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## Location of Industry in Great Britain

THE astonishment and uneasiness with which the evidence given by the Board of Trade to the Royal Commission on the Geographical Distribution of the Industrial Population at its fourth meeting has been received is an indication of how far the old ideas of *laissez-faire* have been left behind. The policy of do-nothing which the Board apparently follows is as unsuited to the present day as it is inconsistent with the general tenor of the Government's active intervention for the promotion of industrial and social well-being. Already Government policy is influencing the location of industry in many indirect as well as direct ways. The making of the Great West Road out of London, the electricity 'grid', the transference of workers, and the housing subsidy are some of the means already used to direct the location of industry away from old to new industrial areas, and are sufficient in themselves to invalidate the complacent view put forward by the Board of Trade.

The whole problem is one to which scientific workers may well give their attention; and welcome evidence that they are doing so is afforded by the meeting recently devoted by the Institution of Chemical Engineers to the Special Areas of England and Wales, at which Mr. C. H. Boyd gave an account of some technical and economic aspects of the Commissioner's work.

Mr. Boyd's survey showed clearly the great progress which has been made in the Special Areas in improving the local services in co-operation with the local authorities and other similar bodies. Arrangements have been made in all the areas whereby the industrialist can be provided, by the trading estates companies in the north-east and in South Wales and by the Industrial Development

Company in West Cumberland, with up-to-date factories of standard type either on the trading estates themselves or by arrangement with the Commissioner in other parts of the areas. The new policy of industrial development is already showing encouraging results, and is assisted by the fact that the areas are now in a position to provide a much more attractive market for the new and lighter industries than they have been for some years.

If there is a defect in Mr. Boyd's paper, it is that, before a technical audience, he made no reference in an otherwise comprehensive bibliography to the admirable report on Science and Industry of the Joint Committee of the Local Sections of the Society of Chemical Industry, the Institute of Chemistry and the Chemical Society submitted to the District Commissioner in May 1935. This is the more regrettable because the preliminary step to the development of new industries must be research of this kind, and of the type undertaken by Prof. Marquand and his colleagues in South Wales—the application of scientific principles of industrial location to the facts of the distressed areas. We must know precisely what industries can be located profitably in the areas, and what industries can, in general, be located with equal success anywhere.

The improvement which has already taken place in the areas, and the fact that the manufacturer need no longer hesitate to try his fortune in them, should not lead us to overlook the fact that essentially recovery has revealed the bare bones of the problem. It is serious enough that more than 1,300,000 persons should be out of work at the height of prosperity. It is even more disturbing that the burden of unemployment should still

be heavily localized in the distressed areas. The major social problem persists in all the Special Areas. Their industries have in part been scaled down and rationalized, but their labour forces, amenities and facilities are still those designed for the old order when the markets of the world were open.

It is to this aspect of the question that Mr. Donald Tyerman directs attention in a trenchant article in *Lloyd's Bank Monthly Review*. Current conditions of recovery and rearmament have, for the time being, largely solved the cyclical problem. The special and more fundamental problems remain, intensified by the accumulation of derelict people and places, although the liquidation of the areas by scaling down and labour transference has commenced. Recovery in the Special Areas has in fact shown us that we must be prepared for distress at least as severe as ever in the next depression, or we must very considerably accelerate the development in them of new industries.

This is not to invalidate the solutions which are already being attempted: the maintenance of the maximum volume of staple exports by a liberal trade policy, and, if need be, by special aid, to reduce the difficulties of adjustment and liquidation to a minimum; the scaling down of equipment, capacity and labour forces to the maximum which can be employed in the staple industries, involving further extensive reorganization of the coal, cotton and iron and steel industries; and the mitigation of distress by curing, cleaning up and caring for human wastage, by special treat-

ment for aged unemployables and young untrained unemployed. These remain as essential, but the establishment of new industries requires much closer investigation than it has yet received.

It is natural to expect that the Royal Commission on industrial distribution will become acquainted with much of the data and proposals available. Armed with this knowledge, the Government, with the assistance of business men, industrialists and technicians, will be in a position to act. It will at least continue its policy of fixing a magnet in the Special Areas which will overcome such attractions of London and the south as are not based upon their essential requirements or on well-founded economic considerations. If, however, it is to go further by increasing the inducements to new industries in the distressed areas, by multiplying trading estates and increasing the moneys available to the Special Commissioners and the Special Areas Reconstruction Association and by guiding or controlling much more vigorously than hitherto the location of industry, it will need in increasing measure the co-operation of scientific workers. They must accept the responsibility for some measure of the basic work required. The position which many men of science now take in industrial leadership and development places upon them, individually and through their professional associations, the further responsibility for that informed, impartial and creative criticism which is of vital importance to a democratic Government.

## A Chemical Encyclopædia

### Thorpe's Dictionary of Applied Chemistry

By Prof. Jocelyn Field Thorpe and Dr. M. A. Whiteley. Fourth edition. Vol. 1: A—Bi. Pp. xxvii + 703. (London, New York and Toronto: Longmans, Green and Co., Ltd., 1937). 63s. net.

THE appearance of a new edition of "Thorpe" arouses mixed feelings. Chemists will welcome what they know will be a lucid exposition of the latest information regarding a host of chemical subjects, compiled by experts, but this welcome must be tempered by the fact that the authors state it will be nine years before the last volume

is to appear, and, since it is, unfortunately impracticable to draw up an index in advance it will be nine years before it is possible to ascertain with any facility what are the contents of the nine volumes. By that time, the present volume will be out of date and, presumably, steps will be taken to issue another edition; in other words, the "Dictionary of Applied Chemistry" is to become a periodical. This method of issue, no doubt simplifies the work of the publishers, and, possibly appeals to librarians who prefer to spread their slender monetary resources over a period of years but it does not yield the best type of book from the user's point of view.

The authors attempt to overcome the difficulty of obsolescence by stating that each substance will be dealt with twice over, once under its own initial letter and again in a general article, the later of the two being the more up to date. Apart from the undesirability of dealing with the same compound twice, all materials are not as accommodating as those mentioned in the preface. For example, in the present volume, "aconitine" has the misfortune to begin with the same letter as "alkaloid" and thus escapes revision.

In spite of the editors' assurance that a new edition is a necessity, some doubt may be felt on the matter. Great as has been the progress of science in the last ten years, the chemistry of 1927 is not obsolete; the old edition of the present work was and still is a most valuable book and a mine of information, but, apparently, it is to be regarded as non-existent, for, among the many hundreds of references, one that never seems to appear is "Dictionary of Applied Chemistry, 1927". Nearly every owner of the new edition is in possession of the old, and there are many subjects of no great general interest—for example, the alcoholometer readings used in different countries—for which a reference to the earlier edition should suffice. Then, as regards newness, a random selection of "anthracene" reveals the fact that about one-eighth of the article contains information obtained after 1927. The proportion for the whole volume is difficult to ascertain, but it would seem to be of this order. If this estimate is not far from the truth, a 'super-supplement' should be sufficient to include all new matter and this could be brought out in one or, perhaps, two years.

With regard to the contents, the first impression is that of a text-book of organic chemistry rather than of a dictionary of applied chemistry. This is, perhaps, due to the lavish provision of structural formulæ, the comparative scarcity of diagrams of plant and the almost complete absence of flow sheets. No one will deny the undesirability, and, indeed, the impossibility, of divorcing technical chemistry from its underlying fundamental principles, but it is manifestly impossible to cover the whole of modern chemistry, even in nine volumes, which implies that something must be left out. There is a great need for a really good reference book on applied chemistry in the English language, and little harm would be done if much of the purely theoretical matter in the present volume were omitted and more technical details were included. The former matter is readily found in journals; the latter is much more difficult of access, although, fortunately, not so difficult as in years gone by, when every process was regarded as secret. As an example, the space occupied by "atlantone" is almost exactly equal to that

devoted to the manufacture of absolute alcohol. Much of the organic matter may be criticized for its text-book style of presentation. It is an exception for yields to be mentioned, although it must be recognized by now that the yield obtained by a given process is not only of vital importance to the manufacturer, but is also of the utmost value in determining the mechanism of the reaction.

The article on "analysis" has disappeared, but there is a hint that this is to be replaced by one on "chemical analysis". It is questionable whether too much space has not been devoted to this subject. With the exception of certain valuable tables, the information given is usually insufficient to enable an analysis to be conducted and could be curtailed. An example of how this may be done is to be found under "Aluminium, detection and determination of"—a most admirable summary.

The general articles are of interest, but the desirability of including them is doubtful; bound together in a separate volume, they might appeal to many, but in their present association they are apt to be overlooked, particularly without an index. How many people requiring information on the weathering of paints would look for the word "ageing", and who would turn to a dictionary of applied chemistry for details of precision weighing? It is suggested that future volumes should give a list of these special articles with a brief indication of their contents. Incidentally, the author of the article "balance" mentions Aston's microbalance for gas densities, but does not refer to the far superior type of Whytlaw-Gray.

It is difficult to discuss individual articles. Of these, the most outstanding are "aluminium", "autoclave", "acetylene", "absorption" and "adsorption". A few omissions and errors have been noticed. The methods given for preparing esters of acetic acid are certainly not those of 1937, the azeotropic process not being mentioned. Austenite is dismissed in thirteen lines. The yield of acetic acid obtained by the distillation of wood is said not to vary greatly with the species of tree, a statement incorrect even for hard woods. The erroneous combination *carum ajowan* is given for the ajowan plant and ascribed to Bentham and Hooker, the correct name being *Trachyspermum Ammi* (Link) Sprague. Finally, the process of manufacture of the important pigment, antimony oxide, is not mentioned, while the conditions of interconversion of the two oxides are not made clear.

Minor defects such as these are unimportant when compared with the value of the book as a whole. If the subsequent volumes contain less of the laboratory and more of the works, their value will be still greater.

H. E. W.

## Academic Spiritualism

### (1) Some Cases of Prediction :

a Study. By Dame Edith Lyttelton. Pp. 160. (London : G. Bell and Sons, Ltd., 1937.) 2s. 6d. net.

### (2) Personality Survives Death

Messages from Sir William Barrett. Edited by his Wife. Pp. xlvi + 204. (London, New York and Toronto : Longmans, Green and Co., Ltd., 1937.) 7s. 6d. net.

### (3) The Superphysical :

a Review of the Evidence for Continued Existence, Reincarnation, and Mystical States of Consciousness. By Arthur W. Osborn. Pp. xvi + 350. (London : Ivor Nicholson and Watson, Ltd., 1937.) 12s. 6d. net.

WITHIN recent years, a distinct change in the character of spiritualistic propaganda has become discernible. A division is becoming apparent and, if we may be pardoned for using a current political expression, its exponents are becoming somewhat 'class-conscious'. The extent and crudity of the fraud now being practised both in Great Britain and in the United States have almost forced the more educated classes to eschew what is presented for the edification of their weaker brethren, and to build up something more in accordance with their own intellectual standards. Propaganda is to-day of a much more sophisticated type ; and the language of modern psychology and statistical method is supplanting the naïve descriptions of earlier years.

(1) Dame Edith Lyttelton, in her study of some cases of prediction, has written a disarming introduction to her collection, since she shows herself fully aware of the objections which are naturally aroused by her narrative. Passing from cases which she admits might be due to coincidence, she proceeds to more detailed instances which can, she thinks, only be understood if we assume what she calls "precognition". Yet on a careful reading of her records the student cannot fail to be assailed by the feeling that, even in the most detailed cases, a normal explanation would suffice were the facts more fully known and reported in a more strictly scientific spirit. Sometimes the central point of the story seems awry, as when a soldier was seen as in a vision with a scar over his left eye. The seer, in a letter to Dame Lyttelton, actually states that his friend did return from the Great War with a scar over his

left eye, whereas the fact was that the scar in question was under the right eye.

(2) From cases of prediction, premonition and extended telepathy, it is easy to consider messages from the dead, and Lady Barrett has thrown down the challenge boldly when she entitles her collection of communications purporting to come from the late Sir William Barrett, "Personality Survives Death". These messages, mainly delivered through the mediumship of Mrs. Osborne Leonard, are strikingly illustrative of the theory which regards the building up of the characters of the deceased personalities as due to the dramatic powers of the medium, who adopts histrionic poses the material for which may be derived either from normal sources or in some other and unknown way. Mingled with this material we find much more which is probably derived from the medium's own mental content, thus suggesting that the effort of sustaining a prolonged dramatization may be severe. However that may be, Lady Barrett appears satisfied that the communicator is really the person he purports to be ; and some of the trivialities and intimate details brought out at the sittings are certainly reminiscent of the late Sir William.

As a serious contribution to spiritualistic literature the book is clearly one which shows how much work remains to be done before we can hope to obtain any clear idea of the nature of the mental processes occurring with a reliable trance medium. Indeed such a task becomes more important when we turn to (3), Mr. A. W. Osborn's study on the "Superphysical", for it is here that we can discern the direction in which modern academic spiritualism is drifting.

In the introductory section to his book, Mr. Osborn discusses and analyses current scientific and psychological ideas, laying stress upon what ever, in his opinion, counteracts the influence of materialism. He then proceeds to pass in review the so-called supernormal phenomena of spiritualism and psychical research, in this part of his book displaying a singular lack of critical appreciation of the material with which he deals. Finally, he attempts to show that an acceptance of the facts alleged in the preceding sections, together with an understanding of the implications involved in the philosophic ideas advanced by certain modern physicists, necessarily lead the student to a fuller realization of mystical states of consciousness and thence to a new order of living.

It is here that we can see the link which is tending more and more to unite those who previously had but little interest in spiritualism regarded as a religion. The phenomena of prediction, the supernormal aspect of which is so sincerely sponsored by Dame Lyttelton, suggests the necessity for radical changes in our psychological approach to problems of human personality which, Lady Barrett assures us, survives death; whilst Mr. Osborn, accepting both

these claims, continues the work by pointing out how such facts lead to a new conception of life and death. Were the alleged facts, however, to be substantiated, it is doubtful whether their interpretation would tend in the direction indicated by Mr. Osborn; and it can scarcely be admitted that the fresh evidence now advanced by Dame Edith Lyttelton and Lady Barrett is more striking than much already printed elsewhere.

## Conservation of Wild Animal Life

### The Animal Year Book:

Vol. 4. Edited by Dr. H. E. Bargmann. Pp. vi + 174 + 10 plates. (University of the London Animal Welfare Society, 1937.) 2s. 6d.

ALL, surely, will agree with the contention, made in the preface to this review of the work accomplished by the University of London Animal Welfare Society during 1937, that "The progress of the movement for animal welfare, both at home and abroad, depends very largely on arousing the interest of the rising generation in its problems".

Two such problems of the very first importance are placed in the forefront of this review. The first, under the title, "The Tragedy of the Possum", reveals the appalling slaughter that has taken place of the common opossum (*Trichosaurus vulpecula*) to supply the insatiable demands of the fur-trade. Mr. David Stead, a well-known Australian naturalist, takes his evidence mainly from Government reports, hence he may be acquitted of bias, or of speaking without authority. Legislation for the protection of this animal now exists in all the States of Australia, but it has been of slow growth, though quickened by the statistics for the year 1919-20 when no less than 7,500,000 were sent to the markets. The attempt to curb this waste of life, made by the Governments in the form of 'close seasons', has proved ineffective, since animals killed during the close season in one area are sent into a neighbouring State to be passed out as the harvest of its open season!

Various subterfuges are resorted to for the purpose of justifying 'open seasons'. But it seems clear that unless the slaughter of this animal for trade purposes is prohibited altogether, its extinction in the very near future is assured. Mr. Stead points out that "Australia has a unique heritage for which it must accept responsibility", and continues, "Is it too much to hope that public opinion which urges that trusteeship of this fauna

shall become active and real, can supply the force to set the machine in effective and permanent motion?"

The second of these problems is ably set out by Mr. A. H. Kirkman. In concerns "Africa's Vanishing Fauna", and the alarming rate of the disappearance of the 'game animals' of Africa. The blaauwbok (*Hippotragus*) and the quagga have already vanished. Only a few skins in museums are left to tell us what they were like. Of the mountain zebra only two herds of twenty or twenty-five are known to exist, on farms, and these are being zealously guarded. The same is true of the bontebok, of which species two herds only, of forty-four and twenty-five respectively, now exist, and under private ownership. Of that extraordinarily interesting antelope the white-tailed gnu, it is estimated that no more than about three hundred remain of the hordes that existed before the advent of the Dutch settlers. The survival of the Cape hartebeest is now precarious, and the sable antelope is in danger of extinction. But we should like to know on what authority the statement is made that the elephant "still exists in several tens of thousands".

The difficulties which confront the game-wardens, where they exist, in the preservation of the animals of Africa in their respective areas of control are great. This is largely due to the fact that the natives now possess fire-arms. A further factor in this alarming progress of extermination is the slaughter carried on for the avowed purpose of exterminating the tsetse-fly and the carriers of sleeping-sickness. The annual report of the Southern Rhodesian Government for 1931 shows that during the year a grand total of 15,067 animals were slain in this effort to achieve the impossible. If, and when, the last of the 'big game' animals in the haunts of this fly is wiped out, sleeping-sickness will still remain, since the trypanosomes which cause the disease are carried

in the blood of numerous species of small mammals the extinction of which would be impossible. Those who wish to read the full story of this rapidly increasing march of destruction would do well to read Mr. Kirkman's admirable summary.

With the issue of the fourth volume of "The Animal Year Book", the editorship passes into

the efficient hands of Dr. Helene E. Bargmann. As is inevitable with a change of editorship of such a publication, this issue is largely occupied by the effort to clear up arrears of accepted matter. The new editor is to be congratulated upon having executed this difficult task with patience and discretion.

W. P. P.

## Polynesia through Many Eyes

### Religion and Social Organization in Central Polynesia

By Robert W. Williamson. Edited by Dr. Ralph Piddington. Pp. xxx + 340. (Cambridge: At the University Press, 1937.) 25s. net.

THE curiosity which Polynesia excited in the eighteenth and nineteenth centuries was not of the scientific kind which searches for facts on which to base generalizations; it was the curiosity of dilettantes. Explorers, sailors and missionaries did not pursue their inquiries to the point at which they would begin to demonstrate but cease to amuse, nor were they prepared to subject the blossoms of imagination to the icy blasts of scientific criticism. To entertain they had to be intelligible, and to be intelligible they had to transpose Polynesian customs into a European mode. The European mind was imbued from childhood with Greek mythology, so Williams arranged the Fijian gods into a pantheon on the Greek model, an arrangement more convenient than true.

Deification was familiar from the history of Rome, so Polynesian theology was reduced to deification. The Polynesian gods were supposed to be deified chiefs, and they were stated to be so as a fact. Now deification is a ceremony, and no such ceremony has ever been recorded in Polynesia, nor is there any word in the language which could by stretching its meaning be translated deification. The facts are that every deceased has power and so may become the object of a cult, which may or may not persist according as he proves effective or not. A dead chief has more power than a dead commoner, and so has a better chance of surviving in the memory of the people.

The distortion of the facts was still further increased when the naturalism of Greek mythologists was combined with misunderstandings of Roman religion. The French missionaries believed that in Mangareva "all the principal phenomena of nature were deified as good or evil spirits, according as they inspired hope or fear" (p. 26). That statement contains at least four theories: of deification, of emotion as the cause of deification,

of a theological dualism, of a hierarchy of phenomena. Every one of these theories requires to be supported with the evidence of facts, the fact being the actions and words of the Mangarevans but the good missionaries were there to convert heathens, not to prove theories; and they cannot be blamed for not even distinguishing between facts and theories. The anthropologist should know better, because it is his business to make distinction, without which science is impossible.

Mr. Williamson, however, was far too modest to distinguish when his masters had not done so. He was far too diffident and too kind to reject any of his witnesses. Equal weight is given to all, and if *X* asserts the opposite of *Y*, the contradiction does not seem to impair his faith (for example, p. 123). Mr. Williamson is more than impartial; he is neutral. The only witnesses that do not benefit by this neutrality are the natives. Wilkes, a passer-by, is allowed to depone as to the meaning of the Samoan word *atua*, but not the Samoans, though their evidence was recorded verbatim in *Man* in 1915 (p. 12).

This neutrality had been a tradition too long for Mr. Williamson to break away from it. He had patience, honesty, thoroughness and industry and a preference for safety. It was not safe to introduce into anthropology the distinction between the observed facts and the interpretation of those facts. It would have meant scrapping ruthlessly, as unfit for scientific consumption masses of travellers' tales, amateurish speculation, careless observations, misunderstandings and mis-translations and faults of memory which had been passed by generations of anthropologists. Mr. Williamson is not the only one who quailed at this sacrilege. Rivers is almost the only one who did not.

What Mr. Williamson had not the courage to do the reader will have to do for himself; he will have to sift the material. To do so he will probably find himself compelled to go to the original. Mr. Williamson has provided him with an exhaustive catalogue and a conscientious guide.

A. M. HOCART.

**Handbuch der Anorganischen Chemie**  
Herausgegeben von Prof. Dr. R. Abegg, Dr. Fr. Auerbach und Dr. I. Koppel. In 4 Bänden. Band 4, Abteilung 3: Die Elemente der achten Gruppe des periodischen Systems. Teil 4: Nickel und seine Verbindungen. Lief. 1. Herausgegeben von Dr. I. Koppel. Pp. xviii+827. (Leipzig: S. Hirzel, 1937.) 78 gold marks.

THE literature relating to any one of the chemical elements is now so great that scientific workers in general should be grateful for comprehensive works such as the volume under review, which save them much labour in their search through numerous and scattered original publications. In the English language we now have the recently completed "Comprehensive Treatise on Inorganic and Theoretical Chemistry" by J. W. Mellor which fulfils this need, whereas in German there is not only "Gmelin-Kraut's Handbuch der Anorganischen Chemie" and the handy "Lexikon der Anorganischen Verbindungen" of M. K. Hoffmann but also "Abeggs Handbuch der Anorganischen Chemie", of which the present volume constitutes a part.

The Abegg series of handbooks enjoys a well-deserved popularity as works of reference. This appreciation is due not only to the comprehensive nature of these volumes but also to the clarity and logical order of their subject matter. The present monograph on nickel maintains fully the high standard of the foregoing volumes, and is to be warmly recommended to all inquirers interested in this element, which is important for both technical and scientific reasons. Nearly one third of the 827 pages of this treatise is devoted to the preparation and properties of the metal, and about an equal amount of space is allotted to nickel compounds, including univalent, bivalent and trivalent derivatives, simple and complex salts, amminated derivatives and complex compounds with organic addenda. Other sections include data on the atomic weight of nickel, the physics of the nickel atom and the colloidal properties of the metal and certain of its derivatives. These topics are surveyed with all the thoroughness usually displayed in this series of treatises.

This volume, which is fully documented up to 1936 and printed clearly on durable paper, is largely free from errors. There are, however, two criticisms which the reviewer wishes to make. The first is the absence of an index. This omission is offset to some extent by a good table of contents at the beginning of the volume and by the orderly arrangement of the text, which follows closely the periodic arrangement of the elements. The second criticism relates to the high cost of the treatise, which at the existing rate of exchange places it beyond the reach of many chemists.

F. H. B.

#### Wide Horizons:

**Wanderings in Central Australia.** By Robert Henson Croll. Pp. xiv+158+27 plates. (Sydney and London: Angus and Robertson, Ltd., 1937.) 9s.6d. net.

MR. CROLL records impressions of Central Australia, which were gathered on four expeditions between

1929 and 1934. He witnessed both the effects of a seven years drought and the rejuvenation of the country and its animal and vegetable life after the rains. The contrast is strikingly portrayed, though, not unnaturally, the narrative stresses the aridity of the dry period. The author conveys to his readers the charm and beauty of the landscape as effectually as he impresses upon them the vastness of its spaces. He is an enthusiast on the economic possibilities of the country, given a water supply and a market such as a newly discovered gold-field might afford.

The concluding chapters deal with the problem of the aboriginal and the half-caste. Here the indictment of the Australian people is mainly in the form of a statement of fact, and is temperate in language. It is all the more telling for that. While recognizing the beneficent work of the missionaries, he holds that humanitarian measures have been no less a failure in the long run than neglect; and that what is needed is a drastic change in method, liberal expenditure in money, and Federal control (see NATURE, Dec. 18, p. 1029).

#### Duše Rostlin (The Soul of Plants)

By Prof. B. Němec. Pp. 234+16 plates. (Prague: Nakladatelství Pražské Akciové Tiskárny, 1937.) 29 crowns.

PROF. Němec, the distinguished Czechoslovak plant physiologist, has written an absorbing survey of the plant kingdom under the title "The Soul of Plants". Writing for men of science in general, he describes plant-life, the evolution of higher forms, the struggle for existence and the purposefulness of their life-cycles. There is a particularly striking chapter, "Death rules the Living", which gives a vivid idea of the contributory causes for the 600,000 plant species and of the genetics of the 'miracle of inheritance', the sources of variation, genes and the ways in which plant posterity is ensured.

It is to be hoped that an English edition of this work will appear, so that Prof. Němec's views may reach a wider circle of readers.

#### Biological Laboratory Technique:

an Introduction to Research in Embryology, Cytology and Histology. By Prof. J. Bronté Gatenby. Pp. vii+130. (London: J. and A. Churchill, Ltd., 1937.) 7s. 6d.

THIS book gives a short introduction to recent methods in microtomy, many of the methods being adapted for the smear technique which does not require section cutting. It is a useful and compact summary for amateurs who do not have an elaborate equipment and for university students and teachers desiring an introduction to the most recent practices. In addition to a statement about apparatus, the treatment of living cells and vital staining, there are sections on smear methods, fixation, embedding in paraffin, dioxan, *n*-butyl alcohol and celloidin. A chapter on staining is followed by notes on methods in histology and embryology.

## Apparent Enlargement of the Sun at the time of Rising and Setting

By Dr. Vaughan Cornish

IT is a matter of common observation that when the sun is nearly on a level with the eye and is in the vicinity of the horizon its apparent size

ment, or any intention of subsequent measurement, but from known angular magnitudes of terrestrial features were afterwards ascertained from the map.

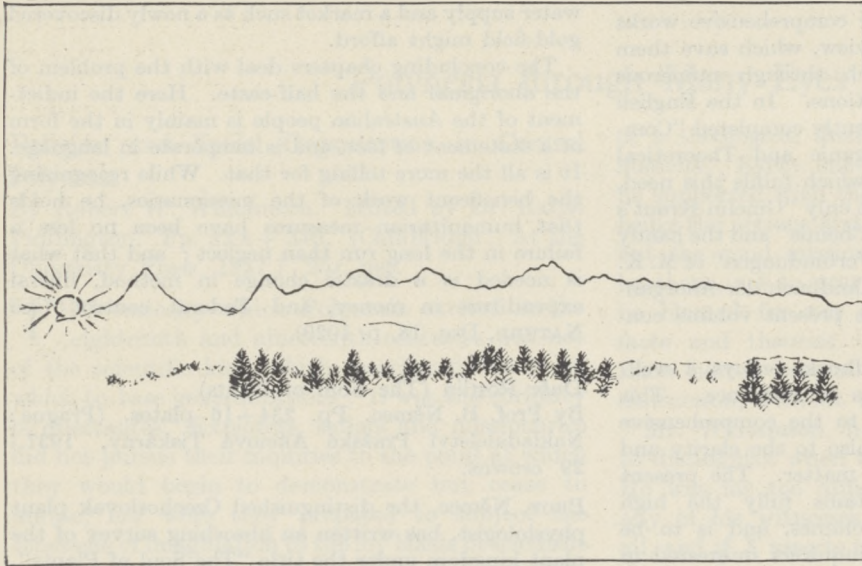


Fig. 1.

THE RISING SUN FROM BERN

is greater than when high up in the sky. It is generally assumed that this is due to the circumstance that the features of the skyline provide a true standard of instinctive comparison which enables the eye to appreciate the angle subtended by the sun's disk. It is true that the linear magnitude of the terrestrial features is fairly well known and that the tone and other qualities of the horizon give an instinctive impression of its distance. The current explanation breaks down, however, under the test of actual measurement of the apparent magnitudes. These measurements are trustworthy only if made by an indirect method which sidetracks the critical faculty, for as soon as thought comes into play, the spontaneous impression of magnitude is impaired. The measurements in question have been made from a number of sketches which I have made during the last forty years, all drawn originally without measure-

ment, or any intention of subsequent measurement, but from known angular magnitudes of terrestrial features were afterwards ascertained from the map. I found that the apparent magnitude in the more

The sun seen from Bern rising above the Bernese Alps forty miles away, measured 0.16 inch on a 7-inch page. As seen from Grindelwald the sun rising above the Wetterhorn four miles away measured only 0.9 inch on a 7-inch page. These measurements seem at first to confirm the expectation that the sun would be apparently enlarged in proportion to the diminution of terrestrial features by greater distance. When, however, I measured the mountains in the two drawings and compared

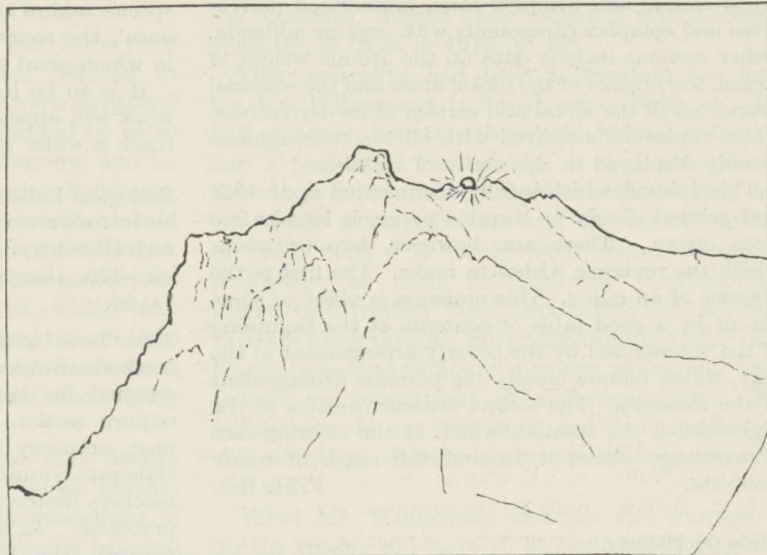


Fig. 2.

THE RISING SUN FROM GRINDELWALD

distant view was not reduced proportionately to the distance, but on the contrary was subjectively



magnified. The arc of horizon comprised in the sketch made at Grindelwald was  $34^\circ$ ; that from Bern,  $21^\circ$ . Thus the subjective enlargement of the mountains seen from Bern was 1.6, that of the sun being 1.7, which for this class of observation is practically identical.

Following up this clue, I measured drawings of the arc of the horizon included in a page of my sketch-book when drawing the long line of comparatively low hills on the west of Bournemouth Bay, and the lofty mountains enclosing the valley of Lauterbrunnen. I found that whereas the impression of lateral extent received in the former case was the greater, the arc of the horizon comprised in the panoramic sketch was much less, that is, the eye was sooner satisfied when it had to deal mainly with one dimension.

Referring again to the small apparent size of the sun when rising above a crest-line something like  $20^\circ$  above the line of sight, that is, above the Wetterhorn seen from Grindelwald, it will be noted that the features of the view are not strung out in a narrow horizontal band as when the range of which the Wetterhorn is a member is

viewed from Bern forty miles away. It seems, therefore, that the more the eye takes in vertically the more it takes in horizontally and the less imposing are both dimensions.

These indications led to an interesting result on measuring drawings which comprised the peaks of Eiger and Mönch seen from Gurten-Kulm and from Kleine Scheidegg, distant respectively about 37 and  $2\frac{1}{2}$  miles. From the former position, the arc of the horizon in the page of the sketch-book was  $18\frac{1}{2}^\circ$ ; in the latter  $60\frac{1}{2}^\circ$ . The peaks seen from Kleine Scheidegg stood about  $26^\circ$ – $27^\circ$  above the line of sight. These measurements explain the familiar sense of disappointment experienced on near approach to mountain peaks the great magnitude of which has impressed the mind when viewed from a distance. As we approach the mountain the field of attention steadily expands without, however, any warning sensation in the eye. Our field of attention varies according to circumstances and the mind transfers the change of magnitude to the objects in the field, but in the reversed sense, an actual restriction of the field being accompanied by apparent enlargement of the objects viewed.

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## Expedition to Baffin Bay, 1937

**A**N expedition, led by J. M. Wordie of St. John's College, Cambridge, has returned from a three months voyage to Davis Strait and Baffin Bay. The party, ten in number, had as its main objectives the geology and archæology of Ellesmere Land and the investigation of the upper atmosphere by free balloons. The Norwegian motor-sealing vessel *Isbjørn*, of Tromsø, 172 tons, carrying a crew of twelve, was specially chartered for the expedition, and sailed from Leith on June 27, returning on October 1. H. Carmichael and E. G. Dymond, who was assisted by I. M. Hunter, made cosmic ray investigations with high-altitude balloons near the magnetic pole. Eskimo anthropology and archæology were studied by T. C. Lethbridge and T. T. Paterson, assisted by R. W. Feachem and D. Leaf; geology, petrology and physiography by Paterson, H. I. Drever and A. H. Robin; and botany by Feachem.

The year was exceptional in that no ice was met with in Melville Bay, and the ship was able to proceed as far north as Bache Peninsula in Ellesmere Land without ice hindrance; the Middle Pack, which usually occupies the west side of Baffin Bay, and is fed from Smith Sound and

Lancaster Sound, was nowhere seen. This lack of ice, though it gave unusual opportunities for archæological work and geographical exploration, had the disadvantage that no large floes were available out at sea as launching grounds for balloon flights, and cosmic ray work was therefore confined to the West Greenland coast.

The cosmic ray experiments involved the measurement of the intensity of the radiation at great altitudes in the polar atmosphere, and instruments were conveyed to heights of more than 25 km. by free balloons, utilizing the methods of Prof. E. Regener of Stuttgart. Two types of apparatus were used, one designed and constructed by Carmichael in the Cavendish Laboratory, Cambridge, consisting of a pressure ionization chamber and electrometer with photographic recording of the ionization, pressure and temperature, and the other, by Dymond in Edinburgh and J. A. Ratchiffe in Cambridge, a triple-coincidence counting set with wireless transmission of the counts and the barometric pressure. In addition, the intensity of the cosmic rays at sea-level was recorded by two ionization instruments, one lent to the expedition by Regener and Hoerlin,

the other by Millikan and Neher. Two flights with Carmichael apparatus were made and four with Dymond apparatus. Both the Carmichael instruments were recovered with their photographic records, and coincidences were counted to considerable altitudes on three of the Dymond flights. One Dymond apparatus to which a recording Bosch meteorograph had been attached was also recovered.

To test wind conditions, pilot balloons were released on every possible occasion, balloons of larger type than usual being used so as to obtain a rapid ascent to great heights. The rate of ascent, about 21 km. per hour, was reliably determined

particular attention being given to work at Turnstone Beach, Buchanan Bay, Ellesmere Land and at Cape Hardy (Cape Sparbo), North Devon. They have brought back a very fine collection which far exceeds any previously made in this part of Arctic Canada, and which it is hoped will determine the early material culture of the Eskimo who crossed Smith Sound into Greenland about twelve hundred years ago.

The geological results were also very satisfactory. In West Greenland, north of Disko Island, sills and dykes were discovered, traversing the Tertiary basalt lavas and showing a differentiated series with banded gabbros and allied rocks, recalling the Tertiary material found by Wager and Deer at Kangerdluak, East Greenland, in 1935-36. The Thule sediments of North-west Greenland were traced into Ellesmere Land and found to pass conformably upwards into Lower Cambrian rocks with a trilobite and brachiopod fauna. This series was also found as far south as Jones Sound, proving a greater extension into Canada than was hitherto suspected.

On the return voyage, unexpected geographical discoveries were made in North-east Baffin Land, which was found to be a region of long fjords penetrating a glaciated mountain area south-westwards into hill country of low relief. This region was probably familiar in part to Dundee whalers last century, but its extent and variety were quite unexpected. New fjords and islands were discovered, and of the fjords six are 40-60 miles in length, while there are



BAFFIN BAY EXPEDITION, 1937. ROUTE SHOWN BY DOTTED LINE.

by synchronized observations with Watts 3½ in. theodolites from the ends of bases of about one mile. In all, twenty-eight pilot balloons were flown, and nineteen were followed to their bursting points, reached from one to one and a half hours after release. The still larger balloons, with apparatus, ascended more slowly and were in the air for three to four hours. The balloon work showed that, in general, during this particular summer, the air near Greenland was remarkably still above 20 km. and that, even up to that height, high-velocity winds were rare. On occasions, balloons ascended almost vertically to their greatest heights. The whole personnel of the expedition assisted in launching and observing the balloons.

The archæologists excavated numerous Eskimo ruins in Ellesmere land and North Devon,

many others of shorter extent. The fjords themselves are steep, with mountain walls 2,000-2,500 feet in height. By contrast, the land beyond is open and not unlike Scottish moorland country, and at one time must have carried a plentiful reindeer stock.

A running survey was made of the new land, using sextant and range-finder methods with the ship's course as base, and in this way more than 600 miles of new coast-line were successfully mapped. The work had to be done quickly late in the season, and was carried out by the entire party led by Paterson, who selected this method as being the best in view of the limited time available, the persistent low clouds on the mountains, and the sluggishness of the compass near the magnetic pole.

## The Standard of Anglo-Saxon Silver Pennies

By Ernest A. Smith

THE Department of Coins of the British Museum was considerably enriched some time ago by the valuable collection of Early English coins, bequeathed by the late Mr. T. G. Barnett, of Birmingham, which includes some five hundred silver pennies of various Anglo-Saxon kingdoms. These begin with a series of Mercia, including fine portrait coins of Offa (A.D. 758-796) of workmanship unrivalled until the reign of Henry VII, and the still rarer portrait coin of his queen Cynethryth, the only queen to appear on coins until Mary Tudor. In describing this collection, Mr. J. Allen<sup>1</sup>, keeper of the Coin Department, points out that "the historical value of the Anglo-Saxon coinage lies in the fact that it records rulers otherwise unknown, illustrates by its mints the rise and fall of Kingdoms, and particularly well illustrates the struggle with the Vikings and Danes".

Apart, however, from their undoubted historical value, the large number of Anglo-Saxon pennies included in the collection is of special interest as, incidentally, it raises afresh the question of the fineness of the silver coinage used at that period, as Anglo-Saxon and Anglo-Norman coins are believed to have been made of the same alloy as that now known as sterling silver. This contains 92.5 per cent of silver, and has been the legalized standard for the silver coinage and the manufacture of silver wares in Great Britain for a period now extending well over six hundred years.

This being so, it will not be without interest to consider briefly the available evidence in support of this belief, especially as there appears to be no lack of suitable material with which to confirm it.

During the past fifty or more years, very considerable numbers of Anglo-Saxon silver pennies have been brought to light by the spade. This is perhaps not surprising when we recall that "the increase of mints inaugurated by Aethelred II (866-871) was continued to the end of the Anglo-Saxon period, during all of which time there was a great output of coins, and throughout a general uniformity of style and fabric" (Gueber). A wonderful find was made as early as 1840, at Preston, when a leaden chest was discovered containing no less than 10,000 silver coins, and nearly 1,000 ounces of silver ingots. It is thought to have been the treasure chest of the Danes who were defeated there in 911. Two years earlier, in 1838, some 550 coins were dug up at Gravesend, Kent; and in more recent years smaller lots have been brought to light from time to time. Doubtless

some of these eventually found their way into the melting pot, but in spite of this, many excellent specimens of Anglo-Saxon coins and silver ware are to be found in the British Museum and other museums of the country. It would appear, however, that up to the present, very few of these coins have been subjected to chemical analysis in order to determine their composition, a method of investigation that is now taking such a prominent place in all modern archaeological research. Such few analyses as have been published seem to indicate that the composition aimed at by the Anglo-Saxon coiners was of the nature of a definite standard, which corresponded more or less to the sterling silver of more modern times. Thus, a few coins issued before the Norman Conquest, assayed by the late Sir W. C. Roberts-Austen<sup>2</sup>, chemist of the Royal Mint, gave the following results in regard to silver content. A coin of Burgred, King of Mercia (A.D. 852-874) contained only 33.2 per cent of silver, whilst one of Ethelred (A.D. 978-1016) was found to contain 91.84 per cent of silver, and was probably intended to represent the old standard of England, 92.5 per cent. A coin of Canute (A.D. 1016-1035) proved to be of the standard 93.1 per cent silver, and Roberts-Austen considered was clearly intended to represent the old standard. A coin of William the Conqueror was found to contain 92.3 per cent of silver, and was therefore of sterling quality. Unfortunately, no analyses of Anglo-Saxon silver wares appear to have been made, or if made, have not been published.

At first sight there may not appear to be very much agreement between the figures quoted, but in considering these compositions, it must not be overlooked that the early silver melters were not conversant with the scientific casting technique adopted at the present time to ensure uniformity of composition. Also they had no knowledge of the segregation that invariably takes place when silver-copper alloys solidify, and gives rise to irregularities of composition.

In regard to the adoption of this somewhat peculiar silver standard, Roberts-Austen has pointed out that, in the case of both the gold and silver currency of Great Britain, the adjustment of the relative proportions of the precious and the base metals was undoubtedly guided by the particular system of weights used. In the case of the silver coinage, the fineness of alloys of this metal has from very early times been computed by divisions of the troy pound, which is said to have

been derived from the Roman weight of 5759·2 grains, the 125th part of the large Alexandrian talent, this weight, like the troy pound, having been divided by the Romans into twelve ounces.

There seems to be little doubt, therefore, that there is a distinct connexion between Roman and modern coins and plate, which suggests that the sterling silver was most probably introduced by the Roman coiners. Both Roman and Anglo-Saxon coins and silver wares were undoubtedly made from silver obtained from argentiferous lead by the cupellation process, to which more or less copper was intentionally added to give greater hardness to the metal to enable it better to withstand wear. That the Romans were skilful in conducting the cupellation process is proved by the high percentage of silver contained in many of their earlier issues of coins for which this silver was employed. Gowland<sup>3</sup> has shown that the coins of the Romans, especially during the periods of the Republic, and the Empire up to the time of Nero, and again, with a few exceptions from Constantine to Justinian, frequently contained 98-99 per cent of silver. Much lower percentages, as for example 95 and less, indicate the intentional addition of copper. Some Roman silver coins of the first three centuries, found at Baden-Baden in 1825, when analysed showed a silver content varying from 91·3 down to as low as 50·5 per cent silver. Some of the higher quality coins had the following percentages of silver :

Tragan	(A.D. 98-117)	89	per cent silver
Hadrian	(A.D. 117-138)	88·25	"
Antoninus Pius	(A.D. 138-161)	91·3	"

A coin of the Triumvir Antoninus (31 B.C.) had almost the same composition as British silver coins, as it contained 92·5 per cent of silver, and 7·1 per cent of copper, the remainder being gold and lead.

The differences shown in these figures are no doubt partly accounted for by the fact that the Romans adopted the method of casting their coins for the sake of cheapness and speed, and in consequence greater irregularities in composition are to be expected than in coins cut from sheet metal.

In this connexion also the assays of Roman silver objects in the British Museum, made by Gowland<sup>3</sup>, are of considerable interest. They gave the following percentages of silver : Spoon, 95·64 ; dish, 94·30 ; dish, 92·50 ; rim of vessel, 95·52 ; bottom of another vessel, 94·90 ; pateas, 95·15 ; large dish, 95·09.

As Gowland remarks, "in these assays the proportion of silver present ranges from 92·5 to 95·6 per cent, which would almost seem to indicate that this composition was aimed at by the Romans for what may be termed silver plate, and was of the nature of a definite standard."

The above data are of extreme interest, and although few in number, and not conclusive, they are sufficient to indicate without much doubt that the origin of sterling silver belongs to a much more remote date than is generally supposed. It is a common belief that the introduction of sterling silver dates only from 1300, when it was first legalized as the quality of silver to be used for silversmiths' work. But in the earliest known accounts in which the standard of fineness is mentioned, it is always spoken of as the 'old standard of England', or as 'Easterling silver', thus showing that it had been in use for a considerable time prior to the passing of the Act. As already stated, the coinage of William the Conqueror was of this standard, which may therefore be said to have been in existence, without much interruption, from that time until the present day. Here it may be stated that opinions differ as to the origin of the term sterling, but the explanation found in the oldest records, and now very generally accepted, is that it is derived from the Germans, who were termed Easterlings by the English, from the fact that they lived 'eastward'. The money made by the German coiners was famous throughout Europe for its good quality, and it is said that German melters were fetched over in the twelfth century to improve the British coinage which at that time had become somewhat debased. The coins made by these melters was termed Easterlings money by the English, but in the course of years, with the propensity for clipping long words, the first two letters were eventually dropped, and thus the alloy became known as sterling silver.

There is little doubt that silver of sterling standard was also used at a very early date for the production of silver wares, and it was only when fraudulent practices increased in their production that it was legalized to protect the honest craftsman and public alike.

The question of its origin is one of more than passing interest, as it concerns an alloy which is produced in considerable quantities annually, and has long been accepted as the most suitable standard for silversmiths' work not only in this country but also in America and elsewhere.

Now that the importance and value of chemical analysis as an indispensable aid to archaeological research is being more generally recognized, it is to be hoped that further analyses of Anglo-Saxon coins and silver objects will be made, so that fresh light may be thrown on this interesting question.

<sup>1</sup> *Brit. Mus. Quart.*, 10, 124 (March, 1936).

<sup>2</sup> Cantor Lectures on "Alloys used for Coinage", Roberts-Austen, *J. Roy. Soc. Arts* (1884).

<sup>3</sup> "The Metals in Antiquity", W. Gowland. Royal Anthropological Institute of Great Britain and Ireland. 1912.

## Obituary Notices

Prof. Arthur Hutchinson, O.B.E., F.R.S.

IN the death of Arthur Hutchinson, emeritus professor of mineralogy in the University of Cambridge, and lately master of Pembroke, the science of mineralogy has lost an able exponent and investigator. His distinguished services to his Department, first as demonstrator and lecturer and finally as professor, extended over a period of thirty-six years. His loss is a heavy blow to his profession, his University, and his friends.

That which Hutchinson accomplished during his scientific life divides naturally into two parts, the results of his investigations and his work as a teacher of mineralogy. His first piece of crystallographic research was carried out while he was still a scholar at Christ's College. Afterwards he studied under Emil Fischer at Würzburg. His accomplishments in the field of analytical chemistry are seen in his early work on the mineral stokesite, which he discovered and described. His analysis of this unique and only known tin silicate and the derivation of its formula was performed upon a minute fragment of the only single crystal that has yet been found.

Hutchinson established the chemical formula of the mineral lengenbachite and with A. M. Macgregor he gave a complete account of the composition and optical constants of another new mineral—cornetite. Hutchinsonite, a rare thallium mineral from the Binnenthal, was named in his honour.

Much time and thought was given by Hutchinson to the graphical treatment of problems in crystallography and crystal optics, and we owe to him the stereographic protractor and a crystallographic slide rule, instruments by means of which laborious calculations may be checked or avoided and the problems accurately solved by graphical methods. Later he showed how his stereographic protractor could be adapted to the rapid indexing of the spots of a Laue crystal photograph. In the field of crystal optics Hutchinson's memoirs on the diathermancy of antimonite are pioneer investigations. Introducing a new method of attack on crystallographic problems, he made an accurate determination of the refractive indices and dispersion of this opaque rhombic mineral for wave-lengths at the extreme red end of the visible spectrum. In these investigations Hutchinson's skill and resource as an experimenter are seen at their height.

Hutchinson excelled as a teacher and he gave unremitting thought and attention to improving the material equipment for his lectures. He constructed with great skill and ingenuity many large crystal models and other apparatus for use in elementary instruction. During the latter part of his career, he devoted much time and energy in the vacations to the care of the large mineral collection, which now became of increasing service in teaching and research.

His genial personality and great capacity for friendship endeared Hutchinson to his colleagues and old

students alike, and the expression of their devotion was signally evoked in the large and representative gathering which assembled to honour him by the presentation of his portrait on the occasion of his retirement from the chair in 1931. He was elected a fellow of the Royal Society in 1922; he also served as president of the Mineralogical Society (1921–24), of which at the time of his death he was foreign secretary.

The period of Hutchinson's professorship (1926–31) coincided with a time of intense activity in research in X-ray crystallography, and he devoted much of his energies towards the organization of his Department to meet the needs both in teaching and research of this rapidly developing branch of his subject. To this time of his tenure belongs the creation of a special lectureship at Cambridge in structural crystallography, and the establishment of a laboratory of crystal physics. These developments foreshadowed the ultimate reorganization of the subject of mineralogy in the Natural Sciences Tripos. The well-equipped new building for mineralogy erected in 1933, and the crystallographic research laboratory, stand as memorials of his life and work.

WE regret to record the death at Warsaw of Dr. Pawal Łada, a young Polish geneticist, who was working in the School of Agronomy of the University of Crakow, in July last, aged forty years. He had made intensive studies of rye and was seeking to produce a variety having six rows of seeds instead of the usual four. He had also studied a disease known as 'brittleness' in rye and showed that it is really a genetic character unaffected by environmental conditions; in his breeding experiments it behaved as a simple Mendelian recessive. He discovered no character of the seed correlated with brittleness, so was unable to find a way of discarding seeds subject to this trouble. As part of his technique he carried out his experiments in special nurseries located in an area of woodland remote from cultivation, so that his plants could be shielded from cross-fertilization from outside sources. Łada was a native of the Ukraine, but he settled in Poland as a refugee, and in his researches he was assisted by his wife, who had been also a fellow student. There was a freshness of outlook and ingenuity in his methods of experiment that promised well for his future had he lived.

WE regret to announce the following deaths:

Dr. N. Gustaf Dalén, inventor of automatic regulators for use in conjunction with gas accumulators for lighting lighthouses and light buoys, for which he received the Nobel Prize in Physics in 1912, on December 10, aged sixty-eight years.

Prof. G. H. F. Nuttall, F.R.S., emeritus professor of biology in the University of Cambridge, on December 10, aged seventy-four years.

## News and Views

### The National Institute of Industrial Psychology

IN his speech at the annual general meeting of the National Institute of Industrial Psychology held on December 16, Lord Dudley, president of the Institute, referred to the ever-widening field of its work. This was particularly shown in the investigations of environmental conditions in schools. The vocational guidance department has had more demands for assistance in the choice of a career than ever before, the figures for the year being 1278, an increase of 17.5 per cent on those of the previous year. In its industrial investigations, the Institute offers a service to industry which it endeavours to make as complete as possible. While all the Institute's work is approached from a psychological point of view, the part which pure psychology plays varies from branch to branch. Devising selection tests, for example, and finding and ameliorating staff grievances depend almost entirely on psychological considerations. On the other hand, problems of heating and ventilation, of lighting and of movement study, involve largely physiological considerations. Sir John Keane, chairman of the Institute, said that alterations and additions have been made to the Institute's premises, but that there is an urgent need of new accommodation. In speaking of new developments, Sir John referred particularly to the promising start that has been made in the north-western area by the Institute's new branch office in Manchester. It is hoped, he said, to develop in other areas regional sections for membership which might lead to the formation of further branch offices. It is also hoped that in the future the Institute's advisory service on the heating, lighting, and ventilation of schools will be extended to hospitals.

### Science and Social Service

IN his address on "Science and Social Service" given to members of the National Institute of Industrial Psychology at the annual general meeting, Sir Richard Gregory stressed the urgent need of the application of scientific method to social and international problems. Although scientific discoveries may be prostituted in the cause of war, it must be acknowledged that the advance of science has on the whole led to an enormous alleviation of human suffering and an increase in the capacity and facilities for happiness. As science is responsible for the industrial developments and economic changes which have caused violent disturbances in our social structure and provided also the means by which civilization may commit suicide, it has a duty to guide the human race in the wise use of the powers it has created. The personal and group loyalties of men, their fears, ideals, passions and ambitions all

lend themselves to scientific study with the view of providing a basis for effective social action. It is fashionable at the present time to blame the machine for the mechanization of life. To do this is to make the fundamental mistake of regarding the machine as the master and not the servant of society, and to forget that the most regrettable results of industrialization are not for the most part the direct fault of technological progress, but of lack of consideration for human needs. One of the prime needs of the present time is the development of research in the social and biological sciences on a scale commensurate with that of the physical sciences. The principal aim of any such studies should be to increase the comfort and promote the intelligence of the worker in order to combat the evils due to conditions arising out of mechanization in industry. Most of the work of the National Institute of Industrial Psychology is designed to this end, and is thus assisting in the adjustment of society to the changes caused by technical development.

### New Buildings for the University of London

AN important modification of the building plans of the University of London on the Bloomsbury site is announced. Mr. Charles Holden's original model published in 1932 proposed a building nearly a quarter of a mile long with two towers and long façades on Malet Street and Woburn Square. This was afterwards modified by the introduction of two bays on the Malet Street frontage. The design received almost complete commendation from the lay and professional Press. *NATURE* in an article by "T. L. H." published in the issue of July 9, 1932, was the first journal to express misgiving. "Questions of style apart," it was suggested, "air, sunlight, and accessibility are crucial in considering the design. Is it wise, from these viewpoints, to build a single huge building, possibly the largest in London, a break-air, if the word may be coined?" Attention was directed to the difficulty of ventilating a large building and the plea put forward "that the idea of a single great building should be abandoned and an alternative design adopted treating the problem in a more free and characteristic way". This policy has now been officially adopted and a group of buildings surrounding the garden of Torrington Square will be substituted for the northern part of the site. Sites have been offered to Birkbeck College and the School of Oriental Studies. Birkbeck College has in recent years greatly developed its work in scientific teaching and research, particularly for evening students, and will presumably require large laboratories, lecture theatres and other accommodation.

### The Metric System and British Export Trade

PRESIDING at a lecture by the Rev. A. J. Stubbs, vice-chairman of the Decimal Association, at the Institute of Export on December 14, Sir Isidore Salmon, M.P., declared that British industry could save large sums of money internally, and increase international trade by millions of pounds a year, if Britain cared to adopt the metric system. "It is unbelievable," he said, "that our own Government has virtually ignored the decimal and metric systems, which are employed by every one of our foreign competitors and many of our Colonies and Dominions. We should in our own interest do all we can to bring before the Government the urgent necessity of appointing a committee to inquire into the whole question." Mr. Stubbs, who before he was ordained, was an electrical and civil engineer, said that of our oversea trade, 64 per cent went to decimalized coinage countries, including about one third of our British oversea markets. The importance of the metric system was also plain, he said, when it was realized that for export purposes we had to manufacture different sizes of machined products, other goods or cartons, and effect intricate internal calculations. It might be said that, to improve export trade, our first duty was to adopt the metric system with its internationally agreed and unalterable values. Mr. Stubbs mentioned that among the influential supporters of a British metric system and decimal coinage were the British Chamber of Commerce, the International Chamber of Commerce, the Federation of British Industries, the Trade Union Congress General Council and the National Association of Head Teachers.

### History of Science

THE October number of the *Annals of Science*, a quarterly journal dealing with the history of science, published by Messrs. Taylor and Francis, contains some papers of unusual interest. Prof. J. R. Partington and Dr. D. McKie contribute the first part of their historical studies on the phlogiston theory, dealing with the levity of phlogiston. This theory had a most important influence on the development of chemistry, yet its history is in many ways defective. Prof. Partington and Dr. McKie have made a very detailed and thorough study of the original sources, and show how the idea of the levity of phlogiston developed and what forms it took during the second half of the eighteenth century. Particular attention is given to the views of Guyton de Morveau, a portrait of whom is prefixed to the issue of the *Annals*. Prof. Marjorie Nicolson and Prof. Nora M. Mohler contribute a very interesting study of Swift's "Voyage to Laputa", in which they show how carefully Swift read the contemporary scientific literature and how skilfully he was able to make use of it in his own writings. There are also interesting papers on views concerning the nature of heat and cold, on aqueous vapour and evaporation, on the teaching of the history of science in a women's college in America, and on the Chemical Society of Glasgow.

### Early Astronomical Instruments at Oxford

ALTHOUGH a manuscript of 1697 in the Bodleian Library has provided an inventory of the instruments belonging to the early Savilian professors, it is only quite recently that certain of these instruments were discovered to be still in existence and within the walls of the University Observatory itself. In the *Observatory* of July, p. 190, Dr. R. T. Gunther describes four instruments which have been re-assembled from "certain old metal bars and plates" found behind some cases in the University Observatory and brought to the notice of Dr. Gunther by Prof. H. H. Plaskett. These newly discovered instruments are: (1) a 14-in. astrolabe made by Thomas Gemini in 1559 for Queen Elizabeth; (2) a mural quadrant of 6 ft. 9 in. radius made in 1637 by Elias Allen; (3) a 6-ft. iron sextant with brass limb, to be attributed possibly to Elias Allen; and (4) an equatorial quadrant of 2-ft. radius of which the maker is uncertain. In describing these interesting instruments, Dr. Gunther directs attention to the high excellence of Allen's work as instanced by the mural quadrant of 1637, which he divided to give direct readings to 2' and, by means of a diagonal scale, to 12". It is suggested that these instruments were installed by Bainbridge, the first Savilian professor, on whose death they passed as his private property to his successor, John Greaves; in 1659, seven years after the death of John Greaves, the instruments appear to have been given to Oxford by his brother, Nicolas Greaves, in memory of the first two Savilian professors.

### Grass Drying

THE development of grass drying since 1927 was discussed by Dr. R. E. Slade in a lecture given to the Institution of Chemical Engineers on December 17. Progress has been remarkable and further advance depends on reducing capital and running costs, designing a plant suitable for small farmers, and improving management so as to ensure a continuous and reasonably steady supply of grass during the growing season. The best plants to-day, said Dr. Slade, can produce high-protein dried grass at an overall cost of £5 a ton, including obsolescence, and this cost compares favourably with that of feeding cakes at the present time. Dr. Slade has recently been experimenting with a simple, inexpensive dryer, workable by one man and suitable for a farm with 50-100 acres of grassland. A single fixed tray, 15 ft. long, 7 ft. wide, with a deep bed of 2½ ft., is charged with grass to a depth of 2 ft. The grass is held down with a hurdle, covered with Hessian, and heated by furnace gases at 120° C. for 1½ hours; it shrinks 10-12 inches, more grass is added, and the heating is repeated for a like time. The grass, now nearly dry, is teded and then heated again for 45 minutes. The average air-cycle efficiency during the 4 hours' heating is 76 per cent, and the weight of water evaporated, in a two-day test, was 7.6 cwt. for each cwt. of coke burned. This simple and inexpensive dryer is to be tested further during the coming year.

### Artificial Wool Production in Italy

THE manufacture of artificial wool from milk has been successfully started in Italy, and the product known as Lanital has been shown to possess properties suitable for the textile industry. Ninety-four tons of Lanital were produced in 1936 and 760 tons in the first seven months of 1937. The process is based on a patent taken out in 1935 by Comm. Antonio Ferretti, and the plant as installed at the factory of Snia Viscosa at Milan is described in an illustrated article in *Engineering* of December 17. In the process, milk is first deprived of most of its cream, and then chemically treated to coagulate the casein. From vats the casein is transferred to tanks in which are placed water and certain solvents, the result being a viscous substance which can be made into fibres by squirting through fine holes in a spinning nozzle. After passing through an alkaline bath, the fibres in bundles are cut into 'flocks' which after further treatment are dried in steam-heated drying machines, the material then being ready for spinning and weaving into fabrics. It is stated that 'Lanital' has higher heat retaining properties than natural wool and that it can be boiled without loss of weight. Though established to render Italy free from the necessity of relying on outside supplies of raw material, purchases of casein are already being made from Holland and Denmark. It is, however, estimated that the country can supply 20-25 per cent of its wool requirements. At a recently opened exhibition in Rome, a whole pavilion is devoted to the Lanital industry.

### Scandinavian Influence in Northumbrian Art

SCANDINAVIAN influence, owing to the Norse occupation, left a deep-seated and long-persistent mark on the life and culture of northern England, which is especially to be noted in art motifs and decorative design at the close of the first and beginning of the second millennia of our era. An interesting and instructive example of this influence is to be seen in the crozier of Bishop Ranulf Flambard, who died in 1128, and whose tomb on the site of the Chapter House of Durham Cathedral was opened in 1878. With his body were found the remains of a pewter chalice, his sapphire ring and his pastoral staff. The ring and staff were exhibited by Mr. T. D. Kendrick at the Society of Antiquaries on December 16. The wood of the staff has perished, but there remains the crook and ferrule of iron. The crook was silver-plated, and had been cleverly and delicately chased with an interlace of slender serpents, the design being inlaid in niello. As Mr. Kendrick pointed out, Flambard had so far identified himself with northern England as to adopt for his crozier the hard and economical ecclesiastical art of Northumbria in preference to the richer style of southern England. Mr. Kendrick went on to show that this ornament was in the characteristic eleventh century Viking style, and must have been made by a smith well practised in making the silver-plated spearheads with niello design of serpents and scrolls, which come chiefly from the Baltic lands. Some of such spearheads had been found in England, and there was

little doubt that Flambard's staff had been made by a Northumberland smith. Though the design was Scandinavian in style and feeling, in detail it showed certain marked peculiarities, which must be regarded as northern English, since they could be explained only as due to a long-established English manuscript style. They were not found in purely Scandinavian art. There was additional evidence for this Anglo-Scandinavian style, as for example in architectural detail at Kirkburn in Yorkshire, which helped to prove its general diffusion.

### Health Legislation in Industry

DR. LEONARD P. LOCKHART opened a discussion on the "Wider Issues of Health Legislation in Industry" in the Section of Medical Sociology at the recent annual meeting of the British Medical Association held at Belfast (*Brit. Med. J.*, September 25, 1937). He said that the new Factories Act, in spite of omissions and shortcomings, represents a very considerable advance in social legislation. While certain provisions will act automatically to improve health and safety, there are others that will depend on a high level of co-operation and of common consent to make the result effective. He pointed out the important part played by voluntary effort preceding the consolidation by law. For example, individual employers have done a considerable amount of experimental work in industrial health, and much of what is known as industrial welfare has proved so valuable that it has now ceased to be voluntary and is to become an obligation. The voluntary activity of progressive employers, aided by the trade unions, has provided the necessary data to form a basis of the new industrial law.

THE Act as it is pegs industrial health and welfare at a higher level than ever before, but it should not be assumed that nothing remains to be done. The long fight to obtain recognition of society's duty to its members is all but won; the next task will be more laborious, and it will lack the spectacular victories of the earlier political struggles. Nor must it be thought that the responsibilities of the employer are ended when he has fulfilled the letter of the law. Many of the wider issues of industrial health, such as the psychoneuroses and emotional disturbance, with their physical sequelæ, arise not out of unhealthy conditions as commonly understood; but out of methods of work, methods of selection of staff, systems of supervision, payment and incentives, and Dr. Lockhart suggests that some form of statutory advisory board might be desirable, since it would be free to raise and discuss these matters before they became political questions. He also advocates an industrial training for doctors as a post-graduate course. The paper raises many important issues, and is worthy of very careful consideration.

### Control of Public Lighting

ON December 10, Mr. J. M. Kennedy, Electricity Commissioner, inaugurated the 'Actadis' system for the ripple control of the public lighting of Maidstone. This is the latest development of a method which



began with the lamplighter going his rounds with his pole. The method is the distribution of high-frequency A.C. ripples over the electric supply network from a central transmitting apparatus. The high-frequency machine which generates the current injected at various points into the network is rated at 30 kilowatts, and its frequency can be varied between 300 and 900. They are injected directly on to the 6,600 volt A.C. system and actuate relays on the low-tension side. As condensers are placed in the high-frequency circuits, the power consumption is small. At present there are about 500 relays installed for the control of the lamps. The great advantage of the system is that the whole street lighting of a city can be switched on or off by actuating push buttons at a central point. If this system were adopted in a city, every street lamp could be extinguished within a few seconds of warning of an emergency being received. The system can also be used to control part of a load, for example the load required for the 'water heaters', for a short time so as to prevent the maximum load, as shown by the 'maximum indicator' being exceeded. The system was installed in Maidstone by Actadis Ltd., Vincent House, Vincent Square, S.W.1. The bulk of the apparatus is manufactured in Great Britain.

#### Coloured Roads

IN *Roads and Road Construction* of October 1 Mr. C. W. Manlove considers the question of whether it would not sometimes be advisable, instead of having a mass of signs at the side of the road, to colour the traffic lanes with various colours. A good driver looks at the road surface ahead, and should not be distracted by having to decipher road signs, a necessity which is sometimes contributory to accidents. If the road surface had a tinted colour when the speed limit changed, the driver would automatically notice that he was entering or leaving a controlled area. The coloured road has for several years been a common feature in the United States. This is probably due to the fact that in America many of the roads are made of concrete; in Great Britain concrete roads are only beginning to be made. Recent official tests on the main Bath Road prove that a concrete road has a very long life. It has been computed that if the load does not exceed 15,000 tons of traffic a day, to wear the surface down one inch would take 200 years. The Cement Marketing Board estimates that the cost of tinting the top of a cement carriage road to the depth of two inches, supposing the road to be 30 feet broad, would be about £250 per mile. As international colours are used for colouring electrical engineering diagrams, the day may come when international colours will be used on the surfaces of the roads for warning and directing chauffeurs when danger is ahead and a change of speed is necessary.

#### The Cross-Channel Ferry Service

THE cross-channel ferry service between Dover and Dunkerque has now been in operation since October 1936. The three ferry steamers engaged in the service carry passengers between Great Britain and

Europe in through sleeping cars. Recently a special ramp has been built which enables motorists to drive straight into the special garage on board the ship, which has accommodation for twenty-five cars. It is not necessary to empty the petrol tanks of the cars before boarding the ship as special fireproof construction has been adopted. The new ramp is a reinforced concrete structure at the side of the ferry dock and there is a portcullis type of transfer bridge which is lowered on to the deck of the ship. The length of each of the ferry steamers is 360 feet and the beam is 63 feet. It is provided with twin screws each driven by a Parsons steam turbine through single reduction gearing. The normal speed is 16½ knots and the total horse-power is 4,900. It takes 500 passengers, 12 sleeping cars (or forty goods wagons) and 25 cars in the garage. The *British Engineers' Export Journal* of August states that the traffic carried by the train ferry is very varied. To the engineering exporter this ferry service is of great value, since heavy and awkward pieces of machinery can be loaded on a truck at Victoria and need suffer no transshipment until they arrive at a destination on the Continent. Up to May 31 of this year, the ferry service conveyed 9,577 loaded wagons, and during the same period 12,277 tons of merchandise were conveyed in through trucks from Dover to Dunkerque, and 23,288 tons were carried in the reverse direction.

#### Forestry Research in Malaya

THE Research Institute of the Forestry Department of the Federated Malay States has now been in existence for some years and is carrying out investigations of varying types which should have considerable importance for the improvement of the forests of the country. The Institute is organized on the lines of the Imperial Forest Institute at Dehra Dun in India, the branches consisting of sylviculture, botanical, wood technology, timber mechanics, seasoning, preservation and durability of timbers and entomology. Chemical investigations affecting forestry are undertaken by the Chemical Division of the Department of Agriculture, a grant being made by the Forest Department for this purpose. The Institute works in collaboration with Princes Risborough and also with the Malayan Railway Department and with the Civil Engineer, H.M. Naval Base, Singapore. The Forest Botanist, whilst on leave, spent some time working on a collection of Malayan specimens at Kew, where, by the courtesy of the director, he was accorded assistance by the Kew Herbarium staff. An item of botanical interest is mentioned in the annual report for 1936 (Forest Research Institute, Kepong, 1936) referring to the Gunong Tahan Expedition. The collection made includes 144 numbers, mainly from the open *padang* of the mountain tops. Although this collection has not yet been completely worked through, it is said that "it is evident that, though it contains very little that is new, it includes some nice material of rare species known only from this locality, e.g. *Agathis flavescens*, Ridl. and *Gentiana malayana*, Ridl."

### Forest Bibliography

Two parts of the "Forest Bibliography to 1933" have now been issued from the Department of Forestry of the University of Oxford. This work has been compiled by Prof. R. S. Troup and his staff. The systematic referencing of current forest literature was commenced at Oxford in 1920, and continued jointly by the Forestry Department and the Imperial Forestry Institute after 1924. The object at first was to provide staff and students with facilities for keeping in touch with forestry literature. Recently, in response to requests, publication was decided upon. The Bibliography comprises literature published to the end of 1933, and contained in the library of the Oxford Department of Forestry. Forest literature published on and after January 1, 1934, is being dealt with under the decimal system of classification prepared by Dr. Flury and recently adopted by the International Union of Forest Research Organizations. The Oxford Bibliography is said to comprise a fairly complete list of material published in English and a considerable amount of literature published in French and German. Material from other countries is mainly confined to literature where an English, French or German summary is appended. The first part opens with a list of abbreviated titles and then gives the subjects of classification as *A*, General Forestry; *B*, Sylviculture; *C*, Forest Protection; *D*, Forest Utilization; *E*, Forest Mensuration; *F*, Forest Valuation and Finance; *G*, Forest Management; *H*, Forest Policy and Economics; *I*, Meteorology; *J*, Geology; *K*, Education and Research; *L*, Terminology and Classification of Information; *M*, Engineering and Surveying; *N*, Botany; *O*, Invertebrate Zoology; *P*, Biography. Most of these branches are divided into sub-heads.

### The Strangeways Research Laboratory

THE investigations described in the report of the Strangeways Research Laboratory, Cambridge, for 1936 fall into two main divisions: one is concerned with the growth and development of cells and tissues, or with their organization in the embryo; the other deals with the action of radiations on the living cell, with the object of analysing their destructive effect so that the different forms can be used to the best advantage in the treatment of cancer. The methods of cell culture have found many applications in the work of biological and medical laboratories. The Strangeways Laboratory continues to attract workers from other centres, who go to Cambridge to obtain instruction and practice in a difficult and still relatively unfamiliar technique. The Trustees point out that the income of the laboratory is chiefly made up of grants from public bodies and corporations and donations from individuals, which cannot be regarded as permanent. The great need is an endowment to provide an income not necessarily large but assured, so that plans may be laid for the future in reasonable security. Additional space is required for the visitors to the laboratory and for the development of the work on experimental embryology, which has now reached a stage when expert assistance from biochemists is urgently needed. The Trustees express

the hope that a capital sum sufficient to provide an extension to the present building may be forthcoming as well as sufficient funds to provide the requisite additional annual income.

### Training in Business Administration

ESTABLISHED seven years ago, the Department of Business Administration at the London School of Economics provides a post-graduate course extending normally over one year for men and women who intend to follow a business career. It has been found that such post-graduate students are of three main types. First, there are university graduates in economics, commerce or Modern Greats who require chiefly to learn the practical application of principles of which they are already familiar. Secondly, there are graduates in modern languages and technical subjects, such as chemistry and engineering who already have technical qualifications which would often enable them to obtain immediate employment without difficulty. Later on, however, as they rise to positions of responsibility, they may find themselves obliged to exercise functions of management for which their technical training by itself provides little preparation. Training in business management should enable them to avoid many of the initial mistakes inevitable in a process of learning by trial and error. Thirdly, there are students who have already had considerable experience of business and who come or are sent by their employers to widen their outlook and increase their capabilities. At first sight it would seem difficult, if not impossible, to frame a course which would be equally suitable for these different groups, with their varying types of training and background. Experience has shown, however, that given appropriate methods of teaching, the lack of homogeneity in the class is a source of strength rather than of weakness. The work is carried on mainly in a series of discussion classes, to which each student can contribute from his own special knowledge.

### Memorial to the late Viscount Grey of Fallodon

THE report of the Natural History Society of Northumberland, Durham, and Newcastle-upon-Tyne, presented at the annual meeting on October 26, states that the North Country Memorial takes the form of a simple inscription engraved upon the masonry of the Hancock Museum in Newcastle, near the entrance. An essential part of the memorial was the creation of an endowment fund which would help to ensure the continuance of the Museum itself and this Memorial Endowment Fund now amounts to £6,156. The sum is none too large for its purpose but the fund is still open, and it is hoped that further donations will be received. The summary of accounts which is included in the report shows that the payments for the past year exceeded the receipts by £52 19s. 10d. The Museum itself is a valuable educational institution, and while the number of ordinary visitors is slightly down at 12,348, the increasing use made of the exhibits by classes of pupils from Newcastle Council Schools is encouraging. During the year, 1,337 scholars visited the Museum with their teachers, and arrangements have been

made whereby pupils of the schools under the Northumberland County Education Committee may share in the advantages hitherto restricted to town children.

#### Garden Plants from China

AN interesting account of the botanical pioneers who first made known the wonderful flora of China, appears in the *Journal of the Royal Horticultural Society* (62, Pt. 8, 347-351, August 1937). It is mainly a review of a "History of European Botanical Discoveries in China" by E. Bretschneider. The volume is one of the treasures of the Society's Lindley Library, and the article is from the pen of Mr. F. C. Stern. It was not until nearly 400 years after Marco Polo's celebrated journey that Europeans took an interest in the decorative plants of China. Domenico Parenin first mentioned *Wistaria chinensis* in 1698, but Father Pierre d'Incarville was probably the first botanical collector in China, about half a century later. It was not until the early part of last century, however, that Chinese plants began to find their way into European gardens; previous collections had been for herbarium material. The work of Dr. Abel, John Reeves, Robert Fortune, Dr. Hance, Father Armand David, Father Jean Marie Delavay, Nicolai Przewalski, Dr. Augustine Henry and other investigators of last century, is described. The account of their collections makes interesting reading, and the plants they introduced are among the greatest contributors to garden beauty.

#### Tokyo Earthquakes of 1936

THE last *Seismometric Report* issued by the Earthquake Research Institute completes the list of earthquakes felt in Tokyo in 1936. In addition to the central station, there are eleven others at various distances up to eighty-four miles from Tokyo, and the records obtained at these stations have enabled the position of the epicentre in all the earthquakes, and the focal depth in all but three, to be determined. The year 1936 is notable on two accounts. It is the year of fewest earthquakes in the district since the network of stations was formed, the number being only 31, or less than half the average number (64) in the preceding twelve years. Also, more than half the centres were submarine, 14 lying beneath the Pacific Ocean, 4 below Tokyo Bay, and only 13 under land. The depth of focus ranges from 15 km. to 80 km., the average being 45 km. None of the earthquakes was of destructive strength, but in one—that of November 3—the shock was of degree 7 of the Rossi-Forel scale or strong enough to throw down ornaments, vases, etc. Indeed, only four of the 797 earthquakes in the thirteen years were strong enough to cause slight damage to buildings.

#### The Rubber Research Institute, Malaya

THE year 1937 will stand out in the history of the Rubber Research Institute, Malaya, as it marks the beginning of a second decade of activity and was the occasion of the occupation of new premises. The purpose and recent work of the Institute are well

described in an illustrated booklet and the annual report for 1936, both of which have recently been published (Kuala Lumpur: The Institute). Research work is carried out in four main divisions, botanical, pathological, chemical and soils respectively. Many of the investigations are necessarily made in the field, both at the Institute's Experimental Station and also on, and in co-operation with, a large number of estates throughout Malaya. Retrenchment of staff during the slump and a disastrous fire in 1936 seriously curtailed the activities of the Institute, but a period of expansion is now coming into being, and the rapid development of the advisory work is good evidence that this service is appreciated by estate owners and small-holders alike.

#### Deep Well Drilling

AT the Rumanian Branch of the Institution of Petroleum Technologists, on November 27, a discussion was held on problems of deep well drilling. (*J. Inst. Pet. Tech.*, 23; 1937). Mr. G. Elias opened by summarizing the points he considered most influential in successful drilling to depth. Accidents must be avoided at all costs, and the only way to safeguard against them is by provision of suitable equipment, drillers and crews. Mud conditions must be good, as they are invariably reflected in the condition of the well itself. The ultimate cost of the well and drilling time are largely dependent on the selection of a suitable casing programme, and this should be drawn up in new areas immediately the necessary information is available from first wells. An adequate steam supply should be available on the site, not only to reduce the time factor, but also to ensure that a big volume of mud is circulated. Particular care should be taken to see that adequate derricks are employed and also that their foundations are such as to prohibit uneven settling.

#### Maternal Mortality

THE Ministry of Health has issued two reports upon this subject, namely, (a) "An Investigation into Maternal Mortality in England", and (b) "Maternal Mortality in Wales" (London: H.M. Stationery Office. 5s. 6d., and 2s. 6d., respectively). The national average for maternal mortality has remained for a number of years in the neighbourhood of 4 mothers per 1,000 live births, despite great expansions in maternity services and remarkable improvement in the general health of the community. The provisional figures for 1936 show a slight decline, the rate for that year being less than 4. In many districts in England and in Wales, however, the maternal mortality rate is higher than the average, being 5 or more, and the two reports survey the circumstances that may be responsible for this excessive mortality in England and Wales, and the measures that may be taken to reduce it. The rate is generally higher in industrial areas and lower in rural ones. The first report deals more fully with prevention, and a section is devoted to the subject of abortion. Attempted abortions appear to be frequent and on the increase, as well as to be responsible for a number of deaths from puerperal sepsis.

### Safe Catgut for Surgical Use

REFERENCE has been made on two or three occasions in NATURE to the risk of tetanus arising from the use of imperfectly sterilized catgut for surgical ligatures. In order still further to reduce the risk of tetanus infection, the Minister of Health has issued new regulations which require all surgical ligatures and sutures, including catgut, that are not sold under the special licensing arrangements of the Therapeutic Substances Act, to bear a label stating in prescribed terms that efficient sterilization is necessary before use (Statutory Rules and Orders, 1937, No. 767, and Circular 1641. H.M. Stationery Office. *Id.*). Catgut which is sold under licence under the Therapeutic Substances Act is free from any possible risk of infection, as its manufacture is strictly controlled and it is properly sterilized before being put on sale.

### Bird Protection in Britain

DISSATISFACTION has often been expressed with the legislation by which birds are protected in Great Britain, although there can be little doubt that the law has had the effect of increasing the number of some desirable birds and of extending the survival period of others which were becoming too scarce. The present code of bird protection laws is, however, too complicated and cumbersome, and in several respects it lacks provisions which would much increase its efficiency, so that time and again attempts have been made to consolidate the position. For those who are interested in the present position, particularly in view of the possibility of future legislation, a brief but informative summary of the Acts under which birds are protected in Great Britain has been written by the editor of *Bird Notes and News*, and a first instalment appears in the autumn number (vol. 17, 167; 1937).

### Bronze Bust of Sir Arthur Keith

IT is proposed to present Sir Arthur Keith with an excellent bronze bust of himself in appreciation of his work in the fields of anatomy, embryology and anthropology. Sir Arthur wishes to hand over the bust to the keeping of the Royal College of Surgeons, should it be found possible to secure it. The sum of £150 is required to purchase the bust, and contributions are invited towards this amount. Cheques should be made payable, and be sent, to the secretary of the Royal College of Surgeons, Lincoln's Inn Fields, London, W.C.2 ("Arthur Keith Bust Fund"). Sir Arthur Keith has been invited by the College to give a lecture on the ancient types of man which were discovered in Palestine some years ago. This lecture will be given in the College Theatre on February 14, 1938, and it is proposed to present him with the bust on that occasion.

### Announcements

THE following awards have recently been made by the Royal Aeronautical Society: *Simms Gold Medal*: to Dr. N. A. de Bruyne for his paper on "Plastic

Materials for Aircraft Construction"; *Taylor Gold Medal*: to G. Mead, for his paper on "Power Plant Trends"; *Wakefield Gold Medal*: to Dr. G. V. Lachman, for his paper on "Aerodynamic and Structural Features of Tapered Wings"; *Edward Busk Memorial Prize*: divided between Major B. C. Carter, for his paper on "AircREW Blade Vibration", and A. G. Pugsley, for his paper on "Control Surface and Wing Stability Problems"; *Pulcher Memorial Prizes*: to A. J. Hanson, for his paper on "Critical Speeds of Monoplanes", and C. O. Vernon, for his paper on "Aircraft Performance Estimation".

At the ordinary meeting of the Institution of Electrical Engineers held on December 16, an oil painting of Mr. Sydney Evershed, by George Harcourt, R.A., was presented to the Institution. The painting was subscribed for by the many business associates and admirers of Mr. Evershed, to commemorate the fiftieth anniversary of his entry into the electrical industry, and it was formally presented, on their behalf, by Lieut.-Col. W. A. Vignoles.

At the annual general meeting of the London Mathematical Society on November 18, the following were elected officers and council for the session 1937-38: *President*: Prof. E. A. Milne; *Vice-Presidents*: Prof. G. B. Jeffery, Miss M. L. Cartwright, Mr. J. Hodgkinson; *Treasurer*: Dr. A. E. Western; *Librarian*: Prof. H. Hilton; *Editor*: Prof. G. N. Watson; *Secretaries*: Mr. F. P. White, Mr. W. L. Ferrar. At the December meeting, the Council received with great regret the resignation of Mr. W. L. Ferrar from the office of secretary, as from January 1, 1938; Mr. P. Hall, King's College, Cambridge, has been appointed to succeed him.

THE twenty-sixth annual Conference of Educational Associations will be held in University College, London, on January 3-10 under the presidency of the Right Hon. Sir Kingsley Wood, M.P. On January 4, Sir Kingsley Wood will deliver his presidential address entitled "Education and Health". A joint conference on "Health in the Schools" will be held on January 6. Further information can be obtained from the Conference Secretary, Gordon House, 29 Gordon Square, W.C.1.

THE Carnegie Institution of Washington has issued a catalogue of its publications, either issued or in press, consisting of a numerical list and a classified list arranged under subjects, with brief descriptive notes on the publications listed. A few copies of the publications still in print are reserved for sale at prices quoted, and those out of print can be consulted in certain libraries throughout the world in which they were deposited on publication. A list of these libraries is obtainable on request. Subjects covered by the catalogue include astronomy, botany, chemistry and physics, engineering, genetics, folk-lore, geology, mathematics, nutrition, philology, terrestrial magnetism and zoology.

## 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. 1102.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

### Divided Aurora Rays with one Part in the Sunlit and another in the Dark Atmosphere

On October 11 last a fine aurora was photographed from eight of my aurora stations in southern Norway. The stations Kongsberg, Tömte and Askim, forming a triangle with sides 105 km., 80 km. and 85 km., worked together with my station on the eastern roof of the Oslo Observatory; all four were connected



Fig. 1.

DIVIDED AURORA RAYS AT 19<sup>h</sup> 55<sup>m</sup> 7<sup>s</sup>, PHOTOGRAPHED FROM KONGSBERG, BY MR. BUSENGDAL.

by telephone and took simultaneous pictures in continual succession as rapidly as possible. Three other stations, Tuddal, Lillehammer and Oscarsborg, forming a triangle with sides 178 km., 159 km. and 101 km., were in the same manner connected with my other station on the western roof of the same Observatory and worked independently of the first set.

Among the sixty-five successful sets of aurora pictures taken this night there are some of unusual



Fig. 2.

THE SAME RAYS PHOTOGRAPHED AS IN FIG. 1 PHOTOGRAPHED SIMULTANEOUSLY FROM TÖMTE, BY MR. ALBERT TÖMTE.

interest showing high aurora rays divided by a dark space where the rays are penetrating the boundary between sunlit and dark atmosphere. A similar case of this rather infrequent phenomenon, on March 15-16, 1929, has earlier been published in NATURE<sup>1</sup>.

In Figs. 1 and 2 are seen two of the four simultaneous pictures taken on October 11, 1937, at

19<sup>h</sup> 55<sup>m</sup> 7<sup>s</sup> G.M.T. from my stations Kongsberg and Tömte, base-line 105 km. Fig. 3 is an explanatory sketch to the Kongsberg picture.

The two other simultaneous pictures from Oslo and Askim show the same features; there can therefore be no doubt that the lower rays are the continuation of the upper ones. Due to the long base-line, the parallaxes are good, about 5°, in spite of the great distance to the rays. In fact they were lying about 1,000 km. away, over a region at 68° latitude and 3°-9° longitude east of Greenwich, to the west of the Lofoten Islands.

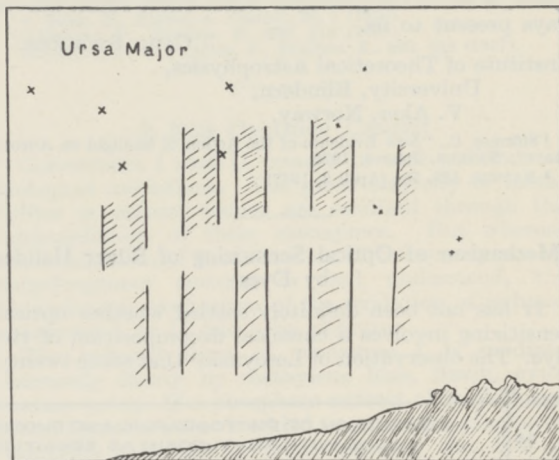


Fig. 3.

SKETCH OF THE KONGSBERG PICTURE.

The upper rays, which had a rather red tint compared with the lower ones, had their base points 415-480 km. above the earth, and their summits reached to about 625 km. These rays were situated in full sunshine. The continuation of the rays downwards went from about 350-400 km. down towards the horizon, where they can be followed to about 175 km. above the earth. They were all in shadow.

What is most remarkable, however, is the dark space between the upper and lower parts of the rays, comprising the boundary between sunlit and dark atmosphere. It seems as if the light of the rays is extinguished in the vicinity of this boundary and recovers again lower down.

This phenomenon is rather infrequent, and lasted only a few minutes. On a picture taken one minute later, the lower parts are much weaker. This last picture gives, however, a valuable check on the height measurements. In fact, by a pure chance, the rays happened to be photographed by all eight stations almost at the same time, and a calculation with the formidable base-line Tuddal-Lillehammer of

178 km. gave very nearly the same height as the calculation with base Kongsberg-Tömtö, namely, a height of 410–450 km. for the base points of the sunlit parts of the rays.

The last traces of sunlit aurora rays were photographed at 20<sup>h</sup> 14<sup>m</sup> G.M.T., four hours after sunset in Oslo. These were lying about 400 km. south-west of their former position and their base points were also near the earth's shadow, more than 400 km. above the earth. The lower parts did not appear this time.

A spectrum was taken of these sunlit rays on a panchromatic plate Agfa ISS. The plate was first exposed from 19<sup>h</sup> 55<sup>m</sup> to 19<sup>h</sup> 58<sup>m</sup> on the rays just under  $\beta$  and  $\gamma$  Ursae majoris, and then from 19<sup>h</sup> 58<sup>m</sup> to 20<sup>h</sup> 15<sup>m</sup> on similar rays to the left of  $\eta$  and  $\xi$  of the same constellation. In this spectrum the line 6300 Å. is by far the strongest; next come the lines 5577 Å., 6550 Å., as in the spectrum obtained on October 16 last year<sup>2</sup>.

These phenomena of sunlit aurora rays are very remarkable and their closer study may throw new light on the physical state of the upper atmosphere. It would be of interest to do experiments on the possible action of light, in particular ultra-violet, on the light phenomena of corpuscular rays in rarified gases, to solve the problems which these sunlit aurora rays present to us.

CARL STÖRMER.

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<sup>1</sup> Störmer, C., "New Evidence of the Action of Sunlight on Aurora Rays", NATURE, June 8, 1929.

<sup>2</sup> NATURE, 139, 584 (April 3, 1937)

### Mechanism of Optical Sensitizing of Silver Halides by Dyes

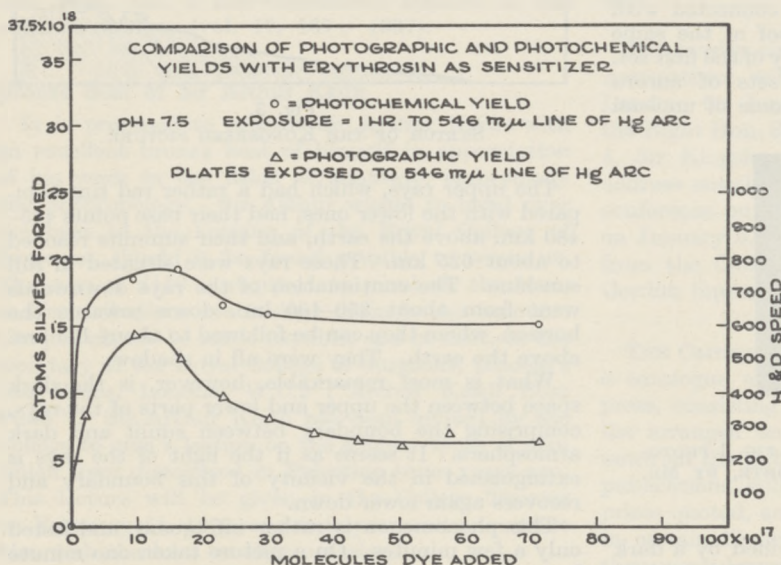
It has not been definitely settled whether optical sensitizing involves a chemical decomposition of the dye. The observation of Lescynski<sup>1</sup> that some twenty

Bokinik and Iljina<sup>2</sup> have published results to somewhat the same effect as those of Lescynski. Working with silver bromide sols sensitized with erythrosin, they found a continued linear growth of silver atoms with number of erythrosin molecules added to the sol, and, according to the exposure, yields of four to fifteen atoms of silver per molecule of dye.

In repeating and extending the procedures of Lescynski and of Bokinik, we have obtained results which, while in agreement on some points, diverge widely on others. In our first experiments with a simple silver halide hydrosol (stabilized with slight bromide ion excess and sensitized with erythrosin) the dye was found to be destroyed progressively with exposure to light, and the number of silver atoms formed was between one and two per dye molecule disappearing. This was obtained in approximately monochromatic light 5460 Å., cutting out the blue-violet light. However, check observations showed that the dye also disappeared on exposure to the blue-violet light absorbed by silver bromide, eliminating the green light absorbed by the erythrosin-silver halide complex. This could only be due to the photolytically produced bromine attacking the dye. On repeating the experiments in green light (5460 Å.) with the blue-violet excluded, but with adequate halogen acceptors present (acetone semi-carbazide, phenol) the result obtained was: The adsorbed dye was *not* destroyed by the light absorbed, but bromide ions were converted to bromine, silver ions to metallic silver, progressively with exposure. (The reaction, at first linear with time, slows down as the surface is exhausted.)

In the case of erythrosin, the evidence is that by no means all the dye molecules adsorbed are active photolytically. The amount of silver produced by a given exposure increases rapidly at first, with increase of adsorbed dye, but reaches a limit long before adsorption saturation. In the case of basic (polymethine) dyes, the limit of the photolytic yield may coincide approximately with adsorption saturation. A photochemical equivalent (silver atoms formed per quantum absorbed) of about 0.3 was found in the case of erythrosin. The photographic efficiency of erythrosin, in terms of photographic sensitivity as a function of dye adsorbed, closely parallels the photolytic yield, as shown in the accompanying curves.

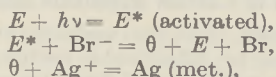
While our results confirm those of Lescynski, and of Bokinik and Iljina, in demonstrating that a single molecule of adsorbed dye can give rise to a large number of silver atoms (depending upon exposure, etc.) they differ widely from those of the latter authors in the observation of an early limit to the photochemical yield as a function of degree of adsorption. These authors make no mention of the addition of a halogen acceptor; in the absence



atoms of silver could be obtained (for a certain exposure) for one dye molecule indicated that either a 'physical' transfer of energy is effected, or else a chain reaction, with regeneration of the dye molecule.

thereof we get no such yields of silver atoms, and find the dye to be destroyed. Our principal result is that the optically sensitizing dye facilitates the transfer of an electron from a bromide ion to a silver ion, without undergoing decomposition itself. Formally,

this might be expressed as



the quantum  $h\nu$  being absorbed by the erythrosin adsorbed to the silver halide, and being much smaller than that required to effect the transfer directly.

A fuller discussion of this process together with details of the experimental and analytical procedures will be published elsewhere.

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Nov. 5.

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<sup>1</sup> Leszynski, W., *Z. wis. Phot.*, **24**, 261 (1926-27).  
<sup>2</sup> Boknik, J. I., and Iljina, Z. A., *Acta physicochimica, U.R.S.S.*, **3**, 383 (1935).

Cozymase in Invertebrate Muscle

RECENT work from the institutes of Meyerhof<sup>1</sup> and von Euler<sup>2</sup> has demonstrated the important part played by cozymase in muscle glycolysis. Cozymase has now been quantitatively determined in, and isolated in a pure form from, mammalian muscle<sup>3</sup>. In muscle, as in other tissues, cozymase is present partly in the reduced, dihydro form in equilibrium with the oxidized form, 35-40 per cent of the total cozymase in mammalian muscle being in the reduced form<sup>2,4</sup>.

An interesting feature in the physiology of cozymase is its rapid inactivation by tissue enzymes after the death of the organism<sup>4</sup>. Its distribution in living tissues has been reviewed by von Euler<sup>5</sup>.

We have now determined the cozymase in the fresh musculature of marine invertebrates from various phyla as well as its autolytic inactivation by the minced tissue. The technique has been described elsewhere<sup>6,7</sup>. As standard, highly purified cozymase, kindly supplied by Dr. P. Ohlmeyer, has been used. The accompanying table summarizes the results.

COZYMASE IN FRESH MUSCLE (mgm. per gm.).

Phylum	Species	Muscle	Structure	Oxidized form	Reduced form	Oxidized + reduced forms	Per cent reduced form
Coelenterata	<i>Metridium senile</i>	Dermomuscular coat	Mixed	0.022	0.008	0.030	27
Gephyrea	<i>Phascolosoma vulgare</i>	Retractors of proboscis	Smooth	—	—	0.174	—
Arthropoda	<i>Homarus vulgaris</i>	Tail	Striated	0.280	0.170	0.450	38
Mollusca	<i>Pecten maximus</i>	Adductor	Striated	0.140	0.099	0.239	41
"	<i>Ostrea edulis</i>	Adductor	Smooth	0.187	0.134	0.321	42
"	<i>Buccinum undatum</i>	Columellar	Smooth	0.132	0.089	0.201	34
"	<i>Sepia officinalis</i>	Mantle	Smooth	0.220	0.170	0.390	44
Echinodermata	<i>Echinus esculentus</i>	Jaw	Striated	0.073	0.058	0.131	45
"	<i>Holothuria nigra</i>	Longitudinal bands	Smooth	0.026	0.008	0.034	23

Although its concentration varies widely, cozymase is present in all the muscles examined. In the powerful striated tail musculature of *Homarus* and in the smooth mantle muscle of *Sepia*, its concentration is as high as in mammalian muscle<sup>3</sup>. Not much difference in concentration is found between striated and smooth muscles. This is particularly exemplified in the adductors of *Pecten* and *Ostrea*. The smallest concentrations are found in the coelenterate *Metridium* and in the two representatives of the echinoderms examined. The higher concentrations are thus shown

by those muscles capable of swift or sustained vigorous activity.

In *Metridium*, *Echinus* and *Holothuria* the pyrophosphate P is also lowest, ranging from a trace to 0.2 mgm. P<sub>2</sub>O<sub>5</sub> per gm. fresh muscle as against 0.5-1.0 in the other groups.

It seems interesting that the ratio of the oxidized to the reduced form is fairly uniform and within the limits of that in mammalian musculature. The amount of enzymic inactivation during 4 hours autolysis at 18° has also been found to be fairly uniform, ranging from 30 to 50 per cent of the cozymase originally present. This is definitely lower than in mammalian musculature, where it ranges from 80 to 95 per cent<sup>3,4</sup>.

This work has been done while one of us (S. O.) was holding a Ray Lankester investigatorship.

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<sup>1</sup> Meyerhof, O., and Ohlmeyer, P., *Biochem. Z.*, **290**, 334 (1937).  
<sup>2</sup> v. Euler, H., Adler, E., Günther, G., and Hellstrom, H., *Z. physiol. Chem.*, **245**, 217 (1937).  
<sup>3</sup> Ochoa, S., *Biochem. Z.*, **292**, 68 (1937).  
<sup>4</sup> v. Euler, H., and Heiwinkel, H., *Naturwiss.*, **25**, 269 (1937).  
<sup>5</sup> v. Euler, H., *Ergebn. d. Physiol.*, **38**, 1 (1936).  
<sup>6</sup> Ohlmeyer, P., *Biochem. Z.*, **287**, 212 (1936).  
<sup>7</sup> Ohlmeyer, P., and Ochoa, S., *Biochem. Z.*, **293**, 338 (1937).

A New Oxidation Catalyst

COENZYMES I and II occupy pivotal positions in biological oxidations. The great majority of metabolites in animal tissues are oxidized through the intermediation of these coenzymes. But whereas the mechanism of the reduction of the coenzymes by dehydrogenase systems is well understood, the physiological mechanism of the oxidation of reduced coenzyme I or II has been obscure.

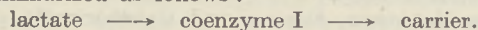
The reduced form of coenzyme I is oxidized extremely slowly by methylene blue, flavin, cytochrome c, etc. If a phosphate extract of washed and ground muscle tissue is added to a mixture of reduced coenzyme and one of these carriers, the rate of

oxidation of reduced coenzyme is increased some twenty-fold. We have fractionated this extract by centrifugation and have found that the insoluble sediment con-

tains the factor which catalyses the oxidation of reduced coenzyme I. The insoluble particles with which the factor is associated can be washed exhaustively by repeated suspension in water and centrifugation without any loss in activity. The factor is destroyed by exposure to 52° for 15 min., by precipitation with acetone or by drying.

The lactic dehydrogenase system as prepared by Green and Brosteaux<sup>1</sup> rapidly catalyses the oxidation of lactate by means of flavin, methylene blue and

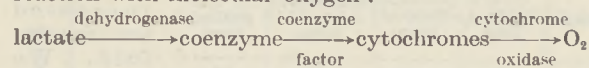
other carriers. The stages in these oxidations may be summarized as follows:



The arrows indicate the direction of transfer of hydrogen. The dehydrogenase is involved only in catalysing the oxidation of lactate by the coenzyme. The fact that the overall reaction is very rapid must therefore mean that the oxidation of reduced coenzyme by the carrier is not the slow spontaneous process referred to above, but that it is definitely catalysed. The lactic dehydrogenase preparation can be resolved by various methods into a water-clear solution containing the dehydrogenase and a suspension of insoluble particles containing the coenzyme factor. Neither solution alone can catalyse the oxidation of lactate by methylene blue whereas both together rapidly do so. This resolution of the two catalytic components has been accomplished with practically every coenzyme dehydrogenase system known in animal tissues; for example, lactic, malic,  $\beta$ -hydroxybutyric, alcohol, hexosemonophosphate, triosephosphate and triose.

Thus for the oxidation of metabolites, in coenzyme systems at least two catalytic agents are required; (1) the soluble dehydrogenases which catalyse the oxidation of the substrate by the coenzyme and (2) the insoluble coenzyme factor which catalyses the oxidation of reduced coenzyme by the carrier.

The studies of Keilin have demonstrated that the oxidation of practically all metabolites directly or indirectly proceeds via the cytochromes. Hitherto, no satisfactory link has been found between coenzyme systems on one hand and the cytochrome system on the other. Recently Dewar and Green described a coenzyme oxidase in animal tissues which catalysed the oxidation of reduced coenzyme by molecular oxygen<sup>2</sup>. We have succeeded in resolving the so-called coenzyme oxidase into three insoluble components, (1) the coenzyme factor, (2) cytochromes *a* and *b* and (3) cytochrome oxidase. What we considered to be a direct oxidation of reduced coenzyme by molecular oxygen is really a two-stage process, namely, oxidation of reduced coenzyme by one of the cytochrome components (probably *a*)<sup>3</sup> and oxidation of reduced cytochrome by molecular oxygen. The coenzyme factor catalyses the first oxidation, and the cytochrome oxidase catalyses the final reaction with molecular oxygen:



Since the cytochrome oxidase is poisoned by cyanide, the overall reaction does not take place in presence of dilute cyanide.

The coenzyme factor is not identical with flavoprotein or any known carrier. Strictly speaking, the coenzyme factor is a dehydrogenase which specifically catalyses the oxidation of reduced coenzyme by carriers. It is interesting to note that whereas flavoprotein, like the coenzyme factor, catalyses the oxidation of reduced coenzyme by carriers in pure solutions, it shows practically no activity as factor in any of the animal coenzyme I dehydrogenase systems we have studied. This paradox is difficult to explain.

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<sup>1</sup> Green and Brosteaux, *Biochem. J.*, **30**, 1489 (1936).

<sup>2</sup> Dewar and Green, *Biochem. J.*, **30**, 1069 (1937).

<sup>3</sup> We are indebted to Professor D. Keilin for this information.

### Influence of Hydrogen and Water Vapour upon the Combustion of Carbon Monoxide Mixtures

It is well known that the addition of hydrogen and water vapour to inflammable carbon monoxide mixtures speeds up the rate of flame travel. Experiments now in progress show that the flame temperatures determined by platinum thermometry also are increased.

The influence of hydrogen will be clear from an examination of Table I, in which are given the flame temperatures developed after the combustion of the mixtures (25 - *x*) per cent CO + *x* per cent H<sub>2</sub> + 75 per cent air when *x* is increased from 0 to 5.

TABLE I.

Percentage hydrogen	Flame temperature (°C.)	Latent energy (per cent)
0	1650	20.5
1	1705	17.5
2	1725	16.5
3	1735	15.5
4	1745	15.0
5	1750	14.5

It will be seen that there is a marked increase in flame temperature when hydrogen replaces a little of the carbon monoxide. A 1 per cent replacement increases the flame temperature by 55° C. A 5 per cent replacement increases the flame temperature by 100° C., in spite of the fact that there is a decrease of 25° C. in the ideal calculated flame temperature.

In a previous letter<sup>1</sup>, it was stated that an addition of about 2 per cent water vapour to a carbon monoxide - air mixture had very little influence upon the flame temperature attained, but since the water vapour was added to the mixture the quantity of combustible gas was reduced. When the proportion of combustible gas is kept constant, and water vapour is added at the expense of the air alone, the flame temperature increases substantially. This may be seen from Table II, in which are given the flame temperatures after the combustion of the mixtures, 25 per cent CO + *y* per cent H<sub>2</sub>O + (75 - *y*) per cent air, where *y* is increased from 0 to 2.14.

TABLE II.

Water vapour (per cent)	Flame temperature (°C.)	Latent energy (per cent)
0	1650	20.5
0.87	1675	19.5
1.50	1690	18.5
2.14	1700	17.5

In all the experiments, combustion took place at atmospheric pressure.

The latent energy, which is expressed as a percentage of the heat of combustion in the tables, resides, we believe, in the long-lived metastable molecules formed in the flame front. Small quantities of hydrogen and water vapour would appear to reduce the number of the metastable molecules formed during the combustion of dry carbon monoxide mixtures.

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<sup>1</sup> NATURE, **139**, 289 (Feb. 13, 1937).



### Sound-Films as Diffraction Gratings for the Visual Fourier Analysis of Sound-Waves

It may be of interest to give a preliminary account of what I believe to be a new method of producing acoustic spectra. The method, which is to employ the striations on "variable-density" sound-film as a diffraction grating for monochromatic light, permits an instantaneous separation of sound into its components which is analogous to the directness with which a spectroscope analyses light. If sound-film is modulated by a pure tone, a visual appreciation of frequency is clearly possible, the diffraction angle increasing with frequency. It might be anticipated that in the case where numerous frequencies are present, the diffraction pattern might contain a confused series of combination frequencies, after the manner of the 'ghosts' which appear with imperfect diffraction gratings possessing extraneous periodicities. A further complication might be expected from the fact that the range of frequencies recorded on the film extends over at least seven octaves, producing a correspondingly great overlapping of orders of spectra.

Theoretical investigation, however, reveals a very interesting state of affairs, which is briefly outlined below. Some of the conclusions are not new, but they are re-expressed because of their present application, and because they represent a departure from the traditional view of optical gratings.

(a) The Fraunhofer diffraction effect achieves as a physical process the same integrations that furnish the amplitudes and phases of the terms of a Fourier series. The function which the series represents is the variation of the light-amplitude on traversing the grating, which may be called for brevity its transparency curve.

(b) The customary orders of spectra of an optical grating represent the harmonics present due to the abrupt discontinuities in the transparency curve.

(c) A sound-film with a purely sinusoidal variation in the amplitude of the light transmitted will give rise to a first-order diffracted beam only; a film with any number of such periodicities superposed will give one diffracted beam for each component and no others.

There is thus no question of orders overlapping, and furthermore, if ghosts appear, they are merely a proper indication that a component of one frequency has been modulated by another frequency, the ghosts arising in the same way as the upper and lower sidebands which occur in wireless. One of the possibilities suggested by the theory is the analysis of transient sounds. Taking as the simplest case a pure tone of short duration, the record on the film acts as a grating of limited resolving power, and the resulting spread of the diffracted beam is just such as corresponds to the frequency range required to form the original 'wave-packet'.

It is necessary to employ for the recording apparatus a light-shutter the response of which is proportional to the square of the amplified audio-frequency current (for example, a shutter operating on the dynamometer principle) in order that the amplitude and not the intensity of the transmitted light may follow the wave-form of the sound pressure.

A simple experiment illustrates the way in which a complex wave-form can be analysed by this method. If interference fringes are formed on a photographic plate with a mercury arc, each actinic wave-length

of the source impresses a different set of sinusoidal bands upon the plate. The developed plate used as a grating with a sodium lamp as source reproduces the lines of the mercury spectrum in yellow light, but in the first order only.

A fuller account of this work will be presented for publication elsewhere.

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### Adiabatic and Isothermal Compressibilities of Heavy Water

ABOUT 50 grams of heavy water supplied by the Norsk Hydro-Elektrisk Kvaestofaktieselskab as 99.2 per cent pure ( $d_{20}^{20} = 1.1049$ ) has been used in the present investigation. The refractive index of the sample has been found to be 1.3278 for the  $D$  line at 30° C., which may be compared with 1.3276 given by Luten<sup>1</sup> under the same conditions. Using a piezometer made of soda glass and similar in construction to that employed by Tyrer<sup>2</sup> and recently by Dakshinamurti<sup>3</sup>, the adiabatic compressibilities of heavy and ordinary water are determined. Tyrer's value for ordinary water is also given below for comparison. The specific volume, its variation with temperature and the specific heat in each case are taken from the existing literature and used for calculating the isothermal compressibility with the help of the well-known thermodynamical equation. Small variations in these do not appreciably affect the result, and hence the degree of accuracy with which they have been determined is of little consequence.

		Temp.	Spec. vol.	$dV/dT$	$C_p$	$\beta\varphi \times 10^6$	$\beta T \times 10^6$
Water	Tyrer	30.0	1.00434	0.000304	0.9979	44.5	45.2
	Authors	29.2	1.00434	0.000304	0.9979	45.9	46.6
Heavy water	Authors	29.5	0.9123	0.000277	1.003	42.0	42.6

The compressibility of heavy water is nearly the same as that of ordinary water, and the ratio of the isothermal to the adiabatic compressibility is very close to unity as in the case of water. The above figures also enable us to predict that the intensity of the Rayleigh scattering in heavy water will be of the same order as that in ordinary water.

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<sup>1</sup> *Phys. Rev.*, **45**, 161 (1934).

<sup>2</sup> *J. Chem. Soc.*, **105**, 2534 (1914).

<sup>3</sup> *Proc. Ind. Acad. Sci.*, **5**, 385 (1937).

### Drift of Net Assimilation Rate in Plants

IN a recently published note<sup>1</sup>, the effect of age on net assimilation and relative growth-rates in the cotton plant is discussed. Although details<sup>2</sup> of the experiments have not reached me, it is evident from the note that O. V. S. Heath's results conflict with data already published<sup>3,4</sup> from this laboratory. In the experiments with cotton, no general rise or fall in the net assimilation rate (dry weight basis) was

found up to the time of flowering and, although it is admitted that the absence of such a drift with time is not proved, Heath claims that his data confirm the findings of Gregory<sup>5</sup>. The latter found the net assimilation rate (area basis) to be independent of time up to maximum leaf area in barley, and he accounts for 80 per cent of the variation of his data in terms of the variation in external factors.

In our own experiments with Sudan grass and oats<sup>3,4</sup>, there are marked significant falls with time in the net assimilation rate or unit leaf rate (dry weight basis) before flowering. With the tobacco plant, too, unpublished data from this laboratory show very rapid falls in net assimilation rates with time on either dry weight or area bases. That the falls are not solely due to an effect of temperature is clear from the fact that the oats<sup>4</sup> were grown under conditions of steadily rising mean daily maximum temperatures. With the Sudan grass<sup>3</sup> also, temperature was rising during a portion of the period before flowering.

Where the dry weight basis is used, a progressive increase in the fibre content of the leaves would partly account for a fall in the net assimilation rate with age; this points to the inadequacy of the dry weight basis for comparative measurements. It is also possible that the use of leaf area as a basis for the expression of metabolic rates introduces time drifts of a complicated kind.

The data from this laboratory call for further interpretation, and to this end analytical work is already in progress.

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<sup>1</sup> Heath, O. V. S., *Ann. Bot.*, N.S. 1, 565 (1937).

<sup>2</sup> Heath, O. V. S., *J. Agric. Sci.* (in press).

<sup>3</sup> Ballard, L. A. T., and Petrie, A. H. K., *Austral. J. Exp. Biol.* 14, 135 (1936).

<sup>4</sup> Williams, R. F., *Austral. J. Exp. Biol.*, 14, 165 (1936).

<sup>5</sup> Gregory, F. G., *Ann. Bot.*, 40, 1 (1926).

### Series Effect on the Dipole Moments of Some Alkyl Halides

THE problem of induction along hydrocarbon chains has been the subject of some of our previous papers<sup>1</sup> on measurements of dipole moments in solution. The experiments now reported relate to the moments of alkyl bromides and iodides as determined in benzene solution at 20°, and the values may be compared with those determined with the vapours<sup>2</sup>.

Although earlier values of these moments determined in solution have been published<sup>3</sup>, considerable divergencies exist among the results, and neither of the two series has been completely investigated in solution under the same conditions. The apparatus and the method of calculation used were those previously described<sup>4</sup>. The values of the polarizations and the dipole moments, expressed in Debye units, are given below.

Compound	$P_{100}$ (c.c.)	$P\bar{E}$ (c.c.)	$\mu$
CH <sub>3</sub> I	61.5	19.3	1.41
C <sub>2</sub> H <sub>5</sub> I	90.8	24.2	1.78
<i>n</i> -C <sub>3</sub> H <sub>7</sub> I	101.0	28.9	1.84
<i>i</i> -C <sub>3</sub> H <sub>7</sub> I	109.5	29.3	1.95
<i>n</i> -C <sub>4</sub> H <sub>9</sub> I	105.0	33.5	1.88
<i>n</i> -C <sub>5</sub> H <sub>11</sub> I	109.7	38.2	1.88
C <sub>3</sub> H <sub>7</sub> Br	94.9	19.1	1.89 <sup>(4)</sup>
<i>n</i> -C <sub>2</sub> H <sub>5</sub> Br	102.8	23.6	1.93
<i>i</i> -C <sub>3</sub> H <sub>7</sub> Br	112.2	23.9	2.04
<i>n</i> -C <sub>4</sub> H <sub>9</sub> Br	107.4	28.3	1.93
<i>n</i> -C <sub>5</sub> H <sub>11</sub> Br	113.7	33.0	1.95

The difference between the bromides and iodides is striking. The moments of the *n*-iodides increase as far as the butyl compound and then preserve a constant value, while those of the *n*-bromides show no increase beyond *n*-propyl bromide. Although the moments of the iodides are slightly lower than those of the corresponding bromides, the increase that extends over a further carbon atom in the former. Both the *i*-propyl compounds possess larger moments than their isomeric *n*-compounds.

The increases in moment with extension of the carbon chain shown by the vapours are larger and apparently continue to higher members of the series. The measurements in solution are complicated by the effect of the principal dipole upon the surrounding solvent molecules, as well as by its influence upon other parts of the polar molecule. For compounds of the present type, the first effect should give rise to an induced moment which opposes the principal dipole of the molecule<sup>5,7</sup>, whereas the moment induced in the second case should either increase or decrease the total moment according as additional polarizable matter is brought within or outside two cones of semi-angle 55° about the dipole axis<sup>6</sup>. Lengthening of the hydrocarbon chain would to some extent add CH<sub>2</sub> groups in this space, and the percentage increase in moment in homologous series should be uniform. That this conclusion is not confirmed by experiment is probably due to the necessary approximations in the theory.

The contributions to the resultant moment of the molecule of the moments induced by the primary dipole in the parts without and within the cones would differ with the polarizability and size of the halogen atom, and the secondary effects produced by addition of CH<sub>2</sub> groups would probably vary in the two cases. The polarizability and size of the iodine atom exceed those of the bromine atom, and it is in the iodides that the greater inductive effect is shown.

It seems that the polarizability of the polar group is a more important factor than the magnitude of the principal dipole in determining the change of moment in these series. This is also shown by the fact that the polarizability of the nitrile group is smaller than that of the iodo-group and, although it possesses a greater moment, the percentage variation of the moment in the nitriles is smaller and the moment attains its limit more quickly than in the iodides.

A fuller account of these results will shortly be published.

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Cowley and Partington, *J. Chem. Soc.*, 1252 (1933); 604 (1935).  
<sup>2</sup> Groves and Sugden, *J. Chem. Soc.*, 158 (1937).  
<sup>3</sup> See *Trans. Faraday Soc.*, 30, Appendix p. 21 (1934).  
<sup>4</sup> Cowley and Partington, *J. Chem. Soc.*, 1184 (1936).  
<sup>5</sup> Cowley and Partington, *J. Chem. Soc.*, 130 (1937).  
<sup>6</sup> Frank, *Proc. Roy. Soc., A*, 152, 171 (1935).  
<sup>7</sup> Higasi, *Sci. Papers Inst. Phys. Chem. Res., Tokyo*, 28, 284 (1936).

### Potato Flowers and Dissemination of Potato Virus

THE exact method of the spread of virus X in the field is not yet known. It has been suggested, however, that a species of thrips is the vector and that infection is conveyed by the insect feeding in the flowers<sup>1</sup>.

In the returns issued by the Department of Agriculture for Scotland<sup>2</sup>, there are fourteen potato varieties which flower sparingly or not at all. Four of these, Arran Crest, Epicure, Ninetyfold and King Edward, are necrotic to virus X when infected artificially through graft unions, and field crops are invariably free from infection. The remaining ten varieties, Duke of York, Eclipse, Sharpe's Express, Witchhill, Great Scot, Royal Kidney, Arran Banner, Arran Chief, Arran Consul and Rhoderick Dhu are non-necrotic, and analyses of samples drawn from commercial stocks have shown that virus X is of common occurrence within them. Of the free-flowering varieties in commerce, none is necrotic to virus X and none is X-free. It would seem, therefore, that the absence of virus X in commercial stocks is more closely related to the necrotic reaction than to the absence of flowers.

In support of this view, there is the observation that the necrotic disease is rarely, if ever, seen in the field, a fact which receives partial explanation on the grounds that as the necrosis is lethal, perpetuation of diseased plants vegetatively is eliminated. There is also experimental evidence derived from artificial methods of infection to suggest that entry of the virus into varieties to which it is lethal does not take place readily through means of infection other than a graft union.

The possibility of a species of thrips acting as a vector of virus is in no way invalidated by this criticism of the locus of entry.

The position with regard to virus A, of which *Myzus persicae* is the vector<sup>3</sup>, is very similar to that of virus X. Of the forty-six varieties listed in the agricultural returns<sup>2</sup>, seventeen are necrotic to virus A and are free from the virus under natural conditions. Ten of these varieties seldom produce flowers and seven are free-flowering. Of the twenty-nine non-necrotic varieties, three non-flowering and five flowering varieties are usually found to be infected with virus A, whilst the virus is not uncommon, either alone or in combination with other viruses in the remaining twenty-one varieties. It seems clear, therefore, that the factor determining the presence or absence of virus A is the reaction of the variety to the virus and not the presence or absence of flowers.

Evidence with regard to non-necrotic aphid-borne viruses has been obtained from a series of controlled field-trials in which free-flowering varieties were kept disbudbed throughout their growing period. Twenty plants of each of eight varieties were interplanted with leaf-roll infector plants. After one season of exposure, 46 per cent of the flowering controls and 49 per cent of the disbudbed plants had contracted infection. At the end of a second season the infected plants had increased to 68 per cent of the flowering controls and 75 per cent of the disbudbed plants. It would seem, therefore, that the presence of flowers *per se* has little effect on dissemination of potato virus diseases.

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Nov. 24.

<sup>1</sup> Smith, K. M., "A Text-Book of Plant Viruses", p. 343 (1937).

<sup>2</sup> Scot. J. Agric., 20, 92-93 (1937).

<sup>3</sup> Loughnane, J. B., NATURE, 131, 833 (1933).

### Mechanism of Polyploidy through Colchicine

THE action of colchicine on plant nuclei has been studied in stamen hairs of *Tradescantia reflexa*. Ovaries with attached filaments from which the pollen sacks had been removed were submerged in a salt sugar solution in which checks will survive more than 48 hours. Colchicine in concentrations ranging from  $2 \times 10^{-4}$  M. to  $6 \times 10^{-2}$  M. inhibits spindle formation and thus prevents anaphase. The drug slows down, but does not inhibit, the normal chromatin changes. Thus the split metaphase chromosomes commence to shorten and swell. Chromonemata become visible within them. Gradually they assume interphase structure. Meanwhile, chromosomes may have assumed various positions within the cell. Single chromosomes or groups of few chromosomes may have separated from the main group. The reconstruction of the amphidiploid colchicine nucleus thus at first leads to an irregular contour, which is gradually lost; micronuclei may be formed.

In summary, colchicine specifically inhibits anaphase, so that polyploid nuclei originate through reconstruction of an interphase nucleus from metaphase chromosomes, wherever plant cells divide under the influence of the drug.

B. R. NEBEL.

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Geneva,  
New York.  
Nov. 22.

### Rotational Analysis of the Visible $O_3^+$ Bands

THE visible  $O_3^+$  bands obtained by a heavy discharge through helium containing a small amount of oxygen have been photographed in the second order of a 21-ft. grating.

Examination of the bands,  $\lambda$  5632 (1, 0),  $\lambda$  6026 (0, 0) and  $\lambda$  6419 (0, 1), shows that each consists of four components containing in all thirty-nine branches. The alternate lines in each branch are missing and the structure agrees with the  ${}^4\Sigma_g^- \rightarrow {}^4\Pi_u$  transition predicted for these bands by Mulliken<sup>1</sup>. The missing lines at the origin show that the  ${}^4\Pi$  level is inverted. The  $\Lambda$ -type doubling is greater in the  ${}^4\Pi_{-1/2}$  than in the  ${}^4\Pi_{1/2}$  state, increasing with  $J$  in each case, and is very small in the  ${}^4\Pi_{3/2}$  and  ${}^4\Pi_{5/2}$  states.

The fine structure of the  ${}^4\Sigma$  level agrees with Budó's<sup>2</sup> theory. The  $F_1$  level is blended with  $F_4$  and  $F_2$  with  $F_3$ , while  $F_1$  and  $F_2$  are separated by a constant interval from which  $\epsilon = 0.146$  and  $\gamma \sim 0$ . The effect of this structure is to reduce the total number of branches to be expected for the transition from 48 to 40.

Preliminary values of the molecular constants obtained from the analysis are as follows:

$$A = -46.9 \text{ cm.}^{-1}, B_e' = 1.292 \text{ cm.}^{-1}, \alpha_e' = 0.027 \text{ cm.}^{-1}, \\ D_e' = -6 \times 10^{-6} \text{ cm.}^{-1}, r_e' = 1.274 \times 10^{-8} \text{ cm.}, B_e'' = \\ 1.108 \text{ cm.}^{-1}, \alpha_e'' = 0.018 \text{ cm.}^{-1}, D_e'' = -5 \times 10^{-6} \text{ cm.}^{-1}, \\ r_e'' = 1.346 \times 10^{-8} \text{ cm.}$$

A complete account of the analysis of these and of the (2, 0) band will be published shortly.

THOMAS E. NEVIN.

University College,  
Dublin.  
Nov. 18.

<sup>1</sup> Mulliken, *Rev. Mod. Phys.*, 4, 51 (1932).

<sup>2</sup> Budó, *Z. Phys.*, 105, 73 (1937).

## Volume-Rectification of Crystals

It has been shown by Khastgir and Das-Gupta<sup>1</sup> that crystals like carborundum, silicon and zincite, which have no centres of symmetry, give volume-rectification when placed between mercury electrodes; whereas with symmetrical crystals, for example, galena and iron pyrites, they did not find this rectifying effect when the crystals were similarly placed with large area of contact between mercury electrodes. Experiments conducted in our laboratory have, however, shown the existence of the so-called volume-rectification in galena, iron pyrites and pyrolusite placed between mercury electrodes.

While it is further expected that all rectifying crystals should show the same effect, our investigation has also given indications which tend to show that either both surface-rectification and volume-rectification (if there be really any volume-rectification) must be coexistent in all rectifying crystals, or the whole phenomenon of rectification is only a surface effect.

B. K. SEN.

Rajshahi College, Rajshahi,  
Bengal. Nov. 10.

<sup>1</sup> *Ind. J. Phys.*, 9, 258 (1935).

## Bright Meteor of November 9

WITH reference to the note in NATURE of December 11, p. 1009, on the meteor observed on November 9 I observed this object at 21h. 26m. G.M.T. while engaged on meteorological work at Hastings. My attention was first directed to a reddish light in a direction west by south of my observation point; this suddenly burst into a brilliant metallic blue head which continued for one or two seconds before vanishing. The light was quite brilliant and resembled a magnesium flare. An interesting feature was that the meteor was of sufficient size to leave a very distinct streak; this was of an ashy grey colour and persisted for 7-10 seconds, growing gradually fainter.

The meteor became visible at an elevation of about 60° and vanished at about 30°. Its deviation from a vertical line from zenith to horizon was in the region of 10° towards the north.

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Hastings.  
Dec. 13.

## Points from Foregoing Letters

PHOTOGRAPHS showing a 'divided' aurora with the upper part of the rays in the sunlit and the lower part in the dark atmosphere, with a dark space occurring at the boundary, are sent by Prof. C. Störmer. The photographs were taken simultaneously in different localities. It appears that the aurora is extinguished at the boundary of the sunlit atmosphere but recovers farther down.

Graphs giving the number of silver atoms liberated from silver halides by the action of light, for each molecule of a 'sensitizing' dye present, are submitted by Dr. S. E. Sheppard, Dr. R. H. Lambert and R. D. Walker. The new results confirm those of previous investigators in showing that a single molecule of adsorbed dye gives rise to a large number of silver atoms, but differ in that they indicate that only a portion of the dye molecules are active.

A new oxidation catalyst is announced by J. G. Dewan and D. E. Green. Its presence was detected in the centrifuged insoluble sediment from a phosphate extract of washed and ground muscle, which increased the rate of oxidation of reduced coenzyme I (in the presence of methylene blue, flavin, etc.). The new 'coenzyme factor' is destroyed by heating for 15 min. at 52° C. It is not identical with flavo-protein or any known 'carrier'. Practically every dehydrogenase known in animal tissues can be resolved into two catalytic components, one soluble and the other insoluble. The insoluble 'coenzyme factor' may be considered as a dehydrogenase which specifically catalyses the oxidation of reduced coenzyme by 'carriers'.

Tables showing that the presence of hydrogen (1-5 per cent) or of water vapour (1-2 per cent) increases by several per cent the flame temperature of (25 per cent) carbon monoxide-air mixtures, are submitted by Prof. W. T. David and B. Pugh.

Dr. D. Brown points out that if sound-film is prepared under certain specified conditions, and the striations on the sound track used as a diffraction grating with monochromatic light, a Fourier analysis is achieved resulting in an acoustic spectrum of

the original sound. One of the applications which is suggested refers to the study of transient sounds.

The compressibility of heavy water is found by Prof. S. Bhagavantam and B. S. R. Rao to be very nearly the same as that of ordinary water, and the ratio of the isothermal to the adiabatic compressibility very close to unity, as in the case of water.

The time drift of net assimilation rate in plants is discussed by R. F. Williams. His results show a fall in the rate during vegetative growth; this fall is independent of the drift in mean maximum temperature. These results are not in agreement with recent findings of Heath and of Gregory.

The polarizations and dipole moments of various organic (alkyl) compounds of bromine and iodine have been redetermined by E. G. Cowley and Prof. J. R. Partington, who discuss the influence of the lengthening of the carbon chain and of the surrounding solvent molecules. It appears that the polarizability of the polar group is a more important factor than the magnitude of the principal dipole in determining the change of moment in these series. The polarizability and size of the iodine atom exceed those of the bromine atom.

From an examination of non-flowering and flowering potato varieties, Dr. G. Cockerham has found no direct relationship between the absence of flowers and freedom from potato viruses.

The effect of colchicine (an alkaloid obtainable from meadow saffron) upon nuclei in process of division in plant cells is briefly described by B. R. Nebel. The drug slows down chromosome changes, inhibits spindle formation and prevents the anaphase stage, so that polyploid nuclei (containing a large number of chromosomes) are formed.

The existence of the so-called volume-rectification has been found by B. K. Sen in crystals other than those having no centre of symmetry. In the course of his investigation, indications have also been found suggesting that the phenomenon of rectification is only a surface effect.

## Research Items

### Origin of the Long Barrow

THE problem of the origin and affinities of the British long barrow, of which the trapezoidal mound is a persistent feature, hitherto eluding search elsewhere, is discussed by Mr. Stuart Piggott in the light of evidence from Brittany in *Antiquity* of December. It had seemed clear that the long barrow was a member of the megalithic tomb complex which extends from Iberia to Orkney; and comparisons had been instituted with remains in Brittany; but it was difficult to present convincing Continental parallels for the whole specialized English long barrow type. It was, however, recently pointed out that the distribution pattern suggested a movement from Armorica to Dorset. Field and museum work in southern Brittany during the past summer have suggested Breton equivalents in a group of tombs on the plateau of Manio to the north-east of Carnac, in which appear long low mounds, peristalith and dry-walled structures. A similar group of cairns was excavated by Miln near Crucuny in 1878. These also showed evidence of the quadrangular mound with enclosing wall and remains of stone structures within the area. These, it is noted, are not megalithic in the true sense. The evidence of the pottery in the grave goods points to an early date. It stands nearest of the Breton pottery to the 'undifferentiated ancestral continuum' of the Westischekeramik postulated by Childe and equated by Mrs. Hawkes with Vouga's "neolithique ancien" and the undecorated wares of Chassy and our English Neolithic A i. It seems impossible to escape from the conclusion that this is the Breton representative of this early Neolithic culture, a further relation with the important Neolithic subgroup established at Hembury Fort in Devonshire being suggested by the occurrence in Brittany of the 'trumpet lug' found in Devon and other sites of the west of England and here regarded as a type fossil.

### 'Minnesota Man'

IN an analysis of the report by Dr. A. E. Jenks on 'Minnesota Man' (see *NATURE*, Oct. 2, p. 596) Dr. Alés Hrdlička criticizes the author's finding as to the antiquity and racial character of this skeleton (*American J. Phys. Anthropol.*, 22, 1937). There is, it is maintained, no certain geological evidence to indicate a Pleistocene age, while the characteristics of the skeletal remains point to a Sioux origin. As regards the geological evidence, there is a serious and irreparable uncertainty as to the original status of the ground above and immediately about the skeleton. All the circumstances point to a burial rather than a deposit after drowning. The generalizations in regard to man's coming to America in glacial times seem too categorical. The evidence is against a land-bridge between Asia and America in Pleistocene times. Mineralization of the bones has only a secondary relation to age. As regards the morphological evidence of the skeleton, in the various features enumerated as unique, unusual or primitive, Dr. Jenks is in part correct, but in part has been misled by defects in the parts, by the immature state of the skull and bones, through lack of sufficient comparative material or through over-concentration on small details. A re-examination of forty-one female Sioux skulls in the

National Museum collections leaves no uncertainty as to the Minnesota skeleton and its appurtenance. Its type is the characteristic type of the Sioux, which differs substantially from that of other North American Indians. As a Sioux, the skull and skeleton cannot possibly be assumed to be twenty, or ten, or even a few thousand years old. No Sioux sites show accumulations which would represent any such period; and on the other hand, though Minnesota was Sioux country, it could not be assumed that any type of American man could have remained in the same limited territory for thousands of years, and that without modification.

### Phosphorylation and Respiration

EVIDENCE is now accumulating to the effect that phosphorylations by animal tissues depend on an intact respiratory system. This is shown very clearly in recent observations by H. Kalckar (*Enzymologia*, 2, 47; 1937) on phosphorylations by kidney cortex tissue. The accumulation of phosphoric esters, consequent upon phosphorylation, was shown after the addition to the tissue of fluoride which inhibits kidney phosphatase. It was found that such esters only accumulated under aerobic conditions; under anaerobiosis no phosphorylation could be demonstrated. The addition of cyanide ( $N/1000$ ) to the system under aerobic conditions inhibited respiration and phosphorylation to the same extent. The inhibition of phosphorylation by anaerobiosis disappeared when oxygen was allowed to re-enter the system. The phosphorylated product from kidney cortex in presence of glucose, phosphate and fluoride was found to be fructose diphosphate. Similar results were found to take place with minced liver tissue.

### Food of the Little Owl

"SWEEPING statements about the damage done by the Little Owl have little justification in fact" is the interesting judgment made by the committee of scientific investigators reporting on the recently completed national survey on the food of the little owl (*Athene n. noctua*) conducted by the British Trust for Ornithology during the past two years (*British Birds*, November 1937). Despite the controversy over the food of the little owl, the repeated claims by gamekeepers and others that the bird was vermin and a great destroyer of pheasant and game chicks, and several statements that it was responsible for the extermination of nightingales in districts, the committee is of the unanimous opinion that the destruction of game, poultry or wild birds is negligible, and that, except in abnormal circumstances, the owl feeds wholly on insects and small mammals. The survey was conducted with the detailed thoroughness of previous surveys, and from March to July 1937 special studies were made on little owls nesting in game-rearing districts in 11 counties. In the general survey, which was under the organization of Miss Alice Hibbert-Ware, of Girton, Cambridge, 73 experienced field naturalists sent pellets, gizzards and larder- and nest-contents from 34 counties. In all, 2,460 pellets, material from 76 nests, and 28 gizzards of little owls were examined. Insects were in 23 gizzards, rodents in 11 and birds in five.

## Fossil Insects from the Permian of Kansas

SINCE the death of Dr. R. J. Tillyard, several important contributions by him have appeared in the *American Journal of Science*. It is only possible to mention two of these very briefly here. In the issue of April 1937, he deals with the only true Embiid so far found in Kansas Lower Permian rocks. This form is named *Protombia permiana* gen. et sp. nov., and is regarded as constituting the new suborder Protombriaria. This fossil has as its nearest related living form *Clathoda*. From the presence of an ovipositor and large compound eyes it is concluded that it was not a web-spinner to the extent that prevails among recent forms. The fore-tarsi, which normally contain spinning glands, are, however, missing from this fossil. In the September issue, Dr. Tillyard discusses the cockroaches or Blattaria from those same rocks. The most interesting feature here brought to light is the description given of the complete hind-wing of a Palaeozoic cockroach for the first time. The configuration of the wing in the genus *Pycnoblattina* is regarded as proving that the latter is ancestral to the archaic living termite *Mastotermes*. The conclusion is reached that the termites or Isoptera as an order were directly descended from the fossil cockroach family Spiloblattinidæ.

## A New Hydroid from Norway

COLLECTIONS of the bottom fauna from two localities on the west coast of Norway, where deposits of mud occurred, at a depth of from 10 to 40 metres, have revealed the presence of a minute and curious hydroid. In his description, Einar Westblad points to certain simple or primitive characters of this form: its small size, 1-1.5 mm.; its few tentacles, four normally but exceptionally three; the tetramerous arrangement of the ground plan; and the absence of perisarc (*Arkiv. Zoologi*, 29 B, No. 7; 1937). For the specimens, a new genus and species have been created, *Boreohydra simplex*, regarded by the author as a form intermediate between *Protohydra* and the more highly developed hydroids, falling into the same family of the Athecata as *Protohydra*. It is a curious feature of the species that it has no method of adhesion to a substratum, but lives with the lower end of the body simply embedded in the mud, after the manner of a newly settled larva of a cerianthid sea-anemone.

## Drying of Plant Materials

ALTHOUGH the drying of plant materials is widely practised commercially, the underlying principles have received comparatively little investigation. The experiments on factors affecting the rate of hop drying described by A. H. Burgess (*J. Inst. Brewing*, 43; 1937) are therefore necessarily of a fundamental nature. From previous work, a formula has been developed showing the effect of atmospheric humidity, temperature, air speed and depth of loading upon the rate of drying, from which the time required for drying hops at constant temperature can be calculated. In practice, however, it is necessary to raise the temperature gradually as drying proceeds, and in the present paper it is shown how this rise influences the time required for drying, and methods are described by which the time can be computed under such conditions. Although it has hitherto been generally accepted that the rate of evaporation is independent of the temperature of the air, heated air, such as is used in hop drying, is shown to promote

evaporation by transmitting heat to the hops. Further, the actual moisture-absorptive capacity of the air, which increases as its temperature rises, also influences the rate of drying. The total rate of evaporation from a very shallow layer of hops is proportional to the 0.39 power of the air speed.

## Ecology of Sooty Mould Fungi

SOOTY moulds consist of a number of different species of fungi growing together. The constituent organisms may be associated closely, or may be segregated, but their general appearance resembles a black felt of hyphæ. Miss Lilian Fraser has studied "The Distribution of Sooty Mould Fungi and its Relation to Certain Aspects of their Physiology" (*Proc. Linn. Soc. N.S. Wales*, 62, Pts. 1-2, 1937). The ecology of such composite moulds naturally depends upon the existence of conditions which are suitable for all the constituent fungi. Cultural requirements of a number of the commoner species are set forth in the paper, and various characteristic associations are described. Growth is usually slow, except during periods of damp weather. The 'honeydew' produced by many scale insects is a good medium for the growth of sooty moulds, but discourages such ubiquitous fungi as *Penicillium*. Its chief constituent is adonite, which is apparently responsible for its suitability.

## Diploid and Haploid Colonies of a Yeast

FROM a commercial yeast consisting of a strain of *Saccharomyces ellipsoideus*, a single cell was isolated, and from its descendants various cell and spore cultures were derived which throw light on the life history of this species (Winge and Laustsen, *Comptes Rendus, Lab. Carlsberg, Serie Physiol.*, 22, No. 6). By using a microdissection technique, the four spores from an ascus were isolated and cultivated. Normally they conjugate in pairs, forming diploid colonies. Isolated spores may germinate in two ways: (1) to form colonies of rounded (torula) cells with (evidently) haploid nuclei, some of which may later conjugate to form diploid colonies of elongated cells; (2) directly on germination an internal fusion of two nuclei may take place, producing at once elongated cells which are diploid. On plaster, the round haploid cells form no spores, whereas the elongated diploid cells function at once as sporangia. The colonies derived from the four spores of an ascus show genetic segregation and probably crossing-over. The four giant-colonies from an ascus do not necessarily show segregation in pairs. In one case the resulting colonies were all different, one being like the parent colony, one with concentric furrows and marginal scallops, one with deep radiate furrows, and one smooth, conical in shape and remaining persistently haploid. Sectoring was also observed. It is thus clear that diploid cells are normally heterozygous and will show segregation in later spore generations.

## Atomic Weight of Neodymium

THE considerable difference between the international atomic weight of neodymium (144.27) and that obtained by Aston with the mass-spectrograph (143.5) has led Hönigschmid to carry out a re-determination of this constant by the chemical method (*Naturwiss.*, 25, 701; 1937). Two neodymium preparations were used. X-ray spectroscopic analysis showed that they contained no other rare-earth elements in greater quantity than 0.04 per cent.

Neodymium trichloride was analysed, and as a mean of a large number of concordant results the value 144.27 was obtained for the atomic weight, in exact agreement with the international value at present accepted. The difference between the physical and chemical values is probably due (as suggested by Aston) to the existence of two heavy isotopes of neodymium of mass 148 and 150 (A. J. Dempster, *Proc. Amer. Phil. Soc.*, 75, 735; 1935), recently confirmed by Dempster (*Phys. Rev.*, [ii], 51, 289; 1937).

#### Action of Nitrous Acid on Amines

THE mechanism of the reaction between nitrous acid and amines is difficult to investigate owing to the instability of nitrous acid and the ease with which the initial products of the reaction undergo secondary changes. The reaction has, however, been studied by many workers, and most recently by J. C. Earl and N. G. Hills (*J. Proc. Roy. Soc. New South Wales*, 70, 322; 1937). The diazotization of aniline in methyl alcohol solution has been studied by dilatometric and conductimetric methods. The results show that the course of the initial reaction is the same for methylaniline as for aniline. The later stages of the reaction involve a rapid increase in hydrogen ion concentration. The reaction may occur between anilinium ions and nitrous acid, but an alternative explanation is that an initial reaction of which the velocity is increased by increasing hydrogen ion concentration proceeds until a critical concentration of the first reaction product is reached. This compound then decomposes, giving hydrogen ions, and causing a rapid decrease in volume and increase in conductivity.

#### Solvent Dewaxing

A GROUP of papers on solvent dewaxing was presented at a meeting of the Institution of Petroleum Technologists on November 9. M. Ba Thi, T. G. Hunter and A. W. Nash dealt with the subject from the phase-rule aspect, consideration being given to the use of double solvents, such as amyl alcohol/naphtha, which are completely miscible with oil at the dewaxing temperature. Representation by means of tetrahedra of simple quaternary systems of four independently variable components was described and application of these principles to equilibria in oil-wax-solvent mixtures discussed. Data deduced from such diagrams for the solvent-oil ratios employed were shown to be in agreement with experimental figures. Dr. Bruno Engel described dewaxing with chlorinated solvents, such as dichlorethane, and gave instances of distillates and residues derived from different crudes which have been dewaxed by the use of such solvents. Oils rich in asphalt and resins have been successfully treated. It has been found to be advantageous to carry out dewaxing in two or more stages, either by fractional precipitation of wax or by de-oiling the wax obtained. The cause of poor filterability and high oil retention of certain high boiling distillates was the subject of a paper by E. C. H. Kolvoort, F. R. Moser and C. G. Verver. In such cases, the wax has indefinite crystalline characteristics, suggesting the presence of branched-chain paraffins together with those of the normal type. A theory explaining how pour-point "depressors" prevent adsorption by such waxes was given. The advantages of methyl-*n*-butyl-ketone as a dewaxing solvent were indicated by O. S. Pokorny and R. K. Stratford. The authors gave data concerning wax solubility, miscibility temperature, vapour pressure,

stability, non-corrosiveness, non-toxicity, cost, etc., and concluded that the solvent should find a wide application for dewaxing purposes.

#### Metal-spraying

A PAPER by R. R. Sillifant, included in those of the recent Autumn Meeting of the Iron and Steel Institute, deals with the spraying of iron and steel with a wire-fed pistol. In normal circumstances the deposit consists of irregular particles flattened by the force of impact and surrounded by an oxide film which renders the deposit brittle. By using dissolved acetylene as the fuel gas in conjunction with nitrogen as the impelling medium, coupled with a suitable heat-treatment after spraying, steel deposits of high quality are obtained. Such a sprayed bar was bent cold through an angle of 90° without any sign of the dislodgement or fracture of the deposit. The technique employed is described, the heat-treatment for a deposit consisting of a steel containing 0.09 per cent of carbon being a two-hour heating at 900° C. The applications of the method in building up worn steel parts and possibly as a surface coating for cast iron are discussed.

#### Frictionless Torque-free Suspensions

FOR the measurement of minute forces, the torsion balance with a quartz suspension has proved invaluable. In his search for a still more sensitive instrument, Dr. F. T. Holmes of the University of Virginia has produced a magnetic suspension which he describes in the November issue of the *Review of Scientific Instruments*. A ferromagnetic needle is supported vertically with its upper end in the axis of and just below a vertical solenoid through which a current flows which is nearly sufficient to support the needle. The rest of the supporting force is provided by a smaller solenoid just below the former, and the current in it is so controlled as to make the needle stable. This is secured by providing the lower part of the needle with a cylindrical vane over the top of which a beam of light passes to fall on a photo-electric cell, the current from which operates an amplifier the output of which feeds the smaller solenoid. A downward motion of the needle admits of more light falling on the cell and the upward pull of the solenoid increases. Damping arrangements are provided. With a needle weighing 0.75 gm., a torsional couple of only  $7 \times 10^{-6}$  dyne cm. per radian was found and the author sees no reason why this should not be reduced considerably.

#### Hyperbolic or Spherical Space

DR. G. C. McVITTIE, in his recent monograph "Cosmological Theory", inferred that space is hyperbolic by an argument based on extrapolating Hubble's observations on the velocity-distance relations of the nebulae. Prof. E. Hubble himself (*Mon. Nat. Roy. Astro. Soc.*, 97, 506; 1937) has criticized this argument on the ground that the method used for extrapolation is unsatisfactory. Dr. McVittie has now shown (*Z. Astrophys.*, 14, 274; 1937) that Hubble's own methods of extrapolation imply hyperbolic space if the average mass of a nebula is taken to be  $2 \times 10^{10}$  times that of the sun. On the other hand, if the average mass is ten times this amount, then the magnitude of the probable errors in the observational formulæ show that spherical space lies within the bounds of possibility. Of course, any argument based on extrapolation into regions of space not accessible to observation must be received with reserve.

## Inland Water Survey in Great Britain

THE second annual report\* (1936-37) of the Inland Water Survey under the Ministry of Health and the Scottish Office continues the story of the progress of the Survey since the date of the previous report. It points out the magnitude of the undertaking and the considerable amount of preliminary work which has been found necessary. The replies to the questionnaire circulated at the outset of investigations showed that relatively little of the varied mass of information in existence was suitable for the purposes of the Survey, and that not only were improvements necessary in the methods in vogue for gauging and recording levels in rivers and streams, but also that a large number of additional gauging stations was required. During the period under review, the efforts of the Committee and its officers have been directed towards the introduction of better methods of survey and to the examination and rearrangement of existing records suitable for publication in a form which would serve as a model for future investigations.

Emphasis is rightly laid on the importance of the functions of the new catchment boards in obtaining a full knowledge of river flows and their variations. In order to assist the catchment boards and others co-operating in the same direction, an instructional memorandum on the water survey of a river system was prepared and published in October, 1936. It is added that during the year an increasing interest has been shown in the Survey, but the comment is made that this interest tends to manifest itself only in regard to those parts of a record which are of most use to the persons or bodies concerned. This is, of course, perfectly natural; but it is obviously insufficient for the purposes of a complete survey. Thus the catchment boards show a disposition to limit their observations to periods of high discharge,

when flooding is liable to occur, and to ignore periods of relatively low discharge. But periods of low discharge are important for pollution prevention and to fishery authorities, and fundamentally so to water undertakers, so that a survey must be comprehensive in its records if it is to be of service to all classes of the community.

Underground water measurement is a branch of the work of the Survey which is being carried on with the assistance of the Geological Survey, and a tribute is paid to the late Dr. Bernard Smith, director of the Geological Survey, who took a great interest in the Inland Water Survey and acted as one of its assessors.

Assistance in hydrographical field work is being given by outside bodies and individuals; in particular, by schoolboys under the direction of their headmasters and geography masters. Their services are being utilized in the location and measurement of wells.

The examination of certain river basins in detail, begun in the previous year, has been continued, and observations of a preliminary character have been made during the twelve months in regard to the Ness Basin, the Tay, Ouse (Yorkshire), Severn, Dee (Cheshire), Irvine, Clyde and Kelvin. The results of these investigations are set out in the report and a well-merited acknowledgement is made of the pioneer work of Captain W. N. McClean in founding and directing at his own expense the organization known as River Flow Records, which has carried out discharge measurements in the Ness Basin and elsewhere during the past eight years.

The investigations made and collected from various sources are being "converted, amplified, corrected, extended and consolidated". It is announced that a selection, dealing with the results from twenty-eight gauging stations in respect of fourteen river basins in Great Britain, will shortly be published.

BRYSSON CUNNINGHAM.

\* Ministry of Health and Scottish Office. Inland Water Survey Committee: Second Annual Report, 1936-37. Pp. 26. (London: H.M. Stationery Office, 1937.) 6d. net.

## Research Grants of the American Academy of Arts and Sciences

INCOME from the Permanent Science Fund of the American Academy of Arts and Sciences, according to agreement and declaration of trust, shall be applied to such scientific research as shall be selected . . . in "such sciences as Mathematics, Physics, Chemistry, Astronomy, Geology and Geography, Zoology, Botany, Anthropology, Psychology, Sociology and Economy, History and Philology, Engineering, Medicine and Surgery, Agriculture, Manufacturing and Commerce, Education, and any other science of any nature or description whether or not now known or now recognized as scientific; and may be applied to or through public or private associations, societies, or institutions, whether incorporated or not, or through one or more individuals."

Applications for grants under this indenture are considered by a committee of the Academy on stated dates only. The next such meeting will be to consider applications received in proper order on blank forms furnished by the committee on March 1, 1938. Correspondence, including requests for application forms, should be addressed to the chairman of the Committee on the Permanent Science Fund, Prof. John W. M. Bunker, Massachusetts Institute of Technology, Cambridge, Massachusetts.

Grants-in-aid from this fund were voted by the Academy on November 10, 1937, as follows:

Prof. Charles Chupp, Cornell University, 400 dollars, to aid in finishing a monograph of the fungus genus *Cercospora*.



Dr. Willi M. Cohn, research lecturer, University of California, 150 dollars to be used in printing, in the *Astrophysical Journal*, the results obtained on the polarization of the solar corona in the 1932 and 1934 eclipse expeditions.

Prof. Ada R. Hall and Helen W. Kaan, Wellesley College, 59 dollars, to assist in a histological investigation of the development of thyroid glands in rat embryos.

Prof. Robert S. Harris, Massachusetts Institute of Technology, 300 dollars, for the purchase of mothers' milk, to be used in an investigation of (a) the chemistry of the casein; (b) the antirachitic properties.

Dr. Francis R. Hunter, Rhode Island State College, 250 dollars, towards the purchase of a Barcroft-Warburg micro-respirometer, to be used in a comparative study of respiration and permeability.

Prof. Walter Landauer, Storrs Agricultural Experiment Station, 150 dollars, for the purchase of an analytical balance to be used in connexion with a quantitative study of growth in lethal embryos of creper and Cornish fowl.

Dr. Clarence C. Little, director of the Roscoe B. Jackson Memorial Laboratory, 1,000 dollars, to be used

to study the incidence of tumours and other growth abnormalities in a species cross in mice.

Dr. Karl E. Mason, Vanderbilt University School of Medicine, 500 dollars, for technical assistance in the development and standardization of trustworthy methods for the routine assay of food substances for their vitamin E content.

Prof. Arthur F. Scott, Reed College, 500 dollars, for the purchase of apparatus to be used in determinations of the atomic weights of beryllium and bismuth.

Drs. Kurt G. Stern and Abraham White, Yale University School of Medicine, 400 dollars, to be used for the construction of equipment for the study of the homogeneity and certain physical properties of highly purified protein preparations and protein derivatives.

Dr. John H. Welsh, Harvard University, 200 dollars, to enable him, during his sabbatical leave, to visit the laboratories of Prof. Koller at Kiel, and Prof. Hanström at Lund.

Prof. William F. Windle, Northwestern University Medical School, 500 dollars, for employing the services of a trained laboratory assistant in a study of neurological factors in the development of foetal respiration, and other general problems of foetal behaviour.

## Foundations of Terrestrial Life: The Soil and the Green Plant\*

THE ideas which I want to put forward may perhaps be indicated best by telling how and by what slow stages they grew up in my mind. A long time ago the late Prof. Gamble and I spent a very long time trying to find out how the green cells which give colour to the marine worm *Convoluta roscoffensis* get into the body of the animal, how they manage to increase and multiply there, and what is the impetus which drives them into the association. The conclusion which we reached as to the significance of the association between *Convoluta* and its green cells is nitrogen hunger. The symbiosis is only one of innumerable examples of the universal fact that the world of plants suffers, and has always suffered, from an insufficiency of nitrogen.

A good many years later, just after the Great War, the late Lord Melchett (then Sir Alfred Mond) and I spent a lot of time trying to improve the farm land surrounding Melchet Court. There was plenty of scope on soil which when it was not gravelly was clayey, and even when it wasn't was panned. Among other things, the effects of nitrogen and other fertilizers were tried on the grass land, and met with a success which was astonishing. In those days nitrogen was generally supposed to be bad for grass land. It was thus proved, however, to be wonderfully good, and that even when the poor grass land was supplied with a complete fertilizer and limed as well, the addition of more nitrogen produced more grass.

About that time, Sir Alfred Mond was taking a practical interest in the synthetic manufacture of ammonia, and there is no doubt that the results of our experiments on the value of nitrogen on grassland had something to do with his asking me

to give up an Oxford professorship and become director of agricultural research in the company which had been formed recently to develop the process at Billingham. The Research Station at Jeallot's Hill was established, and with the aid of colleagues I laid down and conducted a world-wide programme of experiments on the effects of nitrogen and other fertilizers on grass and arable land.

The next step in the development of my ideas was reached when on a visit to Ireland I was shown by one of our staff the almost incredibly swift response to nitrogen that rough, boggy, hillside grazings were making. Sedges and weeds of all kinds with scarcely any grass or clover began to disappear in a season or two, to be replaced by grasses and clovers, with the result that where before no grass grew there was soon good grazing.

The final step was reached in the course of feeding experiments with dried grass made at Jeallot's Hill. The results of the experiments showed that the winter milk of cows fed on a liberal ration of dried grass produced a butter with all the virtues of summer butter in it.

Looking back along this long, tortuous road, I find it difficult to believe that anybody could have been so slow to reach the conclusion to which it leads, or could require so much material on which to base a hypothesis which ought to have jumped to the mind long ago. The hypothesis is that the health and strength of people and their evolution, and the permanence of human societies depend on the soil and the green plant. The conclusions are that if the world has got on so well as it has with a half-starved vegetation and a hungry soil, how much better might it not get on when these deficiencies are discovered and made good.

F. KEEBLE.

\* The argument introduced in a series of three lectures delivered at the Royal Institution on November 30 and December 7 and 14.

## Museum Study of Man and his Work

A PAPER by Mr. de La Valette at a joint meeting of the Royal Society of Arts and the India Society on December 14, on the subject of Holland's colonial museums, raised the vital issue of the clash between the new tendency in science to co-ordinate its various branches devoted to the study of mankind and his works, and the old methods of museum arrangement which kept them severely apart.

This scientific humanism, as we may term it, though it is generally referred to as ethnography, covers much of the ground formerly divided up academically between the subjects of ethnology, anthropology, archæology, geography, history and art. It takes a group, racial or cultural, and studies it as a whole. In Holland, the makers of museums have adopted this point of view with enthusiasm, and have either altered drastically the old differently classified and over-crowded museums, or have built and endowed large new museums especially for the study and appreciation of the peoples and cultures of their overseas empire.

The Colonial Institute at Haarlem enables the Dutch people—students and ordinary citizens—to be initiated into the ancient civilizations embraced by their colonial possessions. Here man is not divorced from his inventions, his art and his accessories. He is shown, not as a 'laboratory specimen', but as a living human being whose racial features, geographic and climatic conditions and particular means of subsistence have forced him to live, dress, create—both in a religious and a material sense—in a manner peculiar to him. Films, lectures, photographs, booklets written by scholars and experts, fill out the picture and make the impact of new knowledge both sharper and deeper. The existence of this museum is almost entirely due to the acumen and enthusiastic enterprise of private individuals—bankers, colonial merchants, collectors and so forth.

Much the same policy is pursued by the Ethnographical Museum at Leyden, which is State supported

and controlled by the University of Leyden. Here is an immensely rich collection of Indonesian religious art and textiles, but although æsthetic values are brought out so far as possible by architectural means, judicious lighting and dramatic placing, yet these exhibits—the apex of a culture—are shown in their relation to the whole. They are not chunks broken off, so to speak, and existing in a vacuum.

In Great Britain the story is very different. The Victorian passion for collecting and labelling specimens has given us magnificently large, well-stocked museums, the policy and arrangement of which are still the old ones of dry scholastic classification. Objects are related in kind and time, but are divorced entirely from the men who made and used them. The only exception to this rule is the India Museum, part of the Victoria and Albert massif, which, under its new curator, Mr. K. de B. Codrington, is endeavouring to pursue this modern policy of co-ordination of all aspects of a nation's (in this case, a sub-continent's) civilization. There is serious talk, however, of this forward-looking policy being abandoned, the collection broken up, and the objects scattered, according to their ethnological, artistic or historic interest, through the various institutes of South Kensington.

Mr. de La Valette ended his talk with a strong bid not only for the continued existence of the India Museum as an entity, but also for a larger, really comprehensive India Museum on the same lines, which would combine its own collection with that of Indian and Indian-influenced objects belonging to the British Museum. This suggestion was supported by Sir Robert Witt (chairman), Lord Amulree and Sir James McKenna, among others. Sir A. Ramaswami Mudaliar made a moving plea that his great country should be studied sympathetically, and that its ancient art and culture, and its present development, should in England have a setting worthy of the Indian Empire.

## Science in Radium Therapy

THE annual reports, which the Medical Research Council has now issued since 1923, enable the reader in retrospect to see how the methods of treatment of disease by means of radium have been evolved from frank experimentation to a procedure based on some, though limited, knowledge of the reactions of living tissues to radiation and supported by precision data on dosage.

The current report, No. 226 of the Special Report Series, "Medical Uses of Radium", is a summary of the work of the Council's research centres for 1936 (London: H.M. Stationery Office). The general scope of the experimental section, pp. 7-16, includes work of a purely physical and biological nature, that of the clinical section being largely concerned with the methods and results of treatment of malignant disease. A section on the treatment of simple metrorrhagia, pp. 37-38, is, however, not only of great

clinical interest, but also affords a good example of the way in which a successful form of treatment has been evolved by the method of trial and error, with still no certainty as to the essential processes set into operation by radiation. As stated in the report, 837 cases have been under observation at the Marie Curie Hospital for from one to ten years, and of these 97 per cent of the menopausal cases and 78.5 per cent of the younger patients have remained well without further treatment. Yet there is no very definite evidence as to the relative importance of the actions of the rays upon (1) uterus and (2) ovary.

By reference to this and earlier reports, the reader can quickly see the chief methods in use in the treatment of cancer of the breast, uterus, mouth, nasopharynx, larynx, œsophagus and rectum. Not only so, but for each one of those sites there are statistical

data giving the results of treatment, ranging in some cases over so much as fifteen years, and rarely so little as five. The data, taken in conjunction with those issued by the National Radium Commission, are in effect the answer to the question: What is the value of radium in the treatment of cancer? There are sites, such as the œsophagus and rectum, where the data show that a permanent improvement in the condition is not as a rule to be expected. On the other hand, a patient exhibiting an early stage of the disease in cancer of the cervix uteri is after suitable radium treatment more likely than not to be free of the disease five to six years later.

Methods change, and the tendency for the last few years has been to avoid interstitial methods and replace them by the use of radium outside the body. Teleradium has been practised by several centres in Great Britain over a period of years, and an interesting account is given of the clinical uses of a one gram unit at the Middlesex Hospital.

Reference to the experimental section shows that researches essential to our understanding of the biological actions are being undertaken by several groups, notably at the Strangeways Laboratory at Cambridge, the Imperial College of Science and Technology, the Royal Cancer Hospital, the Mount Vernon Research Centre and at the Middlesex Hospital. As stated in the introduction, with leading principles being established, the make-shift ground of empiricism gives way to a surer basis of therapy. That basis is quickly becoming a scientific one, in the sense that doses of radiation are now prescribed and dispensed in a quantitative manner; this has been brought about only by long effort, an important step being the establishment of the rontgen as an X-ray unit. The Medical Research Council, systematically and over a course of years, has aided the work of the British X-ray Unit Committee, which had much to do with fixing the value of the unit now in general use.

## Cultural Successions in British Archæology

BRITISH archæology, perhaps, has profited more than any other field of archæological investigation by the recent diversion of interest from the more striking products of a culture to the building up of a culture complex as a whole. By this means it is now becoming possible to trace in greater detail and with more certainty the racial and cultural successions in Britain, and their interrelations, which went to make up the composite product appearing in these islands on the threshold of historic times. Hence the importance of such sites as Maiden Castle, St. Albans and Wheathampstead, on which more or less continuous or contiguous occupation over a comparatively long period affords an opportunity to follow the changes and modifications brought about by successive cultures.

These great sites, however, are exceptional; but an analogous opportunity, if on a somewhat lesser scale, is afforded for northern England by Eddisbury Hill, the Cheshire hill-fort, of which the recent excavation was described by Mr. W. J. Varley before the Ancient Monuments Society of Manchester on December 6. Here no less than six distinct cultural periods have been observed in the earthwork defences on the crest of the hill. A period of open occupation at the very close of the Bronze Age is represented by burial urns. This was followed by an immigration from the south, which was responsible for the largest hill-fort known in the north of England. An elaborate system of ramparts, ditches and entrances was built up during the first century B.C. This was still further enlarged under the threat of invasion by the Romans. This defensive system exceeds in complexity that of any other known Iron Age hill-fort in Britain. During the Roman occupation the rampart was dismantled and the ditches filled in. The hill lost its defensive character; and in late Roman times there is evidence of the floors of an open site occupation. The last cultural phase is early Saxon, of which relics have been discovered in a hut built over a filled-in ditch between two ramparts. Of traces of the Danish invasion none has hitherto been found; but excavation is not yet complete.

Another instance of a succession of occupations comes from Welwyn, which is all the more significant

in that it lies within the sphere of influence of the Belgic culture, which Dr. R. E. Mortimer Wheeler has described in the St. Albans area. The exploration of the Roman villa which was discovered by accident at Welwyn some five years ago points to the probability that this was a Roman farm; but further investigation shows that it had been preceded by a British, or rather a Belgic, farm.

As was pointed out by Mr. J. Ward Perkins, the excavator, in describing the site before the Society of Antiquaries on December 9, this is the first proved instance of the conversion of a pre-Roman into a Roman farm, although it would not be unreasonable to presume that this had happened with some frequency. The site is also notable for affording the rare evidence of a tower forming part of the Roman building. Such a tower might be presumed to be of frequent occurrence in Roman Britain, although actual traces of an upper story have not often been found. Here the lower part of the tower had walls of flint and brick, with coloured wall-plaster, while the upper part was of timber framing, probably filled with *pisé-de-terre*.

The result of the excavation at Welwyn is especially instructive from more than one point of view. The discovery of a pre-Roman agricultural occupation of the site links up with a number of discoveries of recent years bearing on the social and economic life of the period preceding the Roman invasion. That such discoveries have been made is to be traced in no small part to the efforts and influence of a research committee of the British Association, which directed attention to the significance of apparently unimportant and irrelevant finds on sites in Roman Britain by granting a small subsidy for many years to excavations on such sites in return for reports on the pre-Roman finds, which previously had been neglected. The growth from these small beginnings vindicates the prescience of those by whom the committee was instituted.

Further, and in the same connexion, the Welwyn excavation illustrates the advantages which may accrue from investigating the small and superficially unimportant site.

## Science News a Century Ago

### Quack Medicine

IN a letter to the *Lancet* of December 23, 1837, "A Constant Reader" writes as follows: "There is a new system adopted by the puffers of nostrums, which, in the country, must operate very injuriously to the public. The other day travelling in the country, I met with a person who, in proof of the good performed by a quack medicine, pulled out of his pocket a handbill in which were stated the opinions of the leading journals of the metropolis, of course, highly laudatory of the nostrum in question. The plan formed to deceive the public is as follows:—An advertisement is sent to, perhaps, half a dozen of the leading journals, containing the puff intended to be republished in the handbills of the advertiser. As soon, however, as the advertisement has appeared, it is printed in the handbills, as if coming from the editor of the paper, in which it was inserted as an advertisement, and thus many ignorant persons really believe it to be the opinion of that journal."

### Martin Van Marum (1750-1837)

ON December 26, 1837, the death of Martin Van Marum took place at Haarlem. He was born on March 20, 1750, at Groningen, and graduated there in medicine and philosophy. He afterwards practised medicine at Haarlem, but devoted much of his time to lecturing on physical subjects. He made a large number of experiments, especially in electricity, and devised a special form of the plate glass frictional electrical machine, which attracted a good deal of attention.

For more than forty years Van Marum was the secretary of the Dutch Society of Sciences at Haarlem. This Society had been founded in 1752 and was designed to include all branches of science and to further the search for everything necessary for the present and future prosperity of the country, both in its internal and external relations, in peace and war. Its motto was *Deo et Patriæ*. Its first secretary was the preacher Van der Aa, who was succeeded in 1794 by Van Marum, who held office until his death. It was probably through Van Marum that from about 1793 a more predominating place was given to physical science in its proceedings. In 1802 the Society published a volume of *Mechanical and Mathematical Transactions*, and in 1821-22 two volumes of *Philosophical Transactions*. Hooker, Lyell, Owen, Tyndall and Wheatstone were some of the foreign men of science elected to its membership.

### The "Göttinger Sieben"

WHEN Queen Victoria came to the throne of England, the crown of Hanover passed to Ernst, Duke of Cumberland, the fifth son of George II. One of his first acts was to suspend the constitution of the State. This act led to a protest by seven professors of the University of Göttingen, who were dismissed then from their posts. They were afterwards referred to as the "Göttinger Sieben". They were Wilhelm Albrecht, professor of law, Friedrich Dahmann, the historian, Heinrich Ewald, the theologian, Georg Gervinus, Jakob and Wilhelm Grimm, the philologists, and Wilhelm Ed. Weber (1804-1891), the physicist, who, with Gauss in 1833, had set up the first electric telegraph in Germany. As well as being dismissed from their posts, they were banished from the State, but not without meet-

ings of protests from other professors and the students. The streets of Göttingen had to be patrolled by soldiers, and coachmen were forbidden to stop for students with carriages to enable them to accompany the professors to the borders.

Extracts from the German papers were given in *The Times* of December 27, 1837, and it is stated that the students, not to be outdone, within the sixteen miles to Witzenhausen where, a number of exiled professors appeared with their families, were given a rousing reception. Weber was afterwards professor of physics at Leipzig, but returned to Göttingen in 1849.

### An Institution for the Advancement of Science

IN its column of "Weekly Gossip", the *Athenæum* of December 30, 1837, said: "Such of our readers as frequent Regent Street must have observed a pile of building growing up, of late, on the west side, soon after passing Oxford Street, and communicating with one of the houses in Cavendish Square. We are informed it is about to be opened as an Institution for the Advancement of the Arts and Professions, especially in connexion with Agriculture, Manufactures and other branches of Industry; and the advantages of the *Ecole Centrale des Arts et Manufactures* in Paris. The house in Cavendish Square will contain a Reading Room, Library, and accommodation for the meeting of persons for the purpose of an interest in promoting the objects of the Institution, or desirous of acquiring knowledge of such new discoveries as may, from time to time, be made public. To it will be attached the Gallery, now building, which is to be 127 feet by 40 feet wide and high, and adapted, we are informed, for the exhibition of various Models and apparatus illustrative of the various branches of Science and their application to the Arts; with a Laboratory, Experiment Room, a Theatre for Lectures, Consultation Rooms for the use of inventors, patentees, persons wishing to conduct experiments and persons seeking information on any point of science."

### University Events

**BIRMINGHAM.**—The degree of D.Sc. in industrial fermentation has been conferred on J. L. Shirburn for numerous papers, published in the *Journal of the Institution of Brewing*, on bacteriological subjects associated with the brewing and fermenting industry.

**CAMBRIDGE.**—A grant of £100 a year for five years is recommended to be paid from the Chest to the University for the upkeep of Wicken Fen.

The degree of Sc.D. has been conferred on W. G. Palmer of St. John's College.

**LONDON.**—The title of reader in civil engineering in the University has been conferred on Dr. J. H. Higgins in respect of the post held by him at Gresham College, Mary College.

The title of emeritus professor of chemistry in the University has been conferred on Prof. F. G. Donnan on his retirement from the University chair of chemistry at University College.

The degree of D.Sc. in botany has been awarded to Miss Katherine Warington, of Rotham Experimental Station, and that of D.Sc. in physiology to Miss Katherine Tansley, of University College.

## Societies and Academies

## Dublin

Royal Irish Academy, November 8.

K. G. EMELEUS and J. SAYERS: Negative ions in discharge tubes. Rules for the effects of negative ions of molecular dimensions on conductivity and structure in the electric discharge have been formulated. A statistical theory of ion equilibrium in the plasma has been developed; and a source of O-described.

H. SCHMITZ: Irish species of the dipterous family, Phoridae. The paper includes all previous Irish records for the flies of this family and in addition the results of six months (January–June 1937) intensive work at the group by the author and Fr. P. O'Kelly, S.J. Their combined efforts have increased our knowledge of the Irish Phoridae to the extent that there are now records for 117 species where previously we had only ten. Nine species new to science are described and new names proposed for hitherto wrongly identified species, necessary after re-examination of the types of Haliday's species in the National Museum, Dublin.

V. C. A. FERRARO: Functions of quaternions. A function of a quaternion is defined as one which possesses a differential coefficient independent of the differential quaternion. Two cases may be distinguished according as the differential is a pre- or post-factor. The most general type of such a function is arrived at, and suggestions as to other definitions of a function are discussed.

## Paris

Academy of Sciences, November 8 (*C.R.*, 205, 825–884).

SERGE BERNSTEIN: The best approximation of non-regular functions.

KENTARO YANO: The equations of geodesics in a variety with projective connexion.

RAPHAËL SALEM: Diophantine approximations and trigonometrical series.

ALFRED LIÉNARD: The generalization of a theorem of Privaloff.

FERNAND AIMOND: The equilibrium of convex surfaces.

RENÉ SWYNGEDAUF: The slipping of a transmission with unequal pulleys.

EMILE SEVIN: The action of the sources of stellar energy.

JEAN LOUIS DESTOUCHES: The unity of theoretical physics.

LUCIEN BULL and PIERRE GIRARD: The influence of electric and magnetic fields on the electric spark in air at atmospheric pressure. The effect of an electric field is constant, the spark is always curved with the convexity towards the anode. A magnetic field has generally no effect, but exceptionally one spark in a series shows curvature.

HUBERT FORESTIER and RICHARD LILLE: The influence of magnetic transformations on the velocity of formation of ferrite.

GEORGES DÉCHÈNE: Modifications of the phosphorescence of a semi-conducting zinc sulphide under the influence of an electric current.

MME. MARIE FREYMANN: Comparison of the absorption spectra of the amines in the states of liquid and vapour in the near infra-red.

HORIA HULUBEI: New researches on the element 87 (Ml). Discussion of some objections raised to the conclusions on an earlier communication. The lines are admittedly feeble, due to the small proportion of the element present, but the results given in the present paper strengthen the assumption of the existence of the element 87 (moldavium).

WILFRIED HELLER and Mlle. GERMAINE QUIMFE: The isothermal and reversible variation of the absorption in thixotropic salts.

RENÉ FREYMANN and Jules GUÉRON: Absorption spectra, in the near infra-red, of systems constituted by gaseous hydrochloric acid and an oxygenated organic solvent.

AUGUSTIN BOUTARIC and Mlle. SUZANNE THÉVENET: Variations of the viscosity of colloidal solutions of arsenic sulphide as a function of the time and under the influence of electrolytes.

MME. RAMART-LUCAS: The structure of coloured substances in the visible part of the spectrum according to their absorption spectrum.

ANTOINE WILLEMART: Researches on the dissociable anthracene oxides: the influence of fatty groups in the meso position.

LOUIS DUNOYER: Optical illusions produced by a rotating light (in a lighthouse).

EDMOND ROTHÉ and ELIE PETERSCHMITT: The mode of production of earthquakes. The distribution of compressions and expansions.

PIERRE LESAGE: The exchange of the seeds of *Lepidium sativum* between media at different temperatures. Studies on the duration of acquired precocity in plants grown in different climates.

PAUL BERTRAND: Remarks on the comparative ontogeny of living and fossil phanerogams. The correct interpretation of the organization of seedlings of phanerogams gives a means of reconstituting with sufficient accuracy the organization of seedlings of all fossil phanerogams, provided that there is a good transverse section of the stem and some indications on the structure of the root.

LOUIS BLARINGHEM: Remarks on the preceding communication.

JEAN BEAUVÉRIE: The granular structure of the chloroplasts: the stroma.

Mlle. LISE EMERIQUE: Experimental rickets in the guinea pig.

ANDRÉ LWOFF and HISATAKE DUSI: Thiazol, a growth factor for *Polytoma ocellatum*. The importance of the constituents of aneurine for the leucophyte flagellates.

## Amsterdam

Royal Academy (*Proc.*, 40, No. 8, October 1937).

F. A. VENING MEINESZ: (1) Second order disturbance terms in pendulum observations at sea. A discussion of Browne's correction terms and their possible experimental determination. (2) Determination of the earth's plasticity from the post-glacial uplift of Scandinavia: isostatic adjustment.

J. CLAY and G. VAN KLEEF: Conductivity of pure gases at high pressures. Neon and xenon become conducting even in the absence of an external ionizing agent at certain pressures between 60 and 80 atm.

J. G. VAN DER CORPUT: Weyl's method in the theory of numbers.

R. WEITZENBÖCK: Trivectors.

E. COHEN and W. A. T. COHEN-DE MEESTER: Daniel Gabriel Fahrenheit (2). A further contribution to the history of Fahrenheit.

H. BREMEKAMP : Carson's integral equation.  
HWA-CHUNG LEE : Differential geometry of contact transformations.

J. HAANTJES : Conformal representations of an  $n$ -dimensional Euclidean space with a non-definite fundamental form on itself.

J. M. VAN DER ZANDEN : Polymerides of methylchavicol.

A. W. H. VAN HERK : Chemical processes in the spadix of *Sauromatum* (3).

H. W. V. WILLEMS : Relation between the optical properties and the chemical composition of glaucophane.

G. C. HIRSCH : Outlines of a theory of the Golgi bodies (2). The Golgi bodies in time.

G. STIASNY : *Parerythropodium maris-tenebrosi* n.sp., a new alcyonarian from the coast of north-west Africa.

### Vienna

Academy of Sciences, October 21.

H. BENNDORF and MELITTA MITLACHER : Stationary air currents in closed vessels. It is found that the needle of a short-circuited electrometer moves with a period of one day. On certain days, a short-period motion is superposed on the diurnal motion. The short-period motion is due to fluctuations in the barometric pressure causing air to stream in and out of the case, while the diurnal motion is due to small temperature changes in the case of the electrometer setting up slowly varying, quasi-stationary air currents. The diurnal variation of these air currents may give rise to errors in large ionization chambers.

G. STETTER and F. PRANKL : Resonance effect in the disintegration of aluminium by  $\alpha$ -rays.

K. JEZEK : Stress in a lap weld with chamfered seam.

F. WESSELY, A. MÜNSTER and S. WANG : Catalytic hydrogenation of saturated lactones.

October 28.

W. J. MÜLLER and R. GRUBER : Comparative study of the reactivity of lignites and their cokes. The results given by different methods of measurement are compared.

E. BARONI and A. FINK : Concentration of  $D_2O$  in natural ice (4).

K. BRAUNER : Curvature property of manifolds of class 1.

F. WERNER : Fauna of the Peloponnesus, the islands of Cythera and Eubœa and the islets of the Saronic Gulf.

K. ZALESKY : Mammals of Lower Austria, with particular reference to the Gölseental.

November 4.

R. INZINGER : Curve invariants of cyclic series.  
S. MEYER : Age of the sun and the decay constant of actino-uranium.

E. CLAR : Stratigraphy of the Schwarzeck breccia in the Radstädter Tauern.

H. STROUHAL : Greek millipeds collected by Dr. F. Werner in 1937.

J. SCHNEIDER : Discovery of a female *Böi* skeleton at Vill near Innsbruck.

A. ERDELYI : Non-uniform strings with a parabolic distribution of density.

L. LÄMMERMAYR : Amount and nature of the growth of wood at and above the forest boundary.

## Appointments Vacant

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

JUNIOR ASSISTANT CHEMIST (male) at the Royal Ordnance Factory, Irvine—The Under-Secretary of State (C.5), The War Office, London, S.W.1 (January 3) (Quote Appts./60).

TECHNICAL OFFICER (radio development) at the Royal Aircraft Establishment, South Farnborough, Hants—The Chief Superintendent (January 8) (Ref. No. 526).

ONE BACTERIOLOGIST AND ONE NATURALIST in the Laboratories of the Freshwater Biological Association of the British Empire at Wray Castle, Ambleside, Westmorland—The Director (January 31).

LIVESY PROFESSOR OF COAL GAS AND FUEL INDUSTRIES in the University of Leeds—The Registrar (February 5).

ASSISTANT LECTURER in HORTICULTURE in Buckinghamshire—The Agricultural Organizer, County Offices, Aylesbury.

## Official Publications Received

### Great Britain and Ireland

Forestry Commission. Report of the National Forest Park Committee (Snowdonia), 1937. Pp. 5+1 plate. (London : H.M. Stationery Office.) 6d. net. [1611]

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Technical Publications of the International Tin Research and Development Council. Series A, No. 66 : Measurement of the Thickness of Tin Coatings on Steel by a Magnetic and Electromagnetic Method. By Dr. B. Chalmers, W. E. Hoare and W. H. Tait. Pp. 9. Free. Series B, No. 6 : The Wetting of Metals by Metals with particular reference to Tinning and Soldering. By E. J. Daniels and D. J. Macnaughtan. Pp. 11. Free. (London : International Tin Research and Development Council.) [1811]

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University of London : University College. Calendar, Session 1937-1938. Pp. lxxx+14+586+24. (London : Taylor and Francis, Ltd.) [1911]

### Other Countries

Proceedings of the Academy of Natural Sciences of Philadelphia, Vol. 89. Studies on the Family Acrididae (Orthoptera) of Venezuela. By H. Radclyffe Roberts. Pp. 343-368. Zoological Results of the George Vanderbilt African Expedition of 1934, Part 8 : Lepidoptera ; Rhopalocera. By Ezra T. Cresson, Jr. Pp. 369-384. Third Preliminary Report on the Results of the Second Dolan Expedition to West China and Tibet ; Four New Birds from Tibet. By Ernest Schäfer. Pp. 385-386. (Philadelphia : Academy of Natural Sciences.) [1611]

Union of South Africa : Department of Mines : Geological Survey. Memoir No. 33 : The Geology of the Country around Bethlehem and Kestell; with Special Reference to Oil Indications. By O. R. Van Eeden. Pp. 60. (Pretoria : Government Printer.) 7s. 6d., including Map. [1611]

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Annals of the Royal Botanic Garden, Calcutta. Vol. 14, Part 1 : An Account of the Genus *Dioscorea* in the East. Part 1 : The Species which Twine to the Left. By D. Prain and I. H. Burkill. Pp. 210+vi+85 plates. (Calcutta : Government Printing Office.) 75 rupees; £5 13s. 0d. [1911]

Smithsonian Miscellaneous Collections. Vol. 96, No. 6 : Growth of *Avena Coleoptile* and first Internode in Different Wave-length Bands of the Visible Spectrum. By Earl S. Johnston. (Publication 3444.) Pp. 19. (Washington, D.C. : Government Printing Office.) [1911]

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Klassische Philologie, Teil 1. (Antiquariatskatalog Nr. 716.) Pp. 240. Geschenkwerke aus allen Gebieten der Unterhaltung und des Wissens. (Bücher-Anzeiger No. 170.) Pp. 150. Mittelalter : Geschichte, Kulturgeschichte, Rechts- und Wirtschaftsgeschichte, Kirchengeschichte. (Antiquariatskatalog Nr. 718.) Pp. 272. (Leipzig : Gustav Fock, G.m.b.H.)

Catalogue Dissertationum, Philologicarum Classicarum. Editio III. Erläuterungsschriften zu den griechischen und lateinischen Schriftstellern, enthaltend die Literatur aus den Jahren 1911-1936. Pp. 176. (Leipzig : Gustav Fock, G.m.b.H.) 1.50 gold marks.

Dulau's Autumn 1937 Botanical Catalogue, with a few Miscellaneous Natural History Books in addition. (No. 266.) Pp. 45. (London : Dulau and Co., Ltd.)

A Short Catalogue of Books relating to Africa. (Catalogue N.S. No. 25.) Pp. 28. Books of Early Science, Medicine, etc. (Catalogue N.S. No. 26.) Pp. 42. Dawson's Periodica (English and Foreign.) (Catalogue N.S. No. 27.) Pp. 56. (London : Wm. Dawson and Sons, Ltd.)

English Books before 1700. (Catalogue No. 619.) Pp. 72. (London : Francis Edwards, Ltd.)

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Volumes marked with an asterisk (\*) have been received at "NATURE" Office

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**Busch, H., und Brüche, E.,** Herausgegeben von. Beiträge zur Elektronenoptik. Roy. 8vo. Pp. 156. (Leipzig: Johann Ambrosius Barth, 1937.) 16.50 gold marks.

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**Kaván, George.** Factor Tables giving the Complete Decomposition into Prime Factors of all Numbers up to 256,000. 4to. Pp. xii + 514. (London: Macmillan and Co., Ltd., 1937.) 42s. net.\*

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