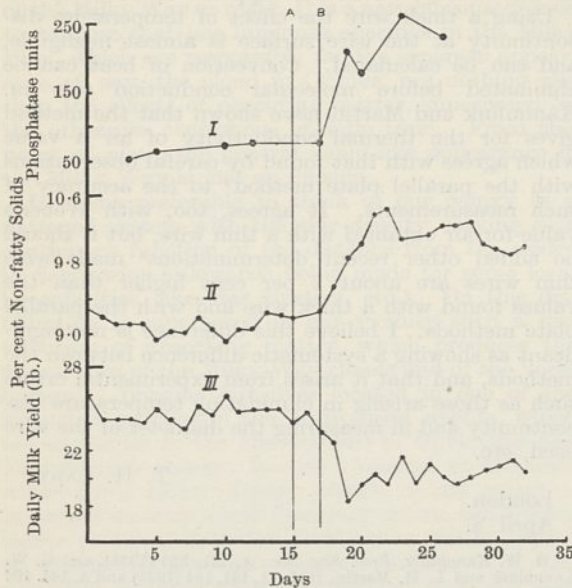


FIG. 1. I. Milk phosphatase concentration.  
II. Per cent non-fatty solids in milk.  
III. Daily milk yield.  
A-B, injection period.

The results of this experiment confirm the suggestion from previous work<sup>3</sup> that the secretion of milk fat is a process not very closely related to the secretion of other milk solids, since in the dose given, oestrogenic hormone had little effect on the fat content of the milk. The percentage drop in the total daily secretion of milk fat caused by the experimental treatment was therefore far greater than the percentage fall in the daily secretion of non-fatty solids. A point of further interest, in view of the inverse relationship known to exist throughout lactation<sup>4</sup> between milk yield and milk phosphatase concentration, is the striking increase in the latter quantity following oestrogenic hormone administration.

These experiments, which are being extended, will be reported in detail elsewhere.

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April 3.

<sup>1</sup> Parkes and Bellerby, *J. Physiol.*, **62**, 301 (1926-27). Robson, *Quart. J. Exp. Physiol.*, **24**, 337 (1934-35). Smith and Smith, *Amer. J. Physiol.*, **103**, 356 (1933). Nelson, *Endocrinology*, **18**, 33 (1934).

<sup>2</sup> Folley and White, *Proc. Roy. Soc. B*, 1936 (in the press).

<sup>3</sup> Graham, *J. Nutrition*, **7**, 407 (1934).

<sup>4</sup> Folley and Kay, *Biochem. Soc.*, March 13, 1936 (*J. Soc. Chem. Ind.*, **55**, 234; 1936).

### Inhibition of the Pasteur Effect

An explanation has been offered<sup>1</sup> for the action of potassium salts<sup>2,3</sup> in inhibiting the Pasteur effect and in increasing the respiration of brain. It was suggested that normally in oxygen only part of the cell-enzymes which attack carbohydrates are accessible to their substrates, and that respiratory energy is responsible for the maintenance of this inaccessibility; in anaerobiosis the enzymes are supposed to be fully accessible. Potassium salts affect the cell-enzymes so as to make them fully accessible.

It is now suggested that the reason why this potassium effect is only observed in brain cortex<sup>3</sup> is because in this tissue the metabolism is mainly located in the superficial dendrites and not in the interior of the cell (as indicated by the work of Holmes<sup>4</sup>). In other cells the ionic concentrations at the actual site of metabolic activity cannot be altered so readily by artificial methods.

It would seem that other inhibitors of the Pasteur effect (for example, dinitro-*o*-cresol<sup>5,6</sup> and pheno-safranin<sup>7</sup>) act by inhibiting a small specific fraction of respiration which is responsible for the Pasteur effect. There is thus a primary inhibition of the specific fraction of respiration which maintains the partial inaccessibility of the respiratory and glycolytic enzymes. The enzymes become fully accessible and there results a secondary rise both in glycolysis and respiration. The net effect on the magnitude of the respiration is determined by how much of the initial respiration is eliminated; this no doubt depends on the nature and concentration of the inhibitor. The sign of the net effect on the respiration is determined by whether the initial inhibition or the secondary augmentation is the greater.

It is thus possible to have either an increase, or a decrease, or even no net change in respiratory rate accompanying this inhibition of the Pasteur effect. There is, however, a qualitative change in the respiration, since the fraction which causes the Pasteur effect has been eliminated. This specific fraction of respiration is more susceptible than the rest. Thus low concentrations of cyanide can cause inhibition of the Pasteur effect without any fall<sup>8</sup>, or even with a rise<sup>9,10</sup> in respiration, while higher concentrations of cyanide cause a net diminution in respiratory rate together with inhibition of the Pasteur effect.

The theory of mechanism earlier advocated<sup>1</sup> can thus well explain inhibition of the Pasteur effect as well as the observed respiratory changes which accompany this inhibition.

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Cambridge.  
March 19.

<sup>1</sup> K. C. Dixon and E. G. Holmes, *NATURE*, **135**, 995 (1935).

<sup>2</sup> C. A. Ashford and K. C. Dixon, *Biochem. J.*, **29**, 157 (1935).

<sup>3</sup> F. Dickens and D. G. Greville, *Biochem. J.*, **29**, 1468 (1935).

<sup>4</sup> E. G. Holmes, *Biochem. J.*, **26**, 2005 (1932).

<sup>5</sup> E. C. Dodds and D. G. Greville, *Lancet*, **i**, 398 (1934).

<sup>6</sup> D. G. Greville and K. G. Stern, *Biochem. J.*, **29**, 487 (1935).

<sup>7</sup> F. Dickens, *NATURE*, **135**, 762 (1935).

<sup>8</sup> H. Laser, *NATURE*, **136**, 184 (1935).

<sup>9</sup> L. Genevois, *Biochem. Z.*, **191**, 147 (1927).

<sup>10</sup> O. Warburg, *Biochem. Z.*, **100**, 230 (1919).

### Host Density and the Success of Entomophagous Parasites

THE subject of this communication is the effect of the density of a host population upon the relative success of a searching female parasite. So far as I am aware, this has not received any prior experimental treatment. Smirnov and Wladimirov, as reported by Gause<sup>1</sup>, have demonstrated a relation between the increase of a parasite population and the concentration of the host, but this is a problem distinct from the present one although similar in nature.

The area which must be traversed by a female parasite searching for a host depends upon the concentration of the host. If the density of the host within a given area is reduced, then it seems obvious that the distance to be covered by the female before



encountering a host individual will be increased. A simple hypothesis would be, that the area to be traversed by the parasite is inversely proportional to the density of the host population, so that we have

$$A = 1/D.$$

If the searching is at random, however, there is no such simple relation. Although the parasite may search, say, a total of 100 units of area, actually she will search only 63 different units. The fundamental nature of the phenomenon is then in conformity with the conception expressed by the formula evolved by Thompson<sup>2</sup> for the random distribution of parasite progeny; namely,

$$Y = N(1 - e^{-x/N}).$$

We should, therefore, have two equations to consider in any study of the problem.

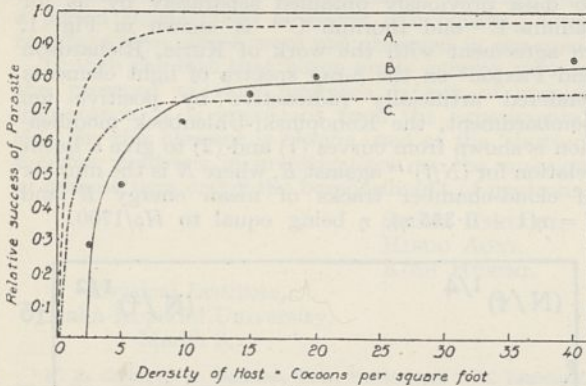


FIG. 1.

A hypothetical case, based upon the above equations, is presented in the following figures:

Density of host per 100 units of area.	0.2	0.4	0.5	1.0	5.0	10.0	20.0	25.0	50.0
Units of area to be traversed.	500	250	200	100	20	10	5	4	2
Different units actually traversed.	99.3	91.8	86.5	63.0	18.0	9.5	4.8	3.9	1.98
Parasitism.	19.8	36.7	43.2	63.0	90.0	95.0	96.0	97.5	99.0

When the percentage of parasitism is plotted against the host density we obtain Curve A (broken line) of Fig. 1. In the experimental investigations, the Chalcid parasite, *Microplectron fuscipennis*, Zett., and its host, *Diprion polytomum*, Htg., were used. The parasite was confronted with varying densities of host population for a definite time. The results obtained are given in Curve B, which embodies records of a number of single females at each host density.

It will be noted that the curves representing the relation between percentage of parasitism and host density in the theoretical and experimental cases are of very similar form. If the formula for random distribution be slightly modified, by the introduction of a constant, so as to read

$$Y = N(1 - e^{-x/N}) - K,$$

we obtain for percentage of parasitism Curve C, which is still more similar to the experimental Curve B.

The results of the experimental work thus support the assumptions that the area searched by the parasite varies inversely as the density of the host population, and that the searching is at random, though it is clear that some modification of this simple theory is required to obtain precise correspondence.

The experiments indicate that the curve obtained is independent of climate and that it is unaffected by the presence in the host population of unsuitable individuals. The latter merely have the effect of reducing the actual host density.

The results forming the subject of this preliminary communication will be dealt with fully elsewhere.

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March 18.

<sup>1</sup> *Z. angew. Ent.*, 20, 619 (1934).

<sup>2</sup> *Ann. Fac. Sci. Marseilles*, 2 (ii), 69 (1924).

### Selective Fading on Ultra-Short Waves

In a recently published paper<sup>1</sup> we have given data indicating that 4.5 metre radio transmission to points below the horizon is affected by meteorological conditions. A subsequent study between stations located at Atlantic Highlands, N.J., and East Moriches, Long Island, has encountered fading which further experience has shown is rarely absent, and we have made, therefore, a rather extensive study of the fading itself.

Over this 70-mile, all water, path we have transmitted at wave-lengths from 1.6 to 4.8 metres, radiating singly or simultaneously from antennae of vertical and horizontal polarisation, under various seasonal and meteorological conditions, during the past twenty months. We find the fading to be relatively slow, compared to short wave fading; a recorder tape running at the rate of 1.5 cm. per minute separates the fluctuations satisfactorily. This fading is apparently quite erratic, but we occasionally have deep (30 db.), usually single, occasionally paired, signal drops, lasting from one to five minutes overall. We also distinguish a rapid, quite uniform, signal oscillation of the order of 5 cycles per minute, and persisting for hours, which we have termed 'scintillation'.

Simultaneous records on two different waves of the same polarisation may show considerable similarity when the wave-length difference is small or the fading slow. Exact coincidence is not observed even though the wave-lengths differ by only 2 per cent, and the shorter wave-length usually shows the worse fading (more and deeper minima per minute). Simultaneous transmission of the same wave-length on the two polarisations shows no coincidence, and the horizontally polarised component always has the deeper and more rapid fading. As the distance from the transmitter decreases, the fading decreases, practically dropping out when an 'air-line' path is reached. No definite correlation of fading with weather and no major diurnal variation has as yet been demonstrated. We find, however, that the average signal intensity falls off during the winter months. Fading on adjacent antennae, 52 ft. and 14 ft. respectively above ground, is practically identical; the received signal level increases with height, however.



Suspecting that wave interference from multiple path transmission is the cause of some of the fading, we have recently applied the frequency sweep method of demonstrating multiple paths. A short-circuiting ring rotating in the tank circuit coil of the transmitter oscillator gave a frequency variation of 6.2 megacycles at about 66 megacycles. The receiver band width, 3 db. down, was 3.2 megacycles. Observations were made by photographing with cinema camera the pattern of the cathode ray tube, whose sweep frequency was synchronised with the rotation of the short-circuiting ring. These pictures have indicated that the fading is usually tied up with wave interference. A sample observation covering 95 seconds is given in Fig. 1, where five frames best

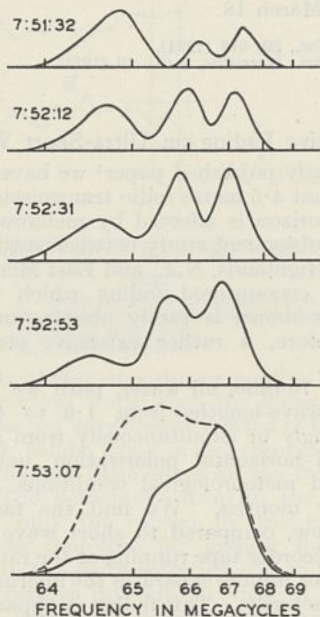


FIG. 1. Typical series of cathode ray oscillograph patterns. Ordinates are proportional to signal voltage squared. Dotted curve is the measured overall characteristic of the transmitter-receiver system for free space. Taken Dec. 13, 1935, 7.50 a.m.

illustrating the sequence have been copied from the film. The phenomenon is complex; apparently at least three components are here present. The multiple minimum structure suggests a pair of components with some 240 metres path difference ( $3 \times 10^{10}/\Delta f = \Delta d$ ,  $\Delta f =$  frequency difference between minima,  $\Delta d =$  path difference in cm.), while the superposed broad moving minimum requires a close variable twin of one of the pair. (This fine structure can serve as a very sensitive indicator of path difference stability.)

It is our experience that while some fades are apparently due to only two components, in general the cathode tube pattern is so complicated that three or more components are required. A stratified atmosphere is the obvious explanation of these multiple transmissions, and the existence of such strata has been independently shown by plotting the dielectric constant of the air versus height from data furnished us by the U.S. Weather Bureau. This Bureau obtains daily pressure, temperature and humidity soundings of the atmosphere by aeroplane.

No Kennelly-Heaviside layer reflection has yet been observed. It is hard to visualise a selective absorption condition which will yield an alternative explanation of these results. This work is being continued.

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<sup>1</sup> *Bell System Tech. J.*, 14-369 (July, 1935).

### End-points of the $\beta$ -ray Spectra of Radium E and Thorium C''

THE result of applying the Konopinski-Uhlenbeck<sup>1</sup> modification of Fermi's<sup>2</sup> theory of  $\beta$ -ray disintegration to data previously obtained separately by us for radium E<sup>3</sup> and thorium C''<sup>4</sup> is shown in Fig. 1. In agreement with the work of Kurie, Richardson and Paxton<sup>5</sup> on the  $\beta$ -ray spectra of light elements rendered artificially radioactive by positive ion bombardment, the Konopinski-Uhlenbeck modification is shown from curves (1) and (2) to give a linear relation for  $(N/f)^{1/4}$  against  $E$ , where  $N$  is the number of cloud-chamber tracks of mean energy  $E$  and  $f = \eta(1 + 0.355\eta)$ ,  $\eta$  being equal to  $H\rho/1700$ .

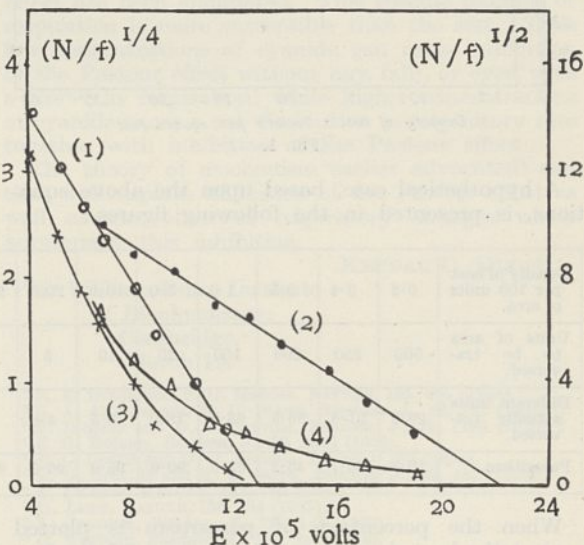


FIG. 1.

Curves (3) and (4) were obtained by plotting  $(N/f)^{1/2}$  against  $E$  as on the unmodified Fermi theory. The end-points, which are situated considerably beyond the last measured track, are found to occur at  $E = 1.35 \times 10^6$  v. and  $E = 2.25 \times 10^6$  v., corresponding to  $H\rho = 5975$  and  $H\rho = 9030$  for radium E and thorium C'' respectively.

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March 27.

<sup>1</sup> *Phys. Rev.*, 48, 7 (1935).

<sup>2</sup> *Z. Phys.*, 88, 161 (1934).

<sup>3</sup> F. C. Champion, *Proc. Roy. Soc., A*, 134, 672 (1932).

<sup>4</sup> N. S. Alexander (unpublished).

<sup>5</sup> F. N. D. Kurie, J. R. Richardson and H. C. Paxton, *Phys. Rev.*, 49, 368 (1936).



## Excitation of Gamma Rays in Boron

By using pure metallic boron, we have recently confirmed the emission of gamma rays from this element in the presence of slow neutrons. By comparing the intensity of gamma rays with that of those emitted from cadmium, and assuming that every absorption process of a slow neutron by a cadmium atom is accompanied by the emission of a gamma ray quantum, we were able to estimate the cross-section of the boron atom for the emission of gamma rays to be about one twentieth of the total absorption cross-section. On account of their low intensity, we have not yet been able to determine their quantum energy. These gamma rays may either be accompanying the well-known disintegration process found by Chadwick and Goldhaber, and Fermi and his collaborators, or they may be emitted by the capture process by  $B^{10}$  to form  $B^{11}$ . The capture process by  $B^{11}$  is excluded, for  $B^{12}$  is radioactive<sup>1</sup>, decaying with a period shorter than a second and emitting very fast beta rays, which were not observed in our case.

Though the fact that boron emits gamma rays in the presence of slow neutrons is not of special importance, it is important from the experimental side, for this element is always used as the 'shutter' for slow neutrons in investigations on the emission of gamma rays under the bombardment of neutrons.

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Osaka Imperial University.  
March 3.

<sup>1</sup> H. R. Crane, L. A. Delsasso, W. A. Fowler and C. C. Lauritsen, *Phys. Rev.*, **47**, 887 (1935).

## Band Spectrum of the Sulphur Molecule

In a recent investigation Maxwell, Hendricks and Mosley<sup>1</sup> have determined the internuclear distance of the sulphur molecule by means of electron diffraction patterns in heated sulphur vapour. They find this distance (for  $S_2$ ) to be  $r'' = 1.94 \pm 0.03$  A., which they state is definitely higher than the band spectra values. From the rotational analysis of six bands, belonging to the main system of the absorption spectrum, however, I have been able to determine this distance as 1.88 A., which must be substituted for the value 1.60 A. hitherto accepted<sup>2</sup>, though according to Badger<sup>3</sup> it is incorrect. The agreement between the two determinations is now satisfactory, within the limit of error, but it may be pointed out here that the method of electronic diffraction must be expected to give a slightly greater value for  $r$ , because it does not refer to vibrationless molecules.

The excited state of the main system, which has proved to be of the  ${}^3\Sigma_u^- \rightarrow {}^3\Sigma_g^-$  type (even levels missing in the ground state), is subject to strong perturbations, as is well known from the vibrational analysis. According to Naudé and Christy, the levels  $v'=1$  and 3 are perturbed and  $v'=2$  unperturbed, but my investigation of the rotational structure shows clearly that the reverse is true. In the bands  $v'=2 \rightarrow v''=n$ , the sub-levels  $F_3$  and  $F_2$  are displaced by 10  $\text{cm}^{-1}$  and 20  $\text{cm}^{-1}$ , respectively, from  $F_1$ . The perturbations are thus of the 'vibrational' type, and not of the 'resonance' form which is common in light molecules. The reason for this is easy to see. The 'resonance' form is dependent on the rapid

growth of the energy difference ( $B_a - B_b$ ).  $K(K+1)$ . Now as  $B$  is small in the case of a heavy molecule (for  $S_2$ ,  $B' = 0.22 \text{ cm}^{-1}$ ), the difference ( $B_a - B_b$ ) is also necessarily very small and the perturbation will extend over a much greater range of  $K$  than in the light molecules hitherto studied.

A full account of the experimental details will shortly be published.

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March 17.

<sup>1</sup> *Phys. Rev.*, **49**, 199 (1936).

<sup>2</sup> Naudé and Christy, *Phys. Rev.*, **37**, 490 (1931).

<sup>3</sup> *Phys. Rev.*, **46**, 1025 (1934).

## Aluminium Bells

NEARLY eighty years ago, Henri Sainte Claire Deville wrote that he had cast an aluminium bell and presented it to the Royal Institution of London. He remarked in his great book, "De l'Aluminium, Ses Propriétés, Sa Fabrication, et Ses Applications", that the tone of this bell was none too good and that it was quickly damped due to the shape of the bell. He regretted that he had cast this bell in the traditional form of all bronze bells, but evidently did no further experimenting. He commented briefly on the fact that a bar or ingot of aluminium when struck sharply rang with a much better tone than his bell.

Faraday seems to have experimented with a rotating bar of aluminium which he caused to ring by appropriate tapping. He noticed two tones, rather similar, following each other in rapid succession.

These historic items come to mind now because, on February 23, when Oberlin College celebrates the semi-centennial of the discovery by Charles Martin Hall of the modern process of preparing aluminium, a great aluminium bell, three feet in diameter and three-fourths of an inch thick, will be rung in honour of this Oberlin student who succeeded so brilliantly at twenty-two years of age. Young Hall was a talented pianist, so it is highly appropriate that the ceremonies begin with aluminium music from this bell and from an aluminium violin of fair quality.

This remarkable bell has just been especially cast in a new shape by the Aluminum Company of America. It is much flatter than the classic bells of the bronze type, and really resembles a huge gong in form. The tone is splendid, sonorous, and lasts a long time. This casting was really an experiment, and the Company expects to cast another to give into the permanent possession of the Department of Chemistry, Oberlin College.

Many readers in Europe may contest the appropriateness of a celebration in honour of Charles Martin Hall, feeling that the youthful Héroult had made the discovery in 1886. The two discoveries were almost simultaneous, but the United States Patent Office records show that Hall made his discovery on February 23, 1886, while Héroult applied for and was granted a French patent on April 23, 1886. Héroult's application for a patent in the United States was denied.

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Feb. 8.



### Crystalline Nature of the Chief Constituent of Ordinary Coal

DUE to the pressure of other duties, I overlooked Prof. H. G. A. Hickling's presidential address to Section C (Geology) of the British Association, delivered at Norwich on September 6, 1935, and extracts from which appeared under the title "Some Geological Aspects of Recent Research on Coal" in NATURE of November 23 and November 30, 1935.

The subject of some fundamental colloidal substance, which acts as the matrix to all the materials of a coal, is, of course, an old one, but I presume to think that a modern aspect of this substance was discussed by me in NATURE several years ago<sup>1</sup> for the first time. I described the substance seen in coal sections in plane polarised light, and between crossed nicols, with a petrological microscope.

The same curious, all-pervading substance is more fully discussed in "The Natural History of Indian Coals"<sup>2</sup>, where it is suggested that *fusain* contains dried up matter which in *gel* form makes *lignite* and

almost entirely constitutes the substance *vitrain*. The 'rank' of a coal depends on the condition of this fundamental substance, as Prof. Hickling has found.

The value of Hill's law is also appreciated in the same memoir<sup>3</sup>, and the question of temperature is also considered. In fact, for several years now the Geological Survey of India has used coal, or I should say the volatile percentage (excluding moisture) of a coal, as a guide to ascertaining pressure (where squeeze has occurred) or temperature (in the case of igneous intrusions) where coal bearing strata are involved. Moisture proves to be a very serious objection in these investigations for obtaining reliable criteria.

CYRIL S. FOX.

(In Camp : Garo Hills, Assam.)  
Geological Survey of India,  
Calcutta.  
March 3.

<sup>1</sup> NATURE, 120, 547 (Oct. 15, 1927); 118, 913 (Dec. 25, 1926).  
<sup>2</sup> Mem. Geol. Surv. India, 57, 224-225, 271, 273, 279-280 (1931).  
<sup>3</sup> *ibid.*, pages 95-97 and 269-271.

### Points from Foregoing Letters

Two photographs of desert flora of Central Australia showing extensive growth of the prickly porcupine grass (*Triodia*) are submitted by Prof. J. B. Cleland. This grass has been frequently referred to as 'spinifex', but this name belongs properly to the 'sandhills cane-grass' (*Spinifex paradoxus*), a less common plant in this region.

Prof. B. P. Gerasimovič brings arguments against the accepted view that our galactic system, unlike other nebulae, consists of several groups or local 'clouds' of stars. He considers that our galaxy is a flattened system the star density of which varies continuously from the centre (in *Sagittarius*), and that the uneven appearance of the Milky Way clouds is due to the presence of dark absorbing matter, such as has also been observed in the Andromeda nebula.

The weight and shape of the 'molecules' of various proteins (ovalbumin, lactoglobulin, etc.) is calculated by A. Polson from the diffusion constant and viscosity of their solutions. The particle weight so deduced is about two-thirds of that calculated from the rate of sedimentation in an ultra-centrifuge, and it is suggested that the difference may be due to hydration.

The heat conductivity of heavy hydrogen, a constant useful in the analysis of mixtures of heavy and light hydrogen, is found by Dr. G. W. Kannuliuk to be  $32.94 \times 10^{-6}$  calories per centimetre per second per degree, as against 41.34 in the case of ordinary hydrogen. Prof. T. H. Laby points out that the method used by Kannuliuk, in which a thick electrically heated wire co-axial with a vertical metal tube is employed, eliminates the effect of temperature discontinuity at the wire surface, which affects the results obtained by the thin wire method.

The quantity and composition of the milk obtained from a lactating cow was considerably changed by the injection of large doses of sex hormones (oestrone and oestradiol benzoate). Dr. S. J. Folley submits graphs showing that while the quantity of milk was decreased the percentage of non-fatty solids in the milk became greater.

K. C. Dixon suggests that the readiness with which the removal of lactic acid formed by brain cortex tissue (*in presence of oxygen*) is inhibited by potassium salts may be due to the fact that the chemical changes involved are located in the more accessible surface branches (dendrites) of those cells. He explains, in terms of the accessibility of the glycolytic enzymes, how two of the factors of tissue respiration, namely, the change of carbohydrates into lactic acid and the further oxidation of lactic acid to carbon dioxide, can vary independently.

From the proportion of cocoons parasitised in a definite time by a Chalcid fly, C. C. Ulyett deduces that the area searched by the parasite varies inversely as the number of cocoons per square foot and that the searching is at random.

The fading of short radio waves (1.6-4.8 metres) travelling across a 70-mile water-path, between Long Island and the American mainland, indicates complex interference, due to the presence of two or more components, travelling along different paths. C. R. Englund, A. B. Crawford and W. W. Mumford suggest that this multiple transmission is caused by a stratified atmosphere; this is supported by measurements of the dielectric constant of air at different heights.

By means of a new formula which gives a linear relation when the energy of the electrons emitted by certain radioactive substances is plotted against a factor based upon the number of cloud-tracks in an expansion chamber, Dr. F. C. Champion and N. S. Alexander find that the highest energies of electrons given off by radium E and thorium C" should be  $1.35$  and  $2.25 \times 10^6$  electron volts respectively.

ERRATUM. In connexion with a note in this column on April 18, Mr. F. Greenshields writes: "The impaternate males of purely arrhenotokous species are not sterile; and moreover their fertility depends on the regular abortion of the reduction division. It is this abortion of meiosis which would require an explanation if my inferences are correct."



## Research Items

### Chinese Art and Chinese Ideas of Life

MR. BASIL GRAY, of the Department of Oriental Antiquities and Ethnography of the British Museum, in a lecture before the Royal Society of Arts on January 29 (*J. Roy. Soc. Arts*, 84, March 13, 1936) surveyed the development of art in China, which is not merely a guide to, but also the actual expression of, her ideas in religion and philosophy. Although Chinese civilisation has been as varied in its development as that of Europe, it has one common element throughout, that man is never the centre of the universe. Its art aims at reflecting the rhythm of life seen in the natural world. The bronze vessels and jades of the Shang Yin and Chou dynasties, dating from early in the second millennium to 221 B.C., were connected with the worship of ancestors, but they also expressed the desire for a larger unity outside the family or clan by representing natural forces, especially the reproductive powers, in the form of animals, dragons, etc. This was the art of a feudal society, an aristocracy which had the monopoly of education and power. With the break-up in the age of the Warring States and the accession to power of the Han dynasty, Confucianism gained the ascendancy and the scholar-official became, and ever since has remained, the ruling class, to whom art was primarily addressed. The last important new influence in China before the nineteenth century was that of Buddhism, to which practically the whole country had been converted by the end of the fifth century of our era. Notwithstanding some masterpieces, sculpture never became a central art. Paradise pictures and Bodhisattvas are by far the commonest among the pictures of the T'ang dynasty recovered by Sir Aurel Stein from Tun-huang; but the Zen sect of Buddhism, which eschewed outward observance, was a home for the mystic leanings of the Chinese, showing its greatest influence in the painting of the thirteenth century.

### Stone Implements from Patagonia

A COLLECTION of stone implements from near Comodoro Rivadavia, Patagonia, numbering in all about one hundred and twenty specimens, has recently been presented to the British Museum by Mr. O. C. Elvins. A selection from the collection is figured with a description by Mr. Elvins and additional notes by Mr. H. J. Braunholtz, in *Man* of April. The stone age of Patagonia came to an end soon after the natives came into contact with the Spaniards, who recorded their use of the bow, arrow and dart. F. Ameghino puts the date at which the use of these arms was abandoned at about 1620, when the horse was introduced. These natives were the Tehuelche Indians, of whom little is known, beyond the fact that they were of more than ordinary height, the males averaging about six feet. The term 'patagon' (big foot) applied to them by the Spaniards is the origin of the present popular name of the country. Traces of the early industry of the Tehuelche are abundant in the form of flint implements and pottery. The latter, however, is found only in fragmentary condition, as the clay used, an absorbent

fusible clay similar to fuller's earth, is practically devoid of plasticity and the crude pottery made from it is extremely fragile. The sites on which stone implements are found are usually along the sea coast. They are reminiscent of the sea-coast sites of Oronsay and Denmark, and like them are characterised by huge shell-mounds, particularly of clam shells, the beds being several feet thick. Burials in the sitting position, characteristic of South America from Peru southward, have been found in them, though burial places are more usually found on hill-tops. Some of the specimens were collected from the Lake Colhue Huapi, drained by the River Chico. Here flakes and worked implements are found on the surface of the sand and hard clay. This site was evidently a factory. Mr. Braunholtz points out that the collection contains a number of types which differ from those figured in the classic work of F. Outes on the Patagonian stone age.

### A Malaria Survey in Western Bengal

DR. HARRY G. TIMBRES has published the results of a malaria survey carried out by him in western Bengal (*Rec. Malaria Survey of India*, 5, No. 4, 345; 1935). The studies covered seven villages, with a population of 2,582 persons, lying in an area of  $9\frac{1}{2}$  square miles in the district of Birbhum. Rice is extensively cultivated, and although there are no swamps, irrigation channels are numerous, coming from small storage lakes. The survey occupied eighty-nine weeks from July 13, 1932, until March 31, 1934. Malaria is very prevalent in the district, sixty per cent at least of all cases of illness being due to this disease. It is conclusively shown that the chief mosquito conveying malaria in that region is *Anopheles philippinensis*, formerly only suspected of being a carrier. This species is definitely anthropophilic, that is, prefers man as a victim rather than animals. There are other related species in the district, anthropophilic and capable of carrying malaria, but to a much less marked degree. *A. philippinensis* is found to leave the houses during the day, and to return in numbers in the late hours of the night. It is much more readily infected with gametocytes early in the malaria season, when it is a comparatively rare mosquito, than later on when it is numerous. Other anophelines in the region, which are not concerned in carrying malaria, exhibit a preference for bovine to human habitations, and are zoophilic rather than anthropophilic. The author suggests that there may be a relation between anthropophilism and those factors which make an anopheline a carrier of malaria.

### Economic Value of American Hawks

THE farmer often bases his estimate of the economic significance of wild birds upon the exasperation of a moment, when they attack his crops or stock. An impartial survey of the food habits of such creatures almost invariably reveals extensive activity upon the credit side, for harmful insects and vermin often form a large part of the diet. The Bureau of Biological Survey of the U.S. Dept. of Agriculture has published



an investigation into "Food Habits of Common Hawks" by W. L. McAtee (U.S.D.A. Circular No. 370, November 1935). This shows that of the seventeen species of common American hawks, only four stand heavily incriminated as unfavourable to agriculture. The rest are either definitely beneficial, or their harmful and beneficial habits cancel each other, except the pigeon hawk, which may be tolerated in small numbers, though not in abundance. A sufficiently large number of stomachs has been examined to establish these conclusions, and the circular makes a plea for local investigation into the food habits of offending birds, before any measures of control are put into practice against them.

#### Nuptial Coloration and Pearl Organs in a Japanese Fish

DR. MITSUO SATO in an interesting paper (*Sci. Rep. Tôhoku Imp. Univ.*, Fourth Series (Biology), Sendai, Japan, 10, No. 3, 1935) describes the nuptial coloration and pearl organs in *Tribolodon hakonensis* (Günther), a cyprinoid fish very common in Japan, occurring both in fresh and brackish water. The brackish water form attains a greater length than the fresh-water form and migrates into the river in the breeding season. The nuptial coloration and pearl organs are found in both sexes during the period of breeding, usually from spring until the beginning of summer; but they are less conspicuous in the female than in the male, especially in those from brackish water. The author finds that the change in coloration is brought about by the chromatophores, mainly the erythrophores, being caused by the change of their size and shape as well as by the increase of their numbers. The pearl organs appear a little later than the nuptial coloration, and all disappear before the coloration fades away. Their number and distribution vary with the sex, and males and females in the breeding season are readily distinguished by these organs which also vary in distribution in the fresh-water and brackish water forms. These pearl organs are shown to be conical elevations of the epidermis, and their formation is mainly due to both cornification and hypertrophy of the epidermal cells. They appear to serve as contact organs, holding the bodies of male and female together whilst fertilisation takes place in the eggs laid by the female.

#### Fossil Echinoids of Belgium

IN his revision of the genus *Echinocorys* in the Senonian of Belgium (*Mem. Mus. Roy. d'Hist. Nat. Belgique*, Mém. 67, 1935) Jérôme S. Smister does not essentially change the groups recognised in Lambert's monograph of 1903, but he does change considerably the views upon the relationships of species and varieties. The details of these changes cannot be indicated here, but, generally, *E. gravesi* is looked upon as the ancestral form of the Belgian fauna, and evolution in closely related varieties is expressed consistently in changes in the general form of the test. When more widely separated species are compared, many other differences are apparent, such as differences in peristome, periproct and apex. End-products of a line of evolution are easily distinguished; but the minor steps in evolution appear not to influence in an obvious way these characters, and changes in body form are resorted to as a final guide to consistent separation of varieties.

#### Water-Table Effects on Fruit Trees

BULLETIN No. 154 of the Egyptian Ministry of Agriculture presents the results of an investigation by A. Fikry into the incidence of 'gumming and death' disease of stone fruit trees, particularly plum, apricot and peach, grown on terraces at different levels on the banks of the Nile. A study was also made of the influence of varying heights of the water-table on the growth of certain plum varieties and the severity of rust, shot-hole and mildew diseases. A high water-table renders the trees more subject to these diseases, the attack occurring during and immediately after the inundation period. The plum variety Wickson is very susceptible to functional disorder whilst Bokra and Japanese Gold are resistant under similar conditions, though they may be affected if grown on low land. The exceptionally high Nile flood of 1934 was detrimental to stone-fruit trees, the influence of high water-table starting either by wilting or shedding of the leaves and ending by death of the trees. Numerous photographs are presented to illustrate the condition of trees on terraces at three different levels.

#### Chemical Analyses of Southern Rhodesian Rocks

BULL. 29 of the Geological Survey of Southern Rhodesia consists of "Chemical Analyses of the Rocks, Ores and Minerals of Southern Rhodesia" by E. Golding; compiled, with brief petrographic descriptions and references, by A. E. Phaup. The analyses number 329 and demonstrate the enormous amount of work which Mr. Golding has accomplished since he joined the Survey in 1926, especially as most of the rock analyses are of a highly detailed character, with determinations of more than a score (sometimes twenty-five) of constituents. The data now made available include a considerable number of analyses that have not hitherto been published; they provide a sound foundation for a geochemical study of the region and comparisons with other regions. One example may be suggested (see *Quart. J. Geol. Soc.*, 88, 423; 1932), based on the occurrence of BaO and SrO. In most parts of the world BaO is generally more abundant in igneous rocks than SrO. In Southern Rhodesia, however, there are few exceptions to the rule that SrO is the more abundant. This rare constituent is also absolutely abundant, as well as relatively. These characteristics are found in the Pre-Cambrian granites, porphyries, diorites, gabbros, dolerites, epidiorites and greenstones of several cycles, as well as in the associated and, in part, older metamorphic rocks of sedimentary origin; in various auriferous quartz-veins; and in the Karroo basaltic rocks. It would be difficult to account for the persistence through geological time of such a remarkable geochemical peculiarity except on the hypothesis that the early rocks of the earth's crust in this region were SrO-rich and that igneous activity has simply rejuvenated material already there.

#### Bright Sunshine Statistics for the British Isles

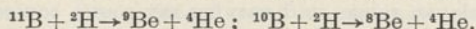
SOME interesting facts relating to the climate of the British Isles are given in a paper by J. Glasspoole and D. S. Hancock that was read before the Royal Meteorological Society on February 19, entitled "The Distribution over the British Isles of the Average Duration of Bright Sunshine: Monthly and Annual Maps and Statistics", and now published (*Quart. J. Roy. Met. Soc.*, April). The number of places at which records of bright sunshine are obtained with the aid of the Campbell-Stokes sunshine recorder, in co-operation



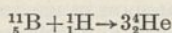
with the Meteorological Office, has increased considerably in recent years, and the summaries covering the period 1901-30 which are given in the official publication M.O. 377, 1934, are more representative than any earlier summaries of this kind. They are the main basis of the paper under review, but some figures have been included from an earlier publication—those obtained at Ben Nevis Observatory in 1891-1902. For the British Isles generally, the period 1901-30 furnishes for the whole year some areas of less than 20 per cent of possible sunshine in the western highlands of Scotland, and of less than 25 in some industrial districts in the northern midlands of England; but this figure rises to just over 40 at a number of places on the south-east and south coasts from Felixstowe to Torquay, and to 42 in the Channel Islands. In Scotland the best is 35 in the low-lying island of Tiree, and the same figure is reached along a small strip of the south-east coast of Ireland. Consideration of individual months and seasons shows that, in general, one of the months April, May or June is the sunniest, expressed similarly as a percentage of the possible duration, April being favoured by most of north-west Scotland and Ireland, and May by the south-east of England. It is pointed out that, on the whole, the figures demonstrate the advantage of taking a summer holiday early. Comparing the duration of bright sunshine with that of the time during which rain is falling at not less than 0.004 inches per hour during the daylight hours, the two were found to be in the proportion of about 41 to 6 in the south-east of England and of 23 to 18 in northern Scotland, a striking climatic contrast.

#### Disintegration of Nuclei by Fast Particles

SEVERAL papers on the disintegration of the lighter nuclei by proton and deuteron bombardment have just appeared (*Proc. Roy. Soc.*, A, March). J. D. Cockcroft and W. B. Lewis have bombarded boron with deuterons, studying the particles emitted by counting them with an ionisation chamber and linear amplifier and estimating their energy by interposing absorbing screens. Two homogeneous groups of  $\alpha$ -particles were attributed to the reactions:



There are also proton groups, discussed in previous work and due to  $^{10}\text{B} + {}^2\text{H} \rightarrow {}^{11}\text{Be} + {}^1\text{H}$ , and two continuous distributions of particles attributed to  $^{10}\text{B} + {}^2\text{H} \rightarrow 3{}^4\text{He}$  and  $^{11}\text{B} + {}^2\text{H} \rightarrow 3{}^4\text{He} + {}^1n$ . The disintegrations of carbon, nitrogen and oxygen by deuterons were also studied in detail, and the energy exchanges intercompared. A slight amendment of the Bethe-Oliphant mass scale for the lighter elements is proposed. In a paper by P. I. Dee and C. W. Gilbert, the reaction



is studied in detail with the cloud chamber. The target was actually placed inside the chamber. The former view, that this reaction often involved the production of three symmetrically emitted  $\alpha$ -particles, had to be abandoned, and evidence was found that the three-body process actually takes place, but usually with the emission of two particles in nearly opposite directions, the third particle receiving little energy. An explanation is suggested in which an  $\alpha$ -particle is first emitted with a range of about 2.4 cm., and the excited  ${}^8\text{Be}$  nucleus disintegrates into two  $\alpha$ -particles in about  $10^{-21}$  sec.

#### Atomic Weight of Carbon

CONSIDERABLE interest has recently been taken in the value of the atomic weight of carbon, the International value 12.00 being probably somewhat too low. Most recent determinations of the densities and compressibilities of gaseous hydrocarbons and oxides of carbon have yielded higher values, and the mass-spectrograph value of  $^{12}\text{C}$  is also somewhat higher than the whole number on the chemical scale. An allowance for approximately 1 per cent of  $^{13}\text{C}$  raises the average value for the mixture of isotopes in ordinary carbon to about 12.01. G. P. Baxter and A. H. Hale (*J. Amer. Chem. Soc.*, 58, 510; 1936) have now carried out combustions in oxygen of some aromatic hydrocarbons of high molecular weight. The direct combustion of carbon in oxygen is not a suitable method for high accuracy, since the practical difficulties of preparing really pure carbon are very great, if it is possible to do so at all, while natural carbon is always impure and the composition of the impurities uncertain. The combustion of organic compounds was used by Dumas and Stas and also, in 1909, by Scott, but in these the formula of the compound was used in the calculation. Baxter and Hale have burnt pyrene, chrysene, triphenylbenzene and anthracene in oxygen and weighed the carbon dioxide and water. From the weight of water the weight of hydrogen was calculated. These higher hydrocarbons contain only a few per cent of hydrogen and no assumption of formula is necessary. Various uncertainties are involved in the calculation of the results; for example, the atomic weight of hydrogen and the isotopic composition of the oxygen and hydrogen in the materials. These uncertainties are small in magnitude. The final result, which is only provisional, is about 12.009, which agrees with some mass-spectrograph results.

#### Ketene Diacetal

MUCH attention was given a few years ago to the supposed compound ketene diacetal,  $\text{CH}_2=\text{C}(\text{OC}_2\text{H}_5)_2$ , which was later shown not to exist. F. Beyerstedt and S. M. McElvain (*J. Amer. Chem. Soc.*, 58, 529; 1936) now report a preparation of this substance by elimination of halogen acid from a halogenated acetal,  $\text{XCH}_2\text{CH}(\text{OC}_2\text{H}_5)_2$ , by means of alcoholic potash. Experiments showed that the elimination of halogen hydracid could be stopped at the ketene acetal stage by carrying out the reaction with iodacetal ( $\text{X}=\text{I}$ ) and potassium in tertiary butyl alcohol. Sodium was much less satisfactory. The reaction was completed in one or two hours at the boiling point of the tertiary butyl alcohol, and after removal of the precipitated potassium iodide the ketene acetal was separated from the tertiary butyl alcohol by fractionation. The yield of purified product was 52 per cent of theory. The ketene diacetal is a colourless liquid boiling at  $124^\circ\text{--}126^\circ$ , which reacts rapidly at room temperature with both water and ethyl alcohol with the evolution of considerable heat, to form ethyl acetate and ethyl orthoacetate, respectively. It polymerises on distillation or heating, and even slowly on standing at room temperature, to a semi-solid white gum. It is clear from these properties that the substance previously described as ketene diacetal was not this compound, which has not previously been obtained. The boiling point is higher than was expected.



## Exploring for Plants in Southern Tibet

By Capt. F. Kingdon-Ward

HAVING left Tezpur, an ancient Assamese town, on the right bank of the Brahmaputra, towards the end of April last year, and crossed the outer range of the Assam Himalaya by the Pankim La at 10,000 ft., I arrived in the dry river valleys early in May. There is only one possible route over the great range in a distance of three hundred miles, between the Bhutan frontier and the gorge of the Brahmaputra; east of the Bhareli River savage tribes—Daflas, Akas, Abors and others—bar the way. Travelling leisurely northwards, the Tibetan frontier was crossed by the Se La (14,000 ft.) early in June and Mönnyul was reached. The rainy season had begun, and this part of the journey, over a series of moderately high passes, was cold and wet.

Already the alpine flowers were in full bloom. Two dozen species of *Rhododendron* were collected, several of them new to science, and half of them new to Assam. Several Chinese species appeared, still further confirming the unity of the eastern Himalayan and Chinese alpine floras. Certain species of *Primula* occurred in vast numbers, painting the meadows bright colours; among them the mauve *P. atrodentata*, *P. Roylei* and *P. Gamblii*. The last two have each two distinct colour forms, yellow and blue-violet.

In the middle of June, I crossed the snow range by two passes both at a height of more than 17,000 ft. and reached the dry Tibetan plateau at the headwaters of the Subansiri. Here the flora was entirely different. There is no forest, but a few trees grow in the villages, where the crops are irrigated. Along the irrigation channels a charming bi-coloured 'sibirica' iris grew in masses. The dry rocky slopes are dotted with thorny bushes and scattered herbaceous plants. To the west, the country grows more and more arid, but eastwards the forest reappears even on the north slopes of the Himalayan range itself. So I turned north-eastwards, and crossing two more ranges at 16,000 ft. altitude, reached the sacred valley of Tsari. Incredible numbers of primulas—chiefly a yellow-flowered form of *P. alpicola*—filled the meadows. Many endemic species grow in this country, where the Tibetan rivers leave the plateau to pierce the Himalaya; for example, *Meconopsis argemontha* (the only known white-flowered species), *Primula Cawdoriana*, *Rhododendron hirtipes* and *R. temoense*, *Cyananthus Wardii*, *Lilium Wardii* and others.

From Tsari, the next range to the north was crossed, and I travelled for eight consecutive days through quite unknown country. The high ranges were all well forested now with conifer forest above and mixed forest below. As the Tsangpo was approached, *Pinus tabulaeformis* became the dominant tree (10,000–11,000 ft.). The Tsangpo was reached at Lilung, thus linking up the new route with my route of 1924. I turned eastwards down the Tsangpo valley and on July 22 reached Tsela Dzong. I was now well into the river gorge country, at the wettest season of the year. Continuing northwards, Tongkyuk was reached, and on August 1 I set out to explore the great unknown range of snow peaks which I had

reason to believe stretched east and west some thirty or forty miles north of the Tsangpo.

For the first time for two months I found myself below 10,000 ft. The Yigrong River was explored to its source; it was followed westwards through a series of magnificent wooded gorges for eighteen days. At first the forest consisted largely of broad-leaved trees, including oaks, laurels, maples and birch, but gradually conifers increased, chiefly *Pinus excelsa*, *P. tabulaeformis* and *Tsuga Brunoniana*. There were snow peaks and glaciers on both sides of the river, but the bulk of the great snow range lay to the south, where there were peaks probably 25,000 ft. high. The source of the Yigrong is in the largest glaciers known north of the Tsangpo.

Recrossing the range by a high pass, I reached the Gyalam (that is, the Lhasa-China road) at Gyamda, about 120 miles east of Lhasa. The country here is much drier again; there is far less forest, and fewer species of trees. It was now the end of August, the height of summer there, and numbers of beautiful flowers were in bloom, including the robust and handsome *Salvia Wardii*, the half shrubby *Dracocephalum Hemslyanum*, with large sapphire blue flowers, *Codonopsis convolvulacea* and species of *Adenophora*.

Continuing westwards, the Lhasa road was followed for two days, and then I turned southwards to cross the unknown country which separated me from the Tsangpo. Crossing the range at 17,000 ft., I reached the Tsangpo sixty miles west of Lilung. The blue-flowered *Onosma Waddellii* was in fruit here, also the delightful sand dune plant *Oxytropis sericopetala*. A different route back to the headwaters of the Subansiri was followed, and plants and seeds were collected.

Finally, in October, I once more crossed the great Himalayan range, and varying my route, covered a good deal of botanically unknown country. One of my last finds was a charming new species of slipper orchid (*Cypripedium*). I arrived at the Assam plain again on the last day of October, after a journey of six months.

During that time I had travelled about 1,500 miles, crossed more than twenty passes between 15,000 ft. and 17,000 ft., and explored 600 miles of unknown routes. Many hundreds of species of plants had been collected, including a number of new species, and seed of some of the best for English gardens was obtained. The great snow range north of the Tsangpo was definitely located and followed for a hundred miles.

Botanically, it was possible to recognise three main divisions of the Tibetan flora, which correspond fairly closely with the three stages in the degradation of the plateau. But the observations and collections also emphasise the unity of the Tibetan flora as a whole, and its close similarity to that of western China and the Himalaya. The Tibetan flora is not of central Asian affinity; Tibet, western China and the entire Himalaya form a phytogeographic whole, which may be distinguished by the term 'Sino-himalayan'.



## Disperse Systems in Gases: Dust, Smoke and Fog

THE Faraday Society held one of its biannual general discussions in the Chemistry Department of the University of Leeds on April 20-22. The subject of the discussion in this instance was "Disperse Systems in Gases: Dust, Smoke and Fog". The meeting was held under the joint chairmanship of Sir Robert Robertson and Prof. F. G. Donnan, owing to the illness of the Society's president, Mr. William Rintoul.

Among the distinguished foreign and overseas guests of the Society attending the discussion were: Prof. J. Firket (Liège), Dr. E. Hiedemann (Cologne), Prof. H. Köhler (Uppsala), Dr. and Mrs. R. Meldau (Berlin-Charlottenburg), Dr. J. L. van der Minne (Amsterdam), Prof. H. Remy (Hamburg), Dr. P. Schuftan (Munich), Dr. H. Schmeel (Darmstadt), Dr. P. Siedler (Frankfort-on-Main).

The discussion was divided into two parts, the first dealing with the general properties and behaviour of dispersed systems, whilst the second was the industrial aspect of such systems in air and gases. In addition, the discussions on Part I were subdivided into those dealing with systems of non-volatile particles, such as smokes and dusts, and systems of aqueous and other volatile particles, such as mists, clouds and fogs.

In an introductory paper to the first part of the discussion, Prof. R. Whytlaw-Gray of the University of Leeds gave a comprehensive summary of modern knowledge of smokes. He pointed out that one of the most fundamental properties of any dispersed system in a gas was its power of spontaneous coagulation. He showed that when dealing with ideal smokes in the laboratory, the decrease of number of particles with time was in conformity with the theoretical equations of von Smoluchowski. Dr. W. R. Harper (Bristol) criticised the derivation of these equations and submitted an alternative method of treatment, which, however, led to the same final formulæ. One point of great interest arose out of the discussion on coagulation which followed, this being the extreme lack of information regarding the initial formation of particles from volatilised substances, and whether there is in fact a primary particle (that is, a homogeneous particle of minimum size as distinct from larger particles consisting of loose aggregates) or not. The microscopic examination of smokes of crystalline substances and the work of Prof. Fuchs (Moscow) on sulphuric acid droplets tends to support the former view. The effect of the reduction of pressure in increasing the rate of coagulation was also discussed.

Two other phenomena exhibited by dispersed systems were also brought before the meeting. The first was the enforced and very rapid coagulation of particulate matter by means of sound waves of supersonic frequencies. In this connexion, Dr. Hiedemann gave a description of his inspiring and extremely comprehensive experimental researches, whilst Prof. E. N. da C. Andrade put forward a theoretical explanation of the phenomena. In the somewhat lively discussion which followed, the economic possibilities of using this method in industry were treated. The other phenomenon was that seen so frequently above radiators, that is, the

deposition of particulate matter on cold surfaces, and the reverse effect of a dust-free space around hot bodies. Mr. H. H. Watson (Porton) gave an account of an experimental investigation of this effect, which was followed with an attempted theoretical explanation by Dr. W. Cawood, based on the asymmetrical bombardment of the particles in a temperature gradient by the gas molecules.

Mr. H. L. Green (Porton) gave an account of an investigation of certain harmful commercial dusts. After describing a method of measuring the particle size distribution, he showed that in all such dusts the range of size was about  $0.2\mu$ - $2\mu$  in diameter, and that the number distribution appeared to be quite random. He pointed out the importance of such measurements in industry due to the probability that certain sizes of particles are more toxic than others.

The next part of the meeting, that is, the part dealing with volatile particles, somewhat naturally resolved itself mainly into a discussion on atmospheric conditions. Dr. G. M. B. Dobson (Oxford) presented the introductory paper, and whilst giving a résumé of our present knowledge of these systems, at the same time stressed the points about which very little is known, such as the distribution of fogs and particulate matter around towns and the effect of dispersoids in cutting off sunlight and daylight.

That in country air the nuclei upon which fogs and mists condense consist mainly of very fine particles of sea salts has been shown by J. H. Coste and H. L. Wright. At this meeting, however, Mr. Coste showed that, in towns, in addition to such nuclei there are nuclei of sulphuric acid droplets, and described how the sulphuric acid content of the air might be determined. He also put forward experimental evidence in support of the view that droplets of nitrous acid are formed by the various combustion processes in a city, which also act as hygroscopic nuclei for the formation of fogs. Prof. Hilding Köhler gave an account of his researches, mainly carried out on the slopes of the Haldde, which also show that the centres of condensation in country air mainly consist of sodium chloride. In addition, he gave a very complete account of the thermodynamics of condensation upon such nuclei. Similar considerations were also shown by Dr. C. F. Goodeve (London) to apply to the old problem of the behaviour of sulphuric acid mist in air of different water vapour concentrations. The determination of the actual mass and size of these atmospheric nuclei was described by Prof. J. J. Nolan (Dublin), who showed that they were identical with the Langevin ions, and the average radius was about  $2.3 \times 10^{-6}$  cm. Prof. J. C. Philip then gave a description of the part played by certain hygroscopic nuclei of ammonium chloride in the formation of fog.

As a rather disturbing climax to this part of the discussion, during which so many of the properties of the nuclei necessary to form a fog had been investigated and described, Prof. J. Firket gave an account of those terrible days during December 1930 when sixty-three people died and several hundred were affected as a result of a dense fog along the Meuse Valley. Prof. Firket described how he and his collaborators proved that the toxic material in



the fog was almost certainly sulphur dioxide and its oxidation product sulphuric acid (the latter being the more poisonous and the actual cause of the casualties), formed in the combustion of coal. It is of interest to note that one fifth of the sulphurous products had their origin in the domestic fireplace. Prof. Firke also said that, given the same exceptional atmospheric conditions, undoubtedly the accidents would occur again unless special plants were installed to absorb the sulphurous fumes from the flue gases of industrial furnaces.

The section of the discussion dealing with the industrial aspects of dispersed systems was opened by Dr. R. Lessing (London), who gave a comprehensive account of the dusts, smokes and fogs formed in various industrial processes, and then described how the flue gas problem had been successfully overcome in Britain. He showed that in the burning of coal, by means of efficiently designed furnaces, the black smoke of unburned carbonaceous matter, once so common, had practically disappeared, so that only a dust of siliceous ash was left in the flue gases. However efficient the furnace, the sulphur oxides are unchanged, and consequently in modern practice the flue gases must be washed by an alkaline solution in order to eradicate them. Mr. G. Nonhebel (Durham) described how the Howden-I.C.I. flue gas scrubber carried out this process. The essential point of the system appears to be the strict control of the pH of the alkaline scrubbing water in order to obviate the copious encrustation of calcium sulphate in the scrubbers.

Apart from the problem of cleansing flue gases in order to prevent air pollution, there is also the problem of precipitating dusts and smokes in such a way that they can be collected. The most widely used method is the Lodge-Cottrell process of electrical precipitation. In this connexion, Dr. R. W. Lunt

(London) discussed the electrical efficiency of the ionisation in such processes. He showed that the ordinary laws do not hold in the corona discharge and that by applying more refined theoretical methods it can be proved that the efficiency is far below the maximum.

A paper was presented by Dr. J. S. Owens (London) entitled "Twenty-five Years of Progress in Smoke Abatement". The study of the various observations taken by Dr. Owens in different parts of Britain shows that the choice of the word 'progress' is unfortunate, as the pollution in certain areas is worse than it was twenty-five years ago. Dr. R. Meldau then described the extreme difficulties of forecasting where dust should distribute itself in and around cities owing to the microvariations of the atmospheric conditions. Mr. Bosanquet dealt with the theoretical aspects of the same problem, in particular, the spread of pollution from chimneys, taking into account the various phenomena of eddy diffusion. He showed that at points close to the chimney the concentration at ground-level is small and that it reaches a maximum at a distance of the order of ten times the chimney height.

Prof. D. Brunt then described in a general way the dissipation of fogs in open spaces such as aerodromes. He took the view that this is now mainly a problem for the engineers. Indeed, one of the results of the discussion was to show that the abatement of atmospheric pollution is now a technical and economic rather than a scientific problem.

In conclusion, the Faraday Society is to be congratulated upon organising an extremely interesting and useful discussion, which should have important consequences in this field of scientific study—a field moreover which has a direct bearing upon the improvement of the living and working conditions of people in industrial cities.

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## International Conference on Timber Utilisation

CHANGES in industry and in housing which have taken place on the Continent since the Great War have altered the incidence of demand for wood, more especially in the small material which formerly was used for firewood or turned into charcoal. Faced with a big unsaleable surplus of such material, forest owners have tried to find new outlets for it, and progress in this direction may be summarised as the use of scientific control in methods of turning wood into a homogeneous product suited to mechanised mass-production conditions of manufacture.

Of the papers read at the Second International Conference on Timber Utilisation recently held in London, the bulk referred more to the disposal of the wood in the round from the forest than to the actual processes of manufacture, and those which referred to uses of wood other than that of a construction material dealt only with very general aspects of the case which have been known for many years.

Dr. von Monroy classified these other uses into wood as a source of energy (other than that of direct combustion, of course), as a textile, a food-stuff and a raw material in chemistry. He himself demonstrated part of the source of energy use by coming

to the Conference in a motor-car driven by producer gas, and spoke of the recent hydrogenation processes evolved for converting wood gas into light and heavy fuel oils.

Dr. Friedrich Bergius in his paper on "Wood, a New Raw Material" dealt with the subject of the preparation of 'wood sugar' and its derivatives, alcohol, glycerol, etc., where improved technique has, he claims, attained the conversion of the whole of the wood substance except the lignin, or roughly two thirds of the original wood. This, he said, results in the possibilities of obtaining from one acre of woodland as much food-stuff as from one acre of arable land and with less labour in cultivation.

Prof. E. Hagglund, following Dr. Bergius, referred to the textile aspect, as concerned with artificial silk and wood pulp. Here, again, progress has lain in improvements in manufacturing methods leading to a reduction in the price of producing viscose and to the use of sulphate pulp in the cuprammonium process, which until then had been restricted to cotton linters. He foreshadowed the use of broad-leaved species in the manufacture of high grade pulp, from which they have hitherto been excluded on account of the shortness of their fibre.



All these aspects of wood utilisation deserve close study by forest owners and wood-consuming industries in Great Britain, in view of the relatively high proportion of low-grade material which newly-formed British forests will produce in the next few decades until they approach maturity; but it would be a grave mistake to think that the problem is already solved. Scientifically it may be; economically it definitely is not. As a stand-by in times of emergency, such derivatives of wood can be of the greatest value, but in emergency economy counts for little. In other times the question of cost of production is all-deciding, and in Great Britain other raw materials are cheaper to produce.

The three papers summarised above were given by men working under conditions of limited trade competition or of large supplies of cheaply transported timber, neither of which conditions obtains ordinarily in Great Britain. Therefore, before any large industries can be built up in this country by the application of chemical methods, the problem of insuring continued supplies cheaply to the factory must first be solved.

This is not to say that the study of wood chemistry in Great Britain is not worth doing; but study must be directed to objects which will fit in with the economic conditions of the country, and it will not necessarily follow lines developed in totally different surroundings.

## Educational Topics and Events

CAMBRIDGE.—The Iron and Steel Industrial Research Council has decided to make a grant of £500 a year to the University for the purpose of supporting scientific research on corrosion, and has indicated its intention of continuing this grant for a short period of years subject to the satisfactory progress of the work. The grant will enable Dr. U. R. Evans to continue the investigations which he is at present carrying out while holding the Royal Society Armourers and Brasiers Company research fellowship, his tenure of which terminates shortly. Dr. Evans will retain complete freedom in planning and carrying out this work, and, while reporting the results to the Corrosion Committee of the Iron and Steel Industrial Research Council, will publish them in scientific journals or in the reports of the Corrosion Committee as may appear to him most appropriate.

The seventh course of Scott lectures will be given by Prof. E. V. Appleton, of St. John's College, Jacksonian professor elect, in the Cavendish Laboratory at 4.30 p.m. on May 11, 13, 15 and 18. The subject of the course will be "The State of the Upper Atmosphere".

ST. ANDREWS.—Mr. D. C. Innes has been appointed to the new chair of geology established by a recent Ordinance of the Court, approved by His Majesty in Council, the appointment to take effect as from August 1. Mr. Innes was appointed lecturer in geology in the University in 1920 and raised to the status of reader in 1927.

Prof. D'Arcy Thompson has been invited to deliver the Lowell Lectures in Harvard University, and the Senatus Academicus of the University has therefore agreed to grant him the necessary leave of absence to enable him to accept this invitation.

Major A. H. R. Goldie, superintendent of the Meteorological Office (Air Ministry), Edinburgh, has

been awarded the degree of D.Sc. for a thesis entitled "The Mechanism of the Depressions of Temperate Latitudes".

On April 23 the Irish Free State Dail passed a motion by 58 to 40 votes putting into force the Bill to abolish university representation. At the next general election, therefore, the three seats for Dublin and the three seats for the National University of Ireland will cease to exist (*The Times*).

## Science News a Century Ago

Prof. D. Don at King's College, London

ON May 2, 1836, Prof. David Don (1800–41), who had succeeded Burnett in the chair of botany in King's College, London, gave his inaugural address. "The Professor," said *The Times* of May 3, "commenced by requesting the indulgence of his auditory, as he was unused to addressing public audiences, and as the lecture he was about to deliver was the first he had ever attempted. He then proceeded to give a detailed account of the history of botanical science and stated its progress from the times of Aristotle and Hippocrates to the days of Linnæus and Jussieu". After directing attention to the various publications relating to botany, he "impressed upon his audience the great importance of the study of botany, its immediate connexion with medical knowledge, and the necessity of its consideration by medical students, its importance to a proper knowledge of agriculture, and its great utility to the illustration of various other branches of learning. . . . Mr. Don was at all times rather inaudible and apparently labouring under the influence of those feelings which generally render persons unused to address a public meeting rather nervous. The general excellence of the lecture was, however, quite sufficient to redeem any drawback which this might have occasioned".

Don was the son of George Don (1770–1814) and brother of George Don (1798–1856), both well-known botanists. Educated in Edinburgh, he went to London in 1819, and in 1822 succeeded Robert Brown as librarian of the Linnean Society.

Annular Eclipse of the Sun, May 15, 1836

JUST as the reappearance of Halley's comet in 1835 had attracted much attention in Great Britain, so the annular eclipse of the sun on May 15, 1836, also created very widespread interest. Ten days before the eclipse, *The Times* on May 5 informed its readers that "On Sunday, May 15, in the afternoon, there will be a large and visible annular eclipse of the sun, which will be central in the north of England, Ireland and in the south of Scotland. It will begin at 50 minutes 59 seconds past 1 o'clock, and will end at 39 minutes 8 seconds past 4. Over England and the adjacent parts the light and the heat of the annular obscuration will be a little more than one tenth of the full sun; and should the atmosphere prove to be clear at the time of the greatest magnitude it may be expected that several of the largest stars will be visible. The breadth of the annulus for England will be about 142 miles. The whole body of the moon will appear on the disc of the sun, leaving a small ring or circle of light on the external edge of the sun, whence its name annular, from *annulus*, a ring".



## Dichroism of Crystals

ON May 5 and 12, 1836, Henry Fox Talbot (1800-77), the pioneer of photography, read a paper to the Royal Society entitled "On the Optical Phenomena of Certain Crystals", in which he gave an account of the optical properties of certain minute crystals, obtained by the evaporation of a solution of borax in phosphoric acid, when they were examined by the polarising microscope.

In a postscript to the paper, the author gave an account of a new species of 'dichroism' in crystals, to the discovery of which he was led by applying to them his peculiar method of observation with polarised light. In these experiments the crystals themselves performed the office of the analysing plates, acting on light previously polarised and transmitted through a plate of mica. The experiments tended to confirm the views of Sir David Brewster and others as to the general cause of the dichroism of crystals.

## Royal Asiatic Society and India

AT the thirteenth anniversary meeting of the Royal Asiatic Society held on May 7, 1836, the Right Hon. C. W. W. Wynn (1775-1850), who had been president of the Society since its formation in 1823, in his address said that "He felt particular gratification in congratulating the meeting on the proposal which had been laid before the Society, for establishing a Committee of Agriculture and Trade in relation to the East. . . . The plan just alluded to would be the means of introducing into India the useful discoveries of Europe in arts and sciences, but in the encouragement lately given by government to a more extended and unrestrained intercourse with the East would be found the true efficient for these ends. . . . As the proposal relative to Trade and Agriculture must, if carried into effect, produce increased means of acquiring information on the capacity of the different nations of the vast Empire of India, he hoped it would meet with encouragement, not only from the Society, but from those engaged in commercial intercourse with the East." (*Athenæum*.)

## Societies and Academies

## PARIS

Academy of Sciences, March 23 (*C.R.*, 202, 993-1124). ERNEST ESCLANGON: The application of the principle of relativity to the study of a dynamical problem. MARCEL DELÉPINE and ALAIN HOREAU: The hydrogenation of carbonyl compounds by Raney nickel, coated with metals of the platinum family. The influence of alkalis. The presence of a trace of alkali is essential for the hydrogenation. Experiments were made with ruthenium, palladium, osmium, iridium and platinum as coating for the nickel. All these metals increase the velocity of addition of hydrogen, palladium being the least active, platinum, iridium and osmium the most active. LUDOVIC MRAZEC was elected *Correspondant* for the Section of Mineralogy, in succession to the late H. F. Osborn. B. HOSTINSKY: Probabilities in chain. ANDRÉ WEIL: The overlapping of topological spaces: complete spaces, bicompact spaces. NIKOLA OBRECHKOFF: Asymptotic formulæ for Jacobi polynomials, and on the development along the polynomials. KARL MENGER: Calculation of the variations in general

spaces. I. PETROWSKY: Cauchy's problem for a system of partial differential equations in the real domain. PIERRE RACHEVSKY: A scheme unifying the theory of abstract groups with Lie's theory of infinitesimal groups. F. H. VAN DEN DUNGEN: Small movements of a system submitted to gyroscopic forces. EDGAR PIERRE TAWIL: A piezoelectric chronograph. The instrument described is capable of measuring to 1/100,000 of a second. E. DE LA VILLEMARQUÉ: The calculation of linear transformations, met with in astronomy, by the combined use of the machine and the method of mobile bands. L. SACKMANN: The study of certain discontinuities in the experimental determination of the polars of [aeroplane] wings. PAUL SCHWARZ: The Bénard-Kármán vortices behind an obstacle, in movement in a rectilinear canal. LOUIS BREGUET: The optimum tonnage of large aeroplanes for use in transport or bombardment. JEAN DELSARTE: A problem of diffraction. WALTER M. ELSASSER: The diffraction of slow neutrons by crystalline substances. PIERRE JOLIVET: A new electrostatic motor. RENÉ PLANIOL: The ionisation and luminescence of atomic jets in a high vacuum. MOSHÉ FELDENKRAIS: Measurement of the voltage of a Van der Graaf electrostatic generator with belts. G. KRAVTZOFF: The anodic behaviour of organic salts of copper. L. NÉEL: The influence of the thermal variation of the molecular field on the Curie constant. THADÉE PECZALSKI: Widening of the lines of the radiation from 'singing' arcs. CHARLES SANNDÉ, LUCIEN AMY and VLADIMIR POREMSKI: The isolation of the triplet 4358 Å. of the mercury arc for use in obtaining Raman spectra. The filter proposed is a solution of nitrobenzene (6 per cent) and rhodamine 5G extra (0.01 per cent) in ethyl alcohol. JEAN ROIG: The temperature of helium in the high-frequency discharge. Although the conditions of the tube varied between wide limits, the temperature always remained in the neighbourhood of 200° C. PAUL SOLEILLET and SERGE NIKITINE: The polarisation of the radiation 2139 Å. emitted by the optical resonance of a jet of zinc atoms. RENÉ AUDUBERT and M. PROST: A radiation emitted during the hydration and dehydration of quinine sulphate. An ultra-violet radiation, between 2500 Å. and 2000 Å. was proved to accompany these changes in water content. MLE. HOANG THI NGA: The influence of the nature and position of the groups on the photo-potential of the substituted aromatic amines. M. E. NAHMIA: The artificial radioactivity of tin. A very slight artificial radioactivity has been produced in tin by irradiation with a radon-beryllium source. MME. EMMANUEL ZAVIZZIANO: Adsorption of protactinium by titanium, and the method of fractionation. ALEX SANIELEVICI: Calorimetric measurements of the energy of disintegration in the actinium family. MARCEL LECOIN: The continuous  $\beta$ -spectrum of actinium B. RAYMOND LAUTÉ: A general constant of Van der Waals. J. TIMMERMANS, M. HENNAUT-ROLAND and D. ROZENTAL: The variation of the volume of heavy water on freezing. The difference of the specific volumes of heavy water in the liquid and solid states is 0.0811: this gives as the rate of change of the freezing point with pressure 0.00705° C. per kilogram. MME. MARIE ELISA P. RUMPF and PAUL RUMPF: The ultra-violet spectra of the bromine derivatives of aniline. GEORGES CARPÉNI: The dissociation constants of reductone and of its oxidation product with iodine. JEAN CHÉDIN: The quantitative analysis by the Raman effect of mixtures of sulphuric and



nitric acids. HENRI LEMONDE: Diffusion and azeotropism in binary mixtures. ALBERT PORTEVIN and PAUL BASTIEN: The mechanical resistance of the skin of alumina and its influence on the surface tension of the fused metal. MME. LÉONE WALTER LÉVY: Basic sulphocarbonate of magnesium. MAURICE DODÉ: Study of the reactions taking place during the absorption of nitrous vapours by solutions of potassium iodide. JACQUES BOURCART: Remarks on the Quaternary deposits on the Portuguese coast between Cap d'Espichel and the Peniche Peninsula. MME. MADELEINE FOURCROY: The evolutive acceleration of the rootlets in wounded roots. YU CHIH-CHEN: A new technique analogous to the Feulgen reaction and its application to the study of the evolution of the nucleolar elements and satellites. M. and MME. FERNAND MOREAU: The action of the sugars on the Saprolegniæ. EMILE PERROT: A new plant containing colchicine, *lofout*, a lilaceous plant from the Sahara. MAURICE HOCQUETTE: Remarks on some characters of the secretion of *Primula obconica*. Evidence that the secretion in the cell and outside differ in composition. MME. CÉCILE SOSA-BOURDOUIL: Comparisons between some peas and their hybrids, relating to the elementary composition of the seeds. MARC SIMONET: New interspecific hybrids of *Iris Pogoniris*. MME. M. GAUTHIER: A new entophyte of the Harpellaceæ group, parasite of the larvæ of Ephemeroidea. GEORGES SOUCHE: The nucleus of *Diplocystis schneideri*. PHILIPPE JOYET-LAVERGNE: The localisation of vitamin A in the red corpuscles of the blood of the vertebrates in the course of the evolution of these globules. HENRI NOUVEL: Observations on abortive cells and the embryology of larvæ of the *Dicyemides*. MME. LUCIE RANDOIN and ROGER NETTER: Marked difference between the degree of necessity of vitamins A and B at a certain period of growth of the young rat, and in the case of a régime very rich in glucides. MME. LAIA OLSZYCKA: Quantitative study of the phenomena of synergy. Contribution to the study of the mechanism of the phenomena of potentialisation of hypnotic action in the rat. ANTOINE MAGNAN and HENRY GIRERD: Attempts at recording the successive attitudes of the wings of a pigeon and the corresponding variations of pressure. MME. VÉRA DANTCHAKOFF: The final result of a "female by hormonal induction". SERGE TCHAKHOTINE: Localised irradiation of the myoneme of the peduncle of *Vorticella* by ultra-violet micropuncture. JACQUES RABATÉ and JEAN DUSSY: Contribution to the study of the flavonolic heterosides of the fruits of *Sophora japonica*. PIERRE and CAMILLE CHATAGNON: The metabolism of bromine in the human organism. The tabulated results do not confirm the conclusions of Zondek and Bier. LOUIS COTONI and JACQUES POCHON: The titration of various therapeutic sera by neutralisation of the antibodies *in vitro*.

## BRUSSELS

Royal Academy (*Classe. Sci.*, December 7, 1935). L. GODEAUX: An algebraic variety in three dimensions of geometric genus zero and bigenus one. J. E. VERSCHAFFELT: Thermomechanics of the electric conductor (3). Reflections on the theory of the transverse magnetic effects. Comparison of the theory given in previous articles with the results of Sommerfeld and Franck. T. SOLOMOS: Probable shape of the cross-section of Saturn's rings. The consequences of assuming a hyperbolic shape for the rings are

examined. P. VAN RYSELBERGHE: The Le Chatelier-Braun principle and moderation theorems. R. LEDRUS: Probe measurements on the inverse alternation of mercury vapour rectifiers. Oscillographic studies. M. DÉSIRANT and J. DUCHESNE: Researches on the molecular spectrum of sulphur vapour. Extension of observations to longer wavelengths.

December 14, 1935. J. GÉHÉNIAT: Correspondence between gravitational fields and the fields of the wave mechanics. S. ARSITIDYSKY: Logical bases of the theory of probability (1). Theories founded on the notion of the limit of the relative frequency. M. KOURENSKY: Reduction of the integration of systems of non-linear equations of the first order with partial derivatives of several unknown functions to the integration of systems of linear equations of the first order of a single unknown function.

December 16, 1935. J. E. VERSCHAFFELT: Modern alchemy. H. BUTTGENBACH: Meteorites.

January 11, 1936. M. WINANTS: Both the two problems  $a_0, III, 3''$  and  $a_0, III, 2'$  can be solved by means of an integral equation with an infinite number of terms. G. FICHTENHOLZ: Linear operations in the space of continuous functions. G. DRINFELD: Integral invariants and contravariant functions. V. PÂQUET: The fundamental formula of the invariant theory of the calculus of variations. O. ROZET: Some remarks on the deformation of quadrics. L. LONG: Some remarkable systems of curves on surfaces (3). L. MARTIN: On Bessel transcendents considered as Riemann functions relative to a class of systems of equations with partial derivatives containing as many equations as there are unknown functions of two independent variables. H. FREDERICQ: Changes of the action of the cardiac pneumogastric of the turtle produced by modifications of the pH of the heart.

## ROME

Royal National Academy of the Lincei (*Atti*, 22, 275-365; 1935). U. CISOTTI: (1) Criterion for evaluating the dynamic forces acting on a circular obstacle containing a source and immersed in a translocirculatory current. (2) Calculation of the 'ballast effects' relative to a rectilinear lamina. M. BETTI and M. MANZONI: Anomalies in the dissociation constants of some halogenated organic acids (2). The dissociation constant of *o*-chlorophenylacetic acid ( $1.35 \times 10^{-4}$ ) is unexpectedly less than that of the corresponding bromo-acid ( $1.92 \times 10^{-4}$ ). G. CHECCHIA-RISPOLI: A Miocene formation from the Appennines of Capitanata. E. GUGINO: (1) Direction derivatives of tensors. (2) Cyclic transport of a tensor of any order. G. DOETSCH: Tricomi's formulæ on the polynomials of Laguerre. R. CACCIOPOLI: Elliptical partial differential equations with two independent variables, and regular problems of the calculus of variations (1). U. BROGGI: Constants of Fourier-Laguerre. G. ASCOLI: A particular differential equation of the second order. L. SONA: Translocirculatory current which invests a bilateral lamina. Integral of the motion (3). L. GIALANELLA: Meridian observations of Uranus in 1934 and of Mars in 1935. E. MEDI: New method of analysis of partially polarised light diffused from the sky. G. GIRAUD: Passage of electricity in a magnetic field when the electrodes are points. G. NATTA and R. RIGAMONTI: Examination by electron rays of some fatty esters.



Long-chain compounds appear to show a two-dimensional isomorphism, which is independent of the active terminal groups and persists when  $\text{CH}_3$  groups are replaced at long intervals by CO or by O. G. B. BONINO and R. MANZONI-ANSIDEI: Raman spectrum of some derivatives of pyrrole. All the alkyl-substituted pyrroles investigated give the two 'pyrrole ring' lines at  $1,460\text{--}1,520\text{ cm.}^{-1}$  and  $1,370\text{--}1,390\text{ cm.}^{-1}$ . G. GOIDANICH: Observations on a rare disease of clover in Italy: anthracnose of *Kabatiella caulivora* (Kirchn.), Karak. M. MITOLO: Presence and distribution of reducing substances in brain tissue. Values are given of the reducing power of different parts of the brain tissue of toads, rats, pigeons, rabbits, cats, sheep, horses and oxen.

## Forthcoming Events

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

### Monday, May 4

VICTORIA INSTITUTE, at 4.30.—Dr. H. C. Morton: "The Supposed Evolutionary Origin of the Soul".

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY, at 5.30.—Prof. G. T. Morgan, F.R.S.: Hofmann Memorial Lecture.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Baroness Ravensdale: "Persia in 1935".

### Tuesday, May 5

INSTITUTE OF PATHOLOGY AND RESEARCH, ST. MARY'S HOSPITAL, LONDON, at 5.—Dr. F. L. Pyman, F.R.S.: "Recent Researches in Chemotherapy".

LONDON SCHOOL OF HYGIENE AND TROPICAL MEDICINE, at 5.30.—Prof. A. Butenandt: "Biochemistry of the Sterol Group" (succeeding lectures on May 7 and 8).\*

INSTITUTION OF CIVIL ENGINEERS, at 6.—E. F. Relf: "Modern Developments in the Design of Aeroplanes" (James Forrest Lecture).

### Wednesday, May 6

ROYAL SOCIETY OF ARTS, at 8.—G. Mackenzie Junner: "The Oil Engine and its Influence on Road, Rail and Air Transport".

INSTITUTE OF METALS, at 8.—(at the Institution of Mechanical Engineers, Storey's Gate, S.W.1).—C. C. Paterson: "The Escape of Electricity from Metals: its Practical Consequences" (Annual May Lecture).

### Thursday, May 7

BEDFORD COLLEGE FOR WOMEN, at 5.15.—Sir Edward Poulton, F.R.S.: "Ants".\*

ROYAL VETERINARY COLLEGE, at 5.30.—Prof. Henry Dryerre and Dr. J. Russell Greig: "Mineral Deficiency Diseases of Farm Animals" (succeeding lecture on May 8).\*

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—Annual General Meeting.

Dr. E. Mallet: "Television—An Outline" (Faraday Lecture).

### Friday, May 8

BEDSON CLUB (ARMSTRONG COLLEGE, NEWCASTLE UPON TYNE), at 6.30.—Dr. C. H. Desch, F.R.S.: "The Chemical Properties of Metals" (Bedson Lecture).

ROYAL INSTITUTION, at 9.—Sir William Bragg, Pres. R.S.: "The Electric Properties of Crystals (II)".

IRON AND STEEL INSTITUTE, May 7–8.—Annual Meeting to be held at the Institution of Civil Engineers, Great George Street, London, S.W.1.

## Official Publications Received

### Great Britain and Ireland

County Borough of Southport: Meteorological Department: The Fernley Observatory, Southport. Report and Results of Observations for the Year 1934, with an Appendix. By Joseph Baxendell. Pp. 32. (Southport: Fernley Observatory.) [303]

The Nutritive Value of Milk. Memorandum by the Advisory Committee on Nutrition, issued by the Ministry of Health and the Department of Health for Scotland. Pp. 12. (London: H.M. Stationery Office.) 3d. net. [303]

Ministry of Health. Costing Returns, Year ending 31st March 1935. Pp. 24. (London: H.M. Stationery Office.) 1s. net. [303]

Rothamsted Conferences. 21: The Use of Electricity in Agriculture: being a Report of a Conference held at Rothamsted on January 29th, 1936, under the Chairmanship of Sir Bernard E. Greenwell. Contributions by Sir E. J. Russell, M. M. Harvey, B. A. Keen and G. H. Cashen, F. E. Rowland, C. A. Cameron Brown, and others. Pp. 77. (Harpden: Rothamsted Experimental Station.) 2s. [14]

Report of the Marlborough College Natural History Society for the Year ending Christmas, 1935. (No. 84.) Pp. 94+8 plates. (Marlborough: Marlborough College.) 5s.; to Members, 3s. [14]

Development Commission. Twenty-fifth Report of the Development Commissioners, being for the Year ended 31st March 1935. Pp. 141. (London: H.M. Stationery Office.) 2s. 6d. net. [14]

Interim Report of the Departmental Committee on the Ordnance Survey. Pp. 16. (London: H.M. Stationery Office.) 3d. net. [24]

The Economic Proceedings of the Royal Dublin Society. Vol. 3, No. 1: Factors influencing the Loss of Butterfat in Churning. By J. Lyons and M. O'Shea. Pp. 18. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.) 1s. [24]

### Other Countries

Veröffentlichungen des Geophysikalischen Instituts der Universität Leipzig. Zweite Serie: Spezialarbeiten aus dem Geophysikalischen Institut und Observatorium. Band 7, Heft 1: Die Singularität im Druckverlauf Ende November, ihr innerer Aufbau und ihr Einfluss auf den Temperaturverlauf Europas im Dezember (Weihnachststauwetter). Von Fritz Engelmann. Pp. 52+16 maps+3 plates. Band 7, Heft 2: Horizontale und vertikale Staubverteilung in einer Grossstadt. Von Alfred Löbner. Pp. 53–100+9 plates. Band 7, Heft 3: Zur Theorie der Luftspiegelungen insbesondere des elliptischen Falles. Von Wolf-Egbert Schiele. Pp. 101–188. (Leipzig: Geophysikalischen Institut.) [14]

U.S. Department of Agriculture. Circular No. 381: Rodents and Moles as pests in Bulb Plantings. By Theo. H. Scheffer and F. E. Garlough. Pp. 16. 5 cents. Technical Bulletin No. 504: *Orius insidiosus* (Say), an Important Natural Enemy of the Corn Ear Worm. By G. W. Barber. Pp. 24. 5 cents. (Washington, D.C.: Government Printing Office.) [14]

Smithsonian Miscellaneous Collections. Vol. 95, No. 2: Lethal Effect of Short Wave Lengths of the Ultraviolet on the Alga *Chlorella vulgaris*. By Florence E. Meier. (Publication 3380.) Pp. 19+2 plates. Vol. 95, No. 3: Liquid-Propellant Rocket Development. By Robert H. Goddard. (Publication 3381.) Pp. 10+11 plates. (Washington, D.C.: Smithsonian Institution.) [14]

Koninklijk Nederlandsch Meteorologisch Instituut. No. 115: Oceanographische en meteorologische Waarnemingen in de Chineseesche Zeeën en in het Westelijk Deel van den Noord Stillen Ocean. 1: Maandkaarten voor Januari–Juni (1910–1930). Pp. 48. ('s-Gravenhage: Rijksuitgeverij.) 7.50 fl. [14]

League of Nations. Bulletin of Information on the Work of International Organisations. Compiled by the Section of International Bureaux. (No. 2, Vol. 7.) Pp. 93–206. (Geneva: League of Nations; London: George Allen and Unwin, Ltd.) [34]

Obras completas y Correspondencia científica de Florentino Ameghino. Vol. 19: Obras póstumas y trunacas. Edición Oficial ordenada por el Gobierno de la Provincia de Buenos Aires. Dirigida por Alfredo J. Torcelli. Pp. 1042. (La Plata.) [64]

Osiris. Vol. 2, Part 2: Speech Consciousness among Egyptians and Babylonians. By Henry Frederick Lutz. Pp. 27. (Bruges: Saint Catherine Press, Ltd.) [64]

The Parliament of the Commonwealth of Australia. Ninth Annual Report of the Council for Scientific and Industrial Research for the Year ended 30th June 1935. Pp. 108. (Canberra: Government Printer.) 4s. 8d. [64]

Studja nad Bocianem Białym w Polsce (Studies on the Stork (*Ciconia ciconia* L.) in Poland.) 2: Bocian na Polskim Śląsku (The Stork in Polish Silesia). By Kazimierz Wodzicki. Pp. 20. 3: Bocian w Województwie Lwowskiem (The Stork in the Voivodeship of Lwów). By Kazimierz Wodzicki. Pp. 44. (Kraków: Państwowej Rady Ochrony Przyrody.) [74]

Państwowe Muzeum Archeologiczne. Wiadomości Archeologiczne, Odbitka z tomu 13: Studja nad Prehistorycznymi Psami Polski (Studien über vorgeschichtliche Hunde Polens). By Kazimierz Wodzicki. Pp. 74+7 plates. (Warszawa: Państwowe Muzeum Archeologiczne.) [74]

### Catalogues

Hortvet Cryscope. (Circular No. 277B.) Pp. 2. Chemical Products. (Pamphlet No. 287.) Pp. 4. Useful Laboratory Requisites. (Circular No. 304.) Pp. 2. Humidity Controlled Cabinet. (Circular No. 306.) Pp. 2. (London: A. Gallenkamp and Co., Ltd.)

Books on Botany, Gardens and Gardening, Forestry and Agriculture, with a section of Herbals. (Catalogue No. 599.) Pp. 34. (London: Francis Edwards, Ltd.)

Chemie, Physik. 14 Verzeichnis antiquarischer Bücher und Zeitschriften nebst Novitätenliste. Pp. 32. (Berlin: Verlag Zent, G.m.b.H.)