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## Food and the Nation

IN those wonder-promising days of the Victorian era, when all seemed well with the world because the *beati possidentes* alone were vocal, there appeared to be general agreement that the functions of the State should be confined to upholding justice, to protecting citizens against aggression, and to providing certain public health services, such as sanitation and preventing the spread of epidemics. As time went on, State intervention was extended to the provision of primary education, old-age pensions, health insurance and unemployment benefit; but it is only recently that the scandal of the slums has compelled Parliament to assist in providing decent housing accommodation for the poorer classes. Last of all, there is now a clear call for the State to take a hand in providing adequate food for the million.

It is strange that this most essential of all the basic needs of man should have been recognised so tardily, except for certain regulations governing chemical and bacteriological purity. It is true that there are some half-dozen Government departments dealing with certain aspects of national nutrition; but there has hitherto been no unified direction, no settled policy and no legislation either based upon, or in any way recognising, the principle that every man who does his duty by the community shall by legal right, and not by charity, be secured from hunger or from the ill-health associated with an inadequate dietary. To-day the word 'inadequate' applies to quality as well as to quantity, for scientific research has shown that man cannot live by calories alone; in addition to proteins, fats and carbohydrates, he

needs certain essential vitamins and minerals that are largely to be found in fresh dairy produce, eggs, fruit and vegetables. Was it not Lavoisier who lamented the fact that the very people who needed most food and nutritious food—the labouring classes—were precisely those who were least able to afford it? What Lavoisier said towards the end of the eighteenth century applies with particular force to-day, especially in regard to nutritional quality.

Sir John Orr, in a remarkable address to the British Association at Norwich, told us that estimates show how in this year of grace 1935 there are some twenty million people—more than forty per cent of the population of Great Britain—who, largely owing to poverty, do not enjoy a diet which according to the modern science of nutrition is completely adequate for health, so that diseases due to malnutrition are still rife. In view of the glut of all kinds of food, this state of affairs is disturbing the public conscience. Although there is a great lack of authentic data, recent investigations by the staffs of the Rowett Institute and the Market Supply Commission indicate that consumption of milk, eggs, fruit and vegetables rises uniformly with income; and that physique is worse, and disease is more prevalent, in the poorer classes. The diet of the lowest income group—those earning ten shillings or less a head of the family each week—is markedly deficient from the point of view of health, and a minimum family income of about £1 a head each week is needed.

To bring the diet of the poorer sections of the community up to the standard required for health



would involve an increased food consumption of 10 per cent, representing at retail prices a hundred million pounds per annum, and to bring all diets up to the average of those of the income level of 25s. a head a week would require 20 per cent more food and two hundred million pounds greater expenditure at retail prices. The additional food, consisting mainly of fruit and vegetables, and animal products such as milk and eggs, could be produced at home without prejudicing our export trade or the interests of our overseas investments, and, of course, our agriculture would benefit greatly.

The measures that have recently been taken to encourage home food-production, by raising prices to a level assuring adequate returns to producers, suffer from the drawback that they maintain food at prices that retard consumption. Therefore they cannot be regarded as elements of a permanent policy. Sir John Orr would like to see the present marketing boards assume the role of public utility companies, which would control slaughter-houses, bacon factories, milk-depots, etc., buy from the farmer and sell to the distributing trades, making the staple foodstuffs available at a special low price to the poorest classes. Such an organisation would in itself lower retail prices by reducing distribution costs, and the rest of the gulf between the price paid to the farmer and the money received from the consumer would be bridged by a direct State subsidy. The ultimate effect of this subsidy would be to reduce State expenditure on public health and social services; meanwhile, it would promote internal trade, stimulate industries, and bring back money to the Treasury in the form of income-tax and other receipts.

Increased consumption, as Sir John says, is the crux of the problem, and in this connexion attention should be directed to that rare thing, a successful economic experiment, which was carried out early this year by the Potato Marketing Board in the depressed area at Bishop Auckland, Co. Durham\*. This area has a population of 19,000, which in February last included 5,000 insured male workers, of whom 2,400 were unemployed. For a period of eight weeks in February and March, potatoes were sold to the unemployed and their dependants (33 per cent of the population) at 4d. per stone, as compared with the ruling price of 7d. per stone. Each buyer had to get a retailer to stamp a voucher, present it at a central warehouse,

pay cash and take away his purchase in his own container. The Board paid to the retailer 1d. per stone of potatoes sold, as compensation for loss of trade, and 10s. per ton to the wholesale merchants for services rendered. About 94 per cent of the issued vouchers were used; 187 tons of potatoes were purchased by the Board at an average price of 59s. per ton, and deducting wastage, 182 tons were sold. The total expenditure of the Board (exclusive of overheads) was £297, comprising £111 for warehouse distribution, £121 for compensation to retailers (13s. 3½d. per ton of potatoes sold), and £65 for wholesale merchants. It was found that, although sales from retail shops fell to 60 per cent of the normal, total sales increased by 96 per cent above the normal, or 69 per cent if full allowances be made for loss of trade sustained by fish-fryers, and for a big reduction in sales during April. No change in the dietary of the unemployed was observed other than an increased consumption of potatoes.

The experiment may, therefore, be held to show that increased consumption of a cheap and valuable commodity like potatoes will follow a drastic reduction in price. The Board does not suggest that the method is of general application; nevertheless, as an emergency measure for the relief of the unemployed, or for disposing of surplus stocks, for example, of milk or meat, it might well receive the consideration of public bodies. Nor would it be maintained that all the evils associated with an unorganised distributive system, or those due to maldistribution in general, could be solved by such means.

One of the most important questions of the day is whether the existing economic system can be modified and amended in such manner that the satisfaction of primary human needs no longer remains subservient to the making of profits. Such schemes as that of Sir John Orr, which has been publicly approved by the Minister of Agriculture, may suffice to raise the general standard of living to a level commensurate with the abundance of supplies that modern industry, based upon modern science, has placed at our disposal, and in accordance with the dictates of the modern social conscience. Failing their success, the only alternative, short of pure communism, appears to be an amount of State control of trade and finance likely to provoke widespread opposition in a people still retaining a degree of liberty of action. After all, there seems to be no reason why, with abundance knocking at the door,

\* An Experiment in the Distribution of Potatoes at Bishop Auckland, February-March, 1935. Potato Marketing Board, Miscellaneous Publications, No. 2. 1s.



every working citizen should not be guaranteed a sufficiency of the basic necessities of life, namely, food, housing, light and fuel, without prejudicing the interests of those who are more fortunately placed.

Those who look askance at the encroachments on personal liberty which such a policy would appear to entail, might consider the dictum of Huxley: "The only liberty I care about is the liberty to do right". Is there not a moral obligation on the part of the State to ensure the bare minima of the means of subsistence to all who render service to it? And what a brave new world might arise, what developments might follow if the

thoughts of even a fraction of those who are now at their wit's end to meet the requirements of daily life could by such means be diverted into the cultural channels of art, science, philosophy and letters! Many no doubt will urge that it is one thing for the State to provide such means towards a fuller life, but quite another for men to use them in the way intended. The answer to that contention is that man, in the mass, has not yet been given the opportunity, and that his future progress depends primarily upon his ability to master and improve his environment, and to provide the young with the best all-round education that his wits can devise.

## Original Sources in Physics

### A Source Book in Physics

By Prof. W. F. Magie. (Source Books in the History of the Sciences.) Pp. xiv+620. (New York and London: McGraw-Hill Book Co., Inc., 1935.) 30s. net.

TWO great efforts to present to the physicist and chemist the *ipsissima verba* or translations of some of the fundamental contributions to science come to mind as one turns the pages of this latest 'source book'—Ostwald's *Klassiker* and the publications of the Alembic Club. He is fortunate who has easy access to a full set of the *Klassiker*—its hundred-odd reprints represent a remarkable attempt to collect in one group those contributions to the advancement of the physical sciences which may be regarded as classic. The publications of the Alembic Club are fewer in number and more restricted in character—they cover certain of the classics of chemical science—and it is interesting to note that a term has not yet been set to the activities of the Club, as reprints, sponsored by Dr. Leonard Dobbin, are still appearing under its name.

It is, perhaps, impossible to consider the publication in English of a series of reprints covering so wide a field as Ostwald has surveyed, and until such a venture becomes possible, we must be content with the very good second-best which Prof. Magie has provided for us. He has shown conclusively—and some of his audience were inclined to be sceptical about it—that it is possible to give something of the atmosphere of a physical paper by selections, brief enough to keep his book within moderate compass, yet chosen so as to illustrate the central thesis of a theoretical

analysis or the essentials of a piece of experimental work.

The main sections of the book are headed mechanics, properties of matter, sound, heat, light, magnetism and electricity; selections from some one hundred and fifty papers are given; and the authors range, in time, from Stevinus, Galileo, Huygens and Newton, to Maxwell, J. J. Thomson, Zeeman, Röntgen and the Curies. A brief account of the life of an author precedes the selection from his papers.

The selections are far from being snippets; they convey something of the method and outlook of the author, and they provide a reference book which serves to elucidate certain obscure and doubtful passages in the ordinary texts. Once again we are privileged to hear Boyle telling how he took "a long glass-tube which, by a dexterous hand and the help of a lamp, was in such a manner crooked at the bottom that the part turned up was almost parallel to the rest of the tube"; and how, having closed the shorter end of the tube, he imprisoned air therein, and "began to pour quicksilver into the longer leg of the siphon, which . . . did . . . straighten the included air: and continuing this pouring in of quicksilver till the air in the shorter leg was by condensation reduced to take up by half the space it possessed (I say, possessed, not filled) before", how he "observed, not without delight and satisfaction, that the quicksilver in that longer part of the tube was 29 inches higher than the other".

We may read for ourselves what Grimaldi really saw in 1658; and if we want to know whether Römer did or did not enunciate a sort of Doppler principle, regarding Jupiter as a body sending



signals to the earth at regular intervals, and now moving towards, now away from the earth, so that the observed intervals varied correspondingly, the evidence is before us. We have the text of Davy's experiments on friction, and we can see for ourselves that Newton's law of cooling was established for forced convection—for bodies *cooling in a breeze*.

This last paper is specially interesting; it is brief, it was published anonymously, and its topic is that of a "Scale of Degrees of Heat". The scale is duodecimal, the zero being the temperature of freezing water, and  $12^\circ$  the normal temperature of the human body. Various temperatures are recorded;  $34^\circ$  is the "heat with which water boils vehemently",  $96^\circ$  is the "least heat with which lead melts", and the highest temperature recorded ( $200^\circ$ – $210^\circ$ ) is the "heat of a small fire made of wood". The scale is established with the assistance of a linseed oil thermometer and red-hot iron.

The translation in the volume under review tells us that Newton "heated a large enough block of iron until it was glowing, and taking it from the fire with a forceps while it was still glowing I placed it at once in a cold place where the wind was constantly blowing; and placing on it little pieces of various metals and other liquifiable bodies I noted the times of cooling until all these bodies lost their fluidity and hardened, and until the heat of the iron became equal to the heat of the human body". He then proceeds to determine the "heats" under review by assuming that the "excess of the heat of the iron and of the hardening bodies above the heat of the atmosphere, found

by the thermometer, were in geometrical progression, when the times were in arithmetical progression".

An interesting point arises concerning the details of part of this translation. It happens that a translation of Newton's paper was appended by Robert Smith to his edition of Cotes' "Hydrostatical and Pneumatical Lectures" (3rd edition, 1775), a useful little volume which contains as an appendix, not only Newton's paper, but also Halley on the reason for the rise and fall of the barometer with change of weather, and Jurin on capillarity. Smith's translation reads, "I heated a piece of iron . . . till it became redhot, and taking it from the fire with the tongs likewise red-hot, . . . upon it I laid particles . . . and noted the several instants of time when by cooling they lost their fluidity and began to coagulate. . . ." The differences are slight but significant and, accuracy apart, the existence of an almost contemporary translation raises the point whether it is not preferable to employ such a translation whenever possible, as more likely to give the atmosphere of the original.

It is impossible to give more than the slightest indication of the generous loading of the table which Prof. Magie has spread. Faraday, Ampère, Coulomb, Hertz; Ohm, Joule, Rowland and Hall; Stokes, Kirchhoff, Balmer and Stefan; these are but a few of the hundred or so authors represented, and there are remarkably few omissions. In the ranks of writers now dead, Waterston should certainly have been included; and there are some obvious omissions of the names of workers still with us.

A. F.

## A New Botanical Annual

### Chronica Botanica

Edited by Dr. Fr. Verdoorn. Vol. 1, 1935. Pp. 448. (Leyden: Chronica Botanica, 1935.) 15 guilders.

**T**HIS new periodical provides abundant matter of many-sided botanical interest. When the editor put forward his general scheme there were many who thought it impossible to carry out in a satisfactory manner, but although there is considerable unevenness of treatment there can be no doubt that the result is very satisfactory. Roughly, the idea is to give the most recent information about the four thousand or so institutions concerned with pure or applied botany and the researches of the sixty or seventy thousand botanists—and to do this annually.

The volume is divided into three parts which

are readily recognised by the yellow, red and blue colouring of the page edges.

The first part (75 pages) deals with a number of heterogeneous subjects. It opens with an article by Dr. E. D. Merrill on "International Co-operation among Botanists", which is a statement of general customs and a plea for their present continuance and future development. Then follows an almanac which, among other matters, gives the birthdays of many former botanists and present ones (with some age restriction); and an outline programme of the Sixth International Botanical Congress held at Amsterdam on September 2–9 with photographs of the Committee and Recorders and of a dozen prominent botanists who have passed away since the last Congress in 1930. Dr. T. A. Sprague then gives a brief "Survey of Nomenclature (1930–35)" mainly concerned with



the effect of the death of Dr. J. Briquet in 1931. Dr. A. B. Rendle contributes "A Short History of the International Botanical Congresses" which goes beyond the Paris Congress of 1900 and begins with the Brussels Congrès International d'Horticulture, 1864: this is the longest article in the volume, and is a most useful and interesting account of a little-known subject. It is followed by thirty-five pages giving information about "International and Important Congresses, Committees, and Societies": those who hold there are too many congresses will surely find some arguments here in favour of their opinion.

The next 258 pages form the main part of the volume. This is a "Review of all Branches of Plant Science during 1934" arranged alphabetically by countries and further subdivided alphabetically. To get the information, a set of questions was sent out. Institutions answered in different ways and at various lengths, which accounts for a good deal of the unevenness of treatment. Research programmes, changes in staff, new buildings, investigations being carried out, explorations, extensions, publications—indeed everything that might be considered of general botanical interest, or of special interest to those working in the same field. This is supplemented by information found by the editor in periodicals; *NATURE* and *Science*

being well combed. But there are others: for example, "*Sovjetskaja Botanica* announces that botanical lectures are regularly given to the soldiers of the Red Army, who are said to be deeply interested in this new feature". This section ought to prove of the greatest value to workers in every branch of botany, for the pages are packed with information.

The last section is again heterogeneous. It begins with "Correspondence", the sixteen letters covering a wide field: there are also half a dozen queries. Two pages are devoted to new periodicals and thirty-four pages to new and changed addresses, which is really a supplement to the "International Botanical Address Book". A touch of intentional humour is provided by "A Short Illustrated History of Botany in the Netherlands" which consists of twenty-eight sketches with legends. Forty-five pages of advertisement and two indexes complete the work.

The volume is very well produced with abundant illustrations. The type, though small, is clear.

The compilation of such a mass of detailed information has meant an enormous amount of labour, and it is to be hoped that Dr. Verdoorn, who has placed botanists under an obligation, will receive the necessary help to go on with this publication.

J. R.

## Practical Aspects of Illumination

### (1) A Symposium on Illumination

Contributing Authors: J. F. Colquhoun, W. J. Jones, J. T. MacGregor-Morris, C. C. Paterson, A. B. Read, F. C. Smith, J. W. T. Walsh, H. C. Weston, G. H. Wilson. Edited by C. J. W. Grieson. Pp. xv + 229 + 20 plates. (London: Chapman and Hall, Ltd., 1935.) 13s. 6d. net.

### (2) Lighting Calculations

By Prof. H. H. Higbie. Pp. xi + 503. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1934.) 31s. net.

### (3) Encyclopédie photométrique

Quatrième section: Cas extrêmes. Tome 4: Photométrie des lumières brèves ou variables. Par Madame Marguerite Moreau-Hanot. Pp. iv + 126. (Paris: Éditions de la *Revue d'Optique théorique et instrumentale*, 1934.) 25 francs.

THE march of progress in illuminating engineering is aptly illustrated by the three books before us. (1) The first of these, "A Symposium on Illumination", comprises a series of lectures by experts, delivered in London under the joint auspices of the National Illumination Committee

and the Illuminating Engineering Society in 1933. The book covers a wide field. Mr. C. C. Paterson's initial address on "Light in the Service of Mankind" is followed by lectures on radiation, gas and electric lamps, photometry, daylight and various applications (public lighting, etc.). The book thus represents a survey of modern knowledge, in the main simple and concise. As Lieut.-Col. Kenelm Edgcumbe suggests in his foreword, it should be of interest to the non-technical, or at least the semi-technical reader. Probably, however, the chief appeal of the book will be to students, giving them an insight into a subject on which everyone ought to know something.

(2) Prof. Higbie's treatise on "Lighting Calculations", on the other hand, is primarily a book for those who make lighting their vocation. In his ten chapters, all devoted to different types, he shows how numerous and varied are the computations that enter into the treatment of lighting problems, and succeeds in answering the question set in his first chapter, "Why bother about Lighting Calculations?" The initial chapters deal with the simpler problems. Following discussions of linear



and surface sources of light, we come to what is perhaps the most usual calculation in connexion with illumination—the predetermination of illumination by the aid of the utilisation coefficient. The apparent intricacy and elaboration of the tabular data here presented is justified by the wide use that can be made of this method, which has been shown to be applicable even to installations of a highly modern and original type.

It may come as a surprise to find from other chapters that calculations may be made on such matters as glare, shadows and the sufficiency or otherwise of the illumination provided. Problems (often containing a useful reference to some specific article or paper) are presented at the end of each chapter. More than two hundred such tests are included in the book, which is terminated by a needful but adequate index.

(3) The third volume, edited by Mme. Marguerite Moreau-Hanot, is of a still more specialised character. It forms one of a series of monographs

by experts, dealing with different aspects of photometry, and is devoted exclusively to the measurement of light impulses of short duration. Such matters as the perception of transient lights, persistence of vision, the use of photoelectric cells and the measurement of variable sources are discussed. In conclusion, some reference is made to television and the optical reproduction of sound. Naturally not all the matter is of an original character—some covers ground familiar to the photometric expert—but the assembly of material makes an instructive whole.

Some of the problems handled, such as the recording of variable candlepower from fluctuating sources and lights of short duration, the measurement of variable illumination, the persistence of luminous impressions and the study of the duration of phosphorescence are of considerable interest. The book takes the reader into various by-ways of photometry not ordinarily encountered.

J. S. D.

## The Hake and its Fishery

### The Hake and the Hake Fishery:

being the Buckland Lectures for 1934. By C. F. Hickling. Pp. 142. (London: Edward Arnold and Co., 1935.) 3s. 6d. net.

THE author's interest in the hake fishery commenced when he was an undergraduate in 1923, and ever since he has been detailed to its study as an officer of the Ministry of Agriculture and Fisheries. This means that he has gone to sea on the Milford Haven and Fleetwood trawlers for two or three months every year, with occasional cruises on research vessels.

The hake is essentially a southern fish, and the English coasts are the northern part of its range, for it extends south to Senegal and, in the Mediterranean, even as far as Palestine. It is a warm water fish, and its prevalence in British waters is largely due to the extent to which the warmer currents reach our shores. Its home is in comparatively deep water, and commercial catches have been made at 450 fathoms. It is not, however, a bottom feeder, its habit being to rest on the bottom in the daytime and to come up to the midwaters for its food at night. Spawning is at 120 fathoms and shallower depths, commencing about April in the deepest waters and then gradually at lesser depths as the summer proceeds. The male spawns when four years old and the female at ten years, then sizes about 11 in. and 30 in.; but they vary,

for the fish grow faster in warmer water, even though such water has less of the ultimate food (diatoms and other plants) on which all animals depend.

The female lays upwards of two million eggs, and fertilisation is in the sea-water, the eggs floating at the mercy of the currents. To a certain degree, the abundance of hake in subsequent years can be foretold by studying their numbers. In the youngest and most vulnerable stages, the food consists largely of crustaceans, but these are gradually replaced by other fish and squids, the adults having marked cannibalistic tendencies. Few ten-year fish are now caught in British waters, the large fish having decreased in the catches by  $7\frac{1}{2}$  per cent per annum for the last ten years—and the author does not suggest any migratory replacement from the south. This means less and less spawn being deposited on the breeding grounds to the west of the British Isles and constitutes a real danger to the fishery, the fish being caught faster than they can make good the loss of their stock by breeding and growth.

The above story is told mainly on the author's own researches. What are his remedies? At first we always seek aid from history, and that does not help us much here. In 1890, hake were hawked all over the west country at 1d. per lb. under the name of "Torbay salmon"; by 1900 the price had gone to 2d. Morley then made his voyages of



exploration and others followed; the result was the opening up of the Spanish and other southern grounds. In 1907 the price was still low, but the quantity was large and there were also soles in the hake catches to add to the profit. Great trawler fleets for this fishery grew up in the west, and one fleet moved from Ireland. In this year the Press began to take an interest, with the result that in the next years hake entered into the 'prime fish' category, and the trawlers, while catching less, made better profits. The absence of fishing during the War stopped any decline in this and all the fisheries of the west Atlantic, our hake trawlers being mainly located in the eastern Mediterranean for mine sweeping. However, western Europe was quite alive to the problems, and the International Council for the Exploration of the Sea came together again in 1920. Hake was a major subject for discussion and inquiry, and the statistics were greatly improved. These show a steady strong demand especially for small hake, and the price far exceeds that of the related cod and haddock.

Withal there is a disturbing loss in catch which has to be stopped, while due attention must be paid to the sufficiency of breeding fish. Any young fish brought to the deck from the trawl are dead owing to the decrease of pressure affecting their air bladders. It is impossible to close grounds in the high seas, and the trawl owner must not take a cynical line—perhaps because he is getting old and thinking of retiring—in resisting the examination of his actual method of catching. The writer remembers nearly thirty years ago a series of conferences in the greater fish ports, where the size of the mesh of the trawl was always discussed. About twenty years later, the matter was considered by the British Fisheries Association, which ought never to have been killed or allowed to die. It was contended that a larger mesh to the trawl would allow many of the smaller, less marketable and much less valuable fish (per pound weight), to escape, while the trawl would clear itself of much of its 'rubbish', move more easily over the bottom, this securing more fish, and would arrive on the deck with its catch less bruised and in better condition for market. It was confidently anticipated that the industry would make its own experiments, but its psychology was antagonistic. Its energies were largely directed to new grounds, to be discovered near British coasts by the Ministry, or to fishing in greater depths, where there cannot be food to support a rich fish fauna, or to proceeding farther afield, in this latter alone (west of Greenland) success being achieved. The industry improved its trawls, but it never, so far as the writer knows, made any scientific experiment with its trawl mesh.

Now the Ministry, acting through Messrs. Davis and Hickling, have done the industry's work, as in these lectures all may read. They have by most ingenious means proved that, with a larger mesh, the smaller hake escape from the trawl while it is actually on the bottom, its contents experiencing no change in pressure and remaining alive. At the same time it is shown that the market value of the catch is slightly increased. The remedy suggested for the hake is the application of this, for a larger mesh would allow an immensely greater proportion of the young fish to continue their growth, and this in a few years should increase the breeding stock, while meantime the fishery after readjustment should be more profitable. It is possible that on certain grounds there would be a lesser catch of soles, but usually in trawling one fish dominates the plan of each voyage, the profit of which depends upon it.

The above work of the Ministry is applicable to the haddock, cod and many fish, and its scientific staff are to be heartily congratulated upon it and many other lines of applied science. Biologists should know the Ministry's work, for it is the most important ecological work being carried on from Great Britain to-day. They should examine its results, so that their expressed ideas may be considered views which may help to form public opinion, not merely expressions against State action that scientific men often lightly express. Furthermore, it would pay the industry to reprint this little book in a cheap form and place it in the hands of every trawler man, for there is no doubt that education makes for efficiency in this as in all other trades. The fishing industry, it must never be forgotten, is a basal industry, essential to Great Britain as a maritime power.

J. S. G.

#### Plato's Theory of Knowledge:

the *Theaetetus* and the *Sophist* of Plato translated with a Running Commentary. By Prof. Francis Macdonald Cornford. (International Library of Psychology, Philosophy and Scientific Method.) Pp. xiv+336. (London: Kegan Paul and Co., Ltd.; New York: Harcourt, Brace and Co., 1935.) 15s. net.

It would have been a real treat for philosophers to have a genuine study of Plato's "Theory of Knowledge" by Prof. Cornford. As it stands, however, the title of the book is misleading as it offers no more than an excellent translation of the "Theaetetus" and the "Sophist" with a running commentary. The latter will be found most useful and inspiring by all students of Plato's philosophy, for it aims at discovering what Plato really means and how the arguments of these two dialogues are related to the rest of his work.



**Catalogue of the Fossil Cephalopoda in the British Museum (Natural History)**

Part 4: The Ammonoidea of the Trias. By Dr. L. F. Spath. Pp. xvi+521+18 plates. (London: British Museum (Natural History), 1934.) n.p.

PARTS 1 to 3 of this Catalogue by Foord and Crick, dealing with the Nautiloids and Palaeozoic Ammonoids, were published in 1887, 1891 and 1897 respectively. The new part, although of larger size, includes only about half of the Triassic Ammonoids, namely, the Pronoritida, Xenodiscida, Meekoceratida, and part of the Ceratitida, nearly all occurring in the Lower and Middle Trias. The remaining groups, of Middle and Upper Triassic age, will be dealt with in the succeeding volume. Since the last part was published, our knowledge of Palaeozoic Ammonoids has increased considerably, so that the author can now affirm that true Ammonites were already prolific in the Upper Palaeozoic, and that the Permian System, contrary to the views of some British geologists, has fully justified its existence.

In the introduction the author gives a critical review of the classifications of Goniatites proposed by previous writers, and expresses in tabular form his own view of the interrelations of the Palaeozoic Ammonoids and their connexion with the Lower Triassic Ammonites. In a section on "Chronology and Stratigraphy" he gives a very valuable account of the zonal divisions and correlation of the Triassic deposits, and concludes from his study of the successive faunas that the Triassic period was considerably longer than the whole of the Jurassic. The author maintains that faunas found in different regions which, although showing some differences, have been regarded as contemporary, are really heterochronous. At the same time he admits the existence of life-provinces in the Trias, but gives no criteria by which the differences dependent on age can be distinguished from those due to geographical distribution.

The main part of the Catalogue is devoted to a systematic account of the groups mentioned above, with a discussion of the mutual relationships of the various families and genera. Unlike most writers on the phylogeny of Ammonoids, the author does not accept the evidence of ontogeny, but bases his views on the morphological characters and the stratigraphical succession of forms. His conclusions will be more easily followed if shown in tabular form in the succeeding volume.

**An Introduction to Inorganic Chemistry :**

for B.Sc. Students of the Indian Universities. By Dr. Satya Prakash. Pp. vii+478. (Allahabad: Kala Press, 1934.) 6 rupees; 10s.

DR. PRAKASH'S book has some unusual features. It deals with the elements in the order of the Periodic System, the inert gases coming first, followed by the metals, and the non-metals come last. This has advantages for a student who has completed an elementary course, since his knowledge of the non-metals is refreshed again after he has dealt with the new material. A special feature of the book is the

stress laid on Indian conditions and interests, a good deal of statistical data being incorporated and the native processes and names being given. This part will be quite valuable to readers wishing to know something of chemical technology in India. Extensive use is made of tables summarising information given in the text.

The text itself is rather condensed, so that a good deal of ground is covered, and the more elementary parts of the subject are briefly treated. Whilst full equations are given in the text, the summary tables contain unbalanced equations with arrows, such as  $\text{NaHSC}_3 + \text{Zn} + \text{SO}_2 \rightarrow \text{Na}_2\text{S}_2\text{O}_4$ , which are liable to lead to neglect of the correct equations by weaker students. Dr. Prakash's book is an interesting one of good standard. The English is not always very good, and should be revised in future editions.

**Dynamo-Electric Machine in its Historical Development :**

Documents and Materials. Collected by D. V. Efremov and M. I. Radovskij. Edited by V. Th. Mitkevitch. (Academy of Sciences of the U.S.S.R.: Transactions of the Institute for the History of Science and Technology, Series 3, Issue 1.) Pp. xviii+560. (Leningrad: Academy of Sciences Press, 1934.) 15 roubles.

THIS volume gives the leading papers and extracts from books, etc., from which we can see the gradual historical development of the modern dynamo. The frontispiece gives a portrait of Faraday and the book begins with his discovery of electromagnetic induction. Practically all the book is in Russian, so it will make a limited appeal to English readers. The table of contents proves that a very wide research has been made through the literature of European countries. It is the first issue of Series III in the *Transactions* of the Russian Institute for the History of Science and Technology. The printing is very clear, but some of the diagrams have not come out very well.

**Hand- und Jahrbuch der chemischen Physik**

Herausgegeben von A. Eucken und K. L. Wolf. Band 6, Abschnitt IA: Elektronenstrahlen und ihre Wechselwirkung mit Materie. Von J. Hengstenberg und Karl Wolf. Pp. 236+12. (Leipzig: Akademische Verlagsgesellschaft m.b.H., 1935.) 24 gold marks.

THE discovery of electron beams is traced back to Pflücker (1859) and the recognition of their nature to Schuster's first determination of the ratio of charge to mass in 1884; but their principal interest arises from the discovery of interference effects, depending on a wave-like character of the electron. This has been demonstrated by the development of Debye-Scherrer rings by scattering (i) in thin films of a solid as in G. P. Thomson's already classical experiments with gold foil and the more recent beautiful photographs of G. I. Finch, and (ii) in vapours, as studied by Mark and Wierl in Ludwigshafen and later in England by de Laszlo. These and cognate topics are reviewed in a monograph which covers 236 pages and includes 182 figures.



## Personality and Age\*

By Dr. Ll. Wynn Jones

A FEW years ago the readers of many German newspapers were invited by Giese to give an account of the signs by which they noticed that they had become old, and to say at what age these signs first appeared. When these reports were analysed, it appeared that the average age of becoming subjectively old was forty-nine years, but this age of becoming old varied widely with the individual—indeed from age eighteen to eighty-two.

The bodily signs were twice as numerous as the mental. The bodily signs in decreasing order of frequency from 17.4 to 1.2 per cent may briefly be summarised thus: (1) motor (muscles, back, teeth, bones, extremities), (2) nerves (including memory and insomnia), (3) sensory (eye, ear), (4) skin (hair, wrinkles), (5) fatigue, (6) sexual, (7) circulatory (heart, arteries), (8) metabolic (sugar, gout, fat), (9) digestive, (10) kidney, (11) respiratory.

It would, of course, be expected that the layman would be more likely to refer to bodily symptoms than to mental, and it was natural that the more educated should show a higher percentage of mental signs.

The subjects who reported mental signs were divided into three classes:

(1) The negatory type. About 18 per cent of those who reported mental signs opposed the suggestion of being old and either indignantly refused to acknowledge it or perhaps referred to the health or longevity of their stock.

(2) About 38 per cent ascertained that they were old by noting the way they have been treated by the outside world in various situations and the like.

(3) About 44 per cent reported experiences from their own introspections—it might be some intellectual change in reaction such as the emergence of old recollections, or it might be an affective change such as a disinclination for amusements.

It is important that bodily and mental manifestations certainly do not go together and have widely different values for different individuals. Some lay great stress on bodily signs and scarcely any on the mental, while others do just the reverse. It is not, of course, suggested that the percentages reported above would agree with medical diagnosis, as the subjects belonged to a sample of the general population. Moreover, many of the physical

symptoms reported had probably a mental origin, for, as Prof. M. Greenwood stated in a recent lecture on "The Temperamental Factor in Industry", "it is becoming realised more and more how easily emotional disturbances may result in bodily ills that can be cured only by dealing with their psychological causes".

Although psychologists have exhibited great interest in the child and the adolescent, yet there remain five or six decades of human life relatively untouched. At least four recent investigations merit our attention. They were initiated by Terman, Thorndike, Walter Miles and Charlotte Bühler respectively. It is significant that each had already made outstanding contributions in child psychology, and each research was furthered by a grant, so that a band of experts were able to collaborate and produce results which would be quite unattainable by a single investigator who had to meet the charges out of his own pocket.

In 1926 there appeared the second volume of Terman's "Genetic Studies of Genius". It is entitled "The Early Mental Traits of Three Hundred Geniuses", and the investigations were carried out by Dr. Catherine M. Cox (now Mrs. Walter R. Miles) under the direction of Terman. It was concluded that youths who achieve eminence have, in general, a heredity above the average and superior advantages in early environment: they are characterised not only by high intellectual traits, but also by persistence of motive and effort, confidence in their abilities, and great strength or force of character.

Thorndike's "Adult Learning" appeared in 1928. His purpose was to study the changes in the amount and changes in the nature of ability to learn from about age fifteen to about age forty-five, and especially from age twenty-five to age forty-five. Some of the conclusions may be briefly summarised:

(1) The differences in rate of learning between old and young are small in comparison with the differences within either group, and when factors other than age are equalised the influence of age approaches zero.

(2) Adults learn much less than they might, partly because they under-estimate their power of learning, and partly because of unpleasant attention and comment. It is disuse and lack of practice and not inner degeneration which is likely to affect learning.

\* From the presidential address to Section J (Psychology) of the British Association, delivered at Norwich on September 6.



(3) Ability to learn a systematic logical language, Esperanto, rises from 8 to 16 years and probably to 20: it is then stationary to 25 or later and then drops very, very slowly to 35 and somewhat more rapidly, but still very slowly, to 45 or later.

(4) The gain made in 50 or 100 or 500 hours of study of a modern language by a group of any age from 20 to 40 will be greater than the gain made by a group aged 8 or 10 or 12. The facts are in flat contradiction to the doctrine that childhood is the period for easiest learning to read, write, or understand the hearing of a language.

(5) Learning representing an approximation to sheer modifiability unaided by past learning shows more inferiority in the case of adults than was indicated by the experiments taken as a whole. Actual learning of such things as adults commonly have to learn shows, however, considerably less.

(6) The curve of ability to learn from 22 to 42 is a very slow decline, and this decline is no greater for inferior intelligence than for superior.

Thorndike studied all sorts of learning and in each case analysed the curve of ability to learn in relation to age. Although he realises that a curve of total or average ability may be unattainable, yet he was able to conclude in general that nobody less than forty-five years of age should restrain himself from trying to learn anything because of a belief that he is too old to be able to learn it. "If he fails in learning it, inability due directly to age will very rarely, if ever, be the reason. The reason will commonly be one or more of these: He lacks and always has lacked the capacity to learn that particular thing. His desire to learn it is not strong enough to cause him to give proper attention to it. The ways and means which he adopts are inadequate, and would have been so at any age, to teach him anything. He has habits or ideas or other tendencies which interfere with the new acquisition, and which he is unable or unwilling to alter. In the last case mere age may have some influence."

Thorndike's conclusions are particularly important when we consider schemes for adult education, and it is interesting to see how well his experimental findings agree with Cicero's dicta on age: "But, you argue, the memory grows feebler. I believe it does unless you practise it, or if you are by nature rather dull. . . . What of lawyers, pontiffs, augurs, philosophers when they are old? How much *they* remember! The old retain their wits, provided their earnestness and energy lasts; and this happens not only with men who are illustrious and who have held high office, but also in a life of privacy and repose."

Having reported facts concerning the relation of adult learning to age, we may pass on to con-

sider some of the most important human abilities in their relation to age, and noteworthy in this respect are the Stanford Later Maturity Publications, which have appeared from 1931 onwards under the direction of Prof. Walter R. Miles, and which were aided by a grant from the Carnegie Corporation. A reference to some of these abilities is now necessary.

#### SENSORY AND MOTOR ABILITIES

The importance of abilities such as reaction speed and co-ordination of movements in the various industries and sports scarcely needs mention. Motor skills are so varied that each has to be studied by itself, and although some evidence for group factors in this field has been obtained, yet in the main it is the specificity of each ability which is striking; and this is not surprising when it is considered that some demand considerable visual acuity, others visual attention, others muscular power, others neuro-muscular speed of reaction, and so forth.

Probably visual acuity is at its maximum in the 'teens. It is probably one of the first physiological functions to show a very slight deterioration with age. About the age of fifty years, on the average, this deterioration may become sufficiently serious to handicap the individual in occupations where visual requirements are exacting. In industry, of course, there are other factors which affect the issue, such as the efforts of an employer to get cheaper, that is, younger, labour, or the effort of the employee himself to acquire a more responsible position. The more striking fact, according to Miles, is the relatively small, although steady, decrement shown throughout the life-span in tests such as reaction speed or rotary motility. "Guessed on the basis of what industry has popularly said of the old and also in terms of the derogatory reports made by old people about themselves, the situation has appeared far harsher than the objective data warrant."

#### INTELLECTUAL ABILITIES

Under this heading may be considered tests of memory, manipulations of symbols and of space areas, interpretations of meaning in verbal form and all the so-called higher mental functions which figure in tests of intelligence. Here again the deterioration due to age as such is relatively small. The differences between individuals at the older ages are often quite marked, so that other factors are probably at least as weighty as age in accounting for an individual's actual score. Thus Sorenson found that the mental abilities of adults who participate in schemes of adult education are maintained at a high level over a long span of adult years.



Miles also points out that when speed is the stressed element in an intelligence test for adults, then the decrement due to age is greater than it is when power in unlimited time is stressed. The fact that intelligence tests are usually standardised for children also points to the need of further research when dealing with adults.

INTERESTS

Here we turn to one of the Stanford Later Maturity Publications—namely, "Change of Interests with Age", by Prof. Edward K. Strong. It is based on examination of more than two thousand men between the ages of twenty and sixty years representing eight occupations. The following quotation gives the author's point of view: "If 'vocational interest' is defined as 'the occupation an individual likes best now', then the conclusion must be reached that vocational interests are very unstable. There are ample data to prove that boys and girls and also older persons change their 'first choices' very frequently, and in most cases without apparent rhyme or reason. But if 'vocational interest' is defined as 'the sum total of all interests that bear in any way upon an occupational career', then we find surprising stability, certainly among adults, and, as far as we have been able to judge, also among young men of college age and presumably among still younger people."

That is to say, just as we do not probe an individual's intelligence by one test but by as many as we can afford time for, so it should be with interest.

The slight differences found between men of twenty-five and fifty-five years of age seem to indicate that interests are not particularly affected by years of activity in a given occupation, and that therefore interests are responsible for choice of occupation rather than a resultant of it.

Older men are no more catholic in their interests than younger men, but their likes and dislikes are not identical with those of younger men. Thus the older men are not so interested in situations involving physical hazards, or in anything which interferes with established habits. This factor appears to be of great significance for both employer and employee. Many an employer is unsuccessful not so much for lack of abilities, but owing to a disinclination to introduce a change, and the old employee often becomes unemployed not on account of inability, but because he has no desire to change his methods when changes are deemed essential by the management.

I now turn to the extraordinarily interesting book of Prof. Charlotte Bühler, "Der Menschliche Lebenslauf als Psychologisches Problem", which was published in 1933. The course of man's life is

studied by the aid of two hundred published biographies of poets, writers, inventors, men of science, statesmen, musicians, painters, theologians, business men, financiers, actors, singers, sportsmen and philosophers. For comparison, fifty life-histories were obtained from the Old People's Homes in Vienna.

Life is regarded from several aspects: as a biological phenomenon, as a series of events and experiences, and from the point of view of work produced. Its normal structure—ascend, culmination and decline—is discussed. It is impossible to do justice to this pioneer study in a brief sketch, and I will only single out what appears to be the importance of age in athletic records. Here, then, Prof. Bühler has at hand the severe tests of the athletic field as substitutes for psychological tests in order to ascertain when various motor abilities are at their maxima in the case of the best athletes. On analysing the best lists for the year 1930 the following were the results:

Individual Sports		Group Sports	
	Age.		Age.
A. Sprint run . . . . .	23.5	A. Boxing . . . . .	21.9
Long jump . . . . .	23.5	Wrestling . . . . .	22.3
Throwing the javelin . . . . .	24.2	Football . . . . .	23.8
B. Medium run . . . . .	24.3	B. Jiu-jitsu . . . . .	26.0
Hurdles . . . . .	24.5	Hockey . . . . .	26.4
High jump . . . . .	24.8	Tennis . . . . .	28.5
Pole vault . . . . .	25.4		
Putting the weight . . . . .	25.4		
C. Long run . . . . .	25.6	C. Polo . . . . .	} up to 50
Rowing . . . . .	26.5	Riding . . . . .	
Throwing the discus . . . . .	26.9	Trotting . . . . .	
Weight lifting . . . . .	30.5		
Throwing the hammer . . . . .	31.0		

It is characteristic of Group A that the activities demand a maximum expenditure of energy per second. Economy of effort plays no part here. In Group B there is demanded economy of effort and a proper distribution of it. As for Group C, in addition to the greatest economy of effort, enormous demands are made on technique which only comes after long experience.

As two typically British sports are not included in the table—namely, cricket and golf—I have attempted to get corresponding figures for batsmen, bowlers and golfers. Taking the season of 1934, the names of eighty-three batsmen who exceeded a thousand runs in first-class cricket appear. The median age is 30 years (the quartiles being 27 and 33 and the extremes 19 and 47). Then the bowling averages were analysed. The median age is again 30 years (the quartiles being 26 and 34 and the extremes 20 and 50).

Taking the names of the forty golfers who headed the Open Championship list in 1934, the median age is about 35 years (the quartiles being 29 and 39 and the extremes 24 and 45).

Taking a still higher standard, it appears that batsmen who have exceeded three thousand runs in a season show a median age of 34.5 years (the



quartiles being 30 and 39 and the extremes 27 and 44).

In golf, the thirty-seven open champions since 1894 show a median age of 31 years (the quartiles being 28 and 37 and the extremes 23 and 44).

#### THEORETICAL IMPLICATIONS

A most important development in modern psychology is the search for innate, basic, unitary traits of personality. There is accumulative evidence in favour of the existence of a number of unitary traits or factors, and it has been found convenient to denote them provisionally by letters of the alphabet, analogous to a practice of physics and other sciences. This does not in the least imply that their functional interpretation is necessarily less clear than that of concepts such as introversion and the like. It is true that polysyllabic words have sometimes only to undergo a very cursory censorship, but this practice leads to abuses of the language mechanism which may retard individual cerebral evolution. Besides, the less popular use of letters to denote new concepts is not likely to proceed indefinitely, if only for the fact that the introduction of such a letter is preceded by many thousand hours of laborious work.

Closely connected with the study of traits is the difficult question of the effectiveness of past

experiences. Spearman's researches show that retentivity is independent of  $g$ , and there is evidence that the old tend to deteriorate in tests of immediate memory. How far is the balance redressed when the extent and variety of all their previous experiences as well as their integration is taken into account? It is scarcely necessary to illustrate the dire effects of lack of experience. Thus the brilliant young debater is often pulverised by one who is dull but elderly. My second example is a very intelligent person who has been totally blind from birth. I found that the subject had no idea at all of the size of the sun as it appeared in the sky. The subject imagined that most stars had five points, but that some had six or even eight, and that a rainbow had the shape of a tied bow, and so forth. Manifestly all knowing, even in the case of the gifted, must start from experiencing.

Now that the method of factorial analysis is becoming increasingly effective, not only in the case of cognitive abilities, but also with regard to personality in all its aspects, it becomes necessary to study age as one of the 'primordial potencies' more systematically, not only during childhood and adolescence, but also throughout the life-span. This will determine the relative importance of the various traits at different stages of life, and in turn will lead to a fuller psychological interpretation of the unitary traits themselves.

## Recent Advances in Seismology\*

By Dr. F. J. W. Whipple, Kew Observatory, Richmond, Surrey

SEISMOLOGY, the science of earthquakes, is primarily concerned with such questions as where, how and why earthquakes occur, but it is also concerned with the question how the waves generated by earthquakes travel through the earth, and with the question what information as to the constitution of the earth can be deduced from the behaviour of the waves. Living in a country which is seldom troubled by earthquakes, but a country in which the waves from distant earthquakes can be studied, we have a more direct interest in questions of the latter types. This interest has been fostered by the British Association, which has facilitated the discussion and collection of the records from observatories in all parts of the world. This is an enterprise of which we may well be proud.

\* Paper read before Section A of the British Association at Norwich on September 9, opening a discussion on recent advances in seismology.

John Milne, who was a great pioneer, organised the collection of observations. He used to publish lists of the readings of the seismograms at as many observatories as possible. On the death of Milne, Prof. H. H. Turner, who was already chairman of the B.A. committee, accepted responsibility for the work, which he transferred to the University Observatory, Oxford, and soon began the publication of the observations in a more convenient form, dealing with each earthquake separately. This arrangement was continued when Turner became president of the Seismological Section of the International Union for Geodesy and Geophysics. The collections of observations are now known as the International Seismological Summary. As the number and efficiency of seismological stations has increased, so the I.S.S. has grown. The Summary for 1930 is a substantial volume of 426 pages. Since Turner's death in



1930, the work has been carried on most loyally and efficiently by Mr. Hughes and Miss Bellamy. Seismologists are under a great debt of gratitude to them, and to Prof. H. H. Plaskett who has given facilities for the continuation of the work.

The I.S.S. provides a wealth of material for research. One of the objects which Turner had at heart was the preparation of more reliable tables of the travel times of earthquakes. This task was eventually undertaken by Dr. H. Jeffreys, whose revised tables for the times of *P* and *S* waves were published in 1932. Jeffreys regarded this work as a preliminary to a closer examination of the material, and with the help of Mr. K. E. Bullen he discussed the records of 61 earthquakes. For each the epicentre was redetermined and a close examination of the material of the I.S.S. was made to discover the reflected waves of different types.

The results of this heavy investigation were presented by Jeffreys at the Lisbon meeting of the I.S.A. two years ago, and have now been published. It was not to be expected that there would be anything very exciting in the results. Perhaps that is the strongest reason for admiring the enterprise of Jeffreys and Bullen. The most striking development is the confirmation of an irregularity in the run of the times of transmission of the waves of compression and distortion. This irregularity, which occurs at ranges of about  $20^\circ$ , had previously been studied by Miss Lehmann of Copenhagen and probably signifies that there is a discontinuity in the nature of the rocks at a depth of about 400 km.

An interesting development was the calculation by an indirect method of the time required for shearing waves to travel to the core and back. An *S* wave which reaches the core is resolved into a reflected wave, known as *ScS*, and a transmitted *K* wave. When a *K* wave reaches the boundary of the core again, some of the energy passes out as an *S* wave and some is reflected to pass out further on. Thus *SKS* and *SKKS* are produced. It is clear that the time of transmission of the *SKS* is the mean between the times for the *ScS* and *SKKS* waves. Thus the time for *ScS* waves where they are not readily observed could be calculated. It should be mentioned that Dr. Jeffreys has recently revised this *ScS* table, using records for deep focus earthquakes.

The Jeffreys and Bullen tables are now being used as the standard of reference of the I.S.S. so that they will be the starting point for the investigations of such questions as the possible departure of the earth from spherical symmetry.

The most spectacular of recent advances in seismology is in our knowledge of earthquakes with deep foci. Turner was led to the discovery of

such earthquakes by finding that the ordinary tables of transmission times, which were reasonably satisfactory for ordinary earthquakes, were not applicable in certain cases. He was led to attribute the abnormality to the depth of foci, which might in some cases be so great as 9 per cent of the earth's radius, or 500 km. Similar conclusions were reached by Wadati in Japan, and the theory was confirmed by the close analysis of world-wide records by Scrase and Stechschulte.

That the great majority of the earthquakes were to be found round the Pacific was noticed by

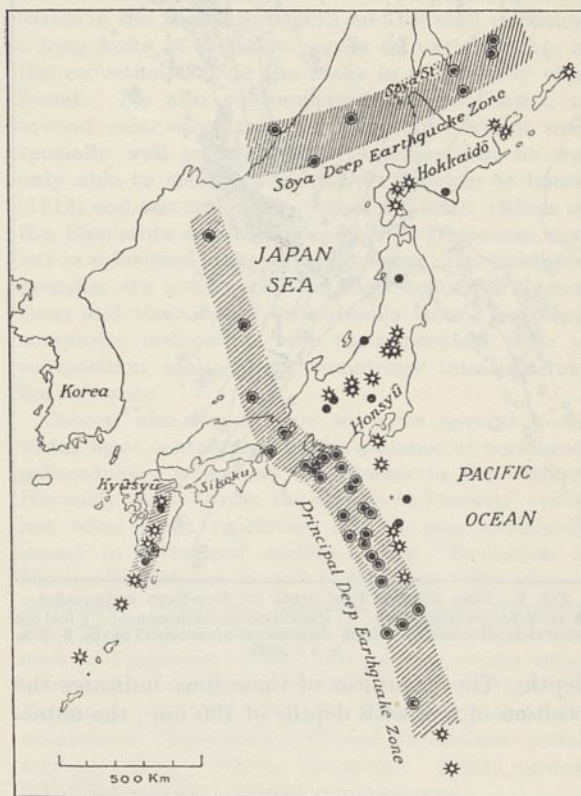


FIG. 1. Deep-focus earthquake zones and volcanoes. ● Deep earthquakes which occurred during 1927-33; \* Volcanoes which have been in eruption since 1867. From *Geophysical Magazine* (Tokyo), 8, No. 2; 1934.

Turner. Japanese seismologists have mapped the foci near their own country with striking results. There is a remarkably orderly arrangement. Not only are the foci to be found on two belts meeting at right angles on the continental side of the sea of Japan, but also the depths are systematically arranged, the greatest on the outside of the angle formed by the belts.

In Fig. 1, which is due to H. Honda, the positions of the zones in which deep-focus earthquakes occur are shown, together with the positions of such volcanoes as have been in eruption since 1867. Fig. 2 is reproduced from a paper by K. Wadati. In this diagram the two principal zones



of deep focus earthquakes are joined by lines which serve to emphasise the distribution of

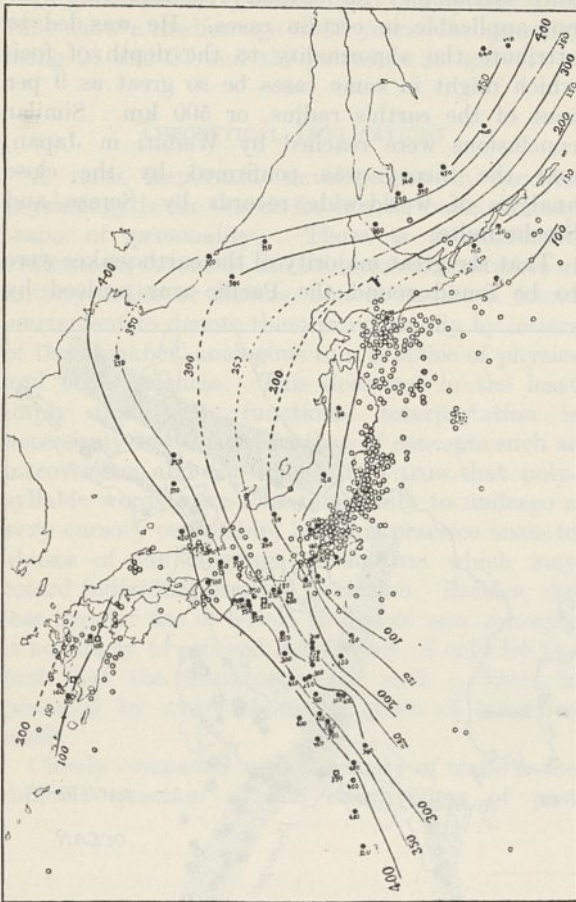


FIG. 2. Lines of equal focal depth for deep-focus earthquakes. ● Deep-focus earthquakes; ○ shallow-focus earthquakes; □, foci not accurately determined. From *Geophysical Magazine* (Tokyo), 8, Nos. 3, 4; 1935.

depth. The innermost of these lines indicates the position of foci with depths of 100 km., the outer-

most of the main series of lines indicates a depth of 400 km. The way in which the foci of ordinary earthquakes cluster on the east of Japan is also illustrated in this diagram.

The directions of the impulsive movements in deep-focus earthquakes with their foci near to the region where the main belt crosses Japan have been studied by Honda. He finds that at places to the north-east of the belt the ground moves downwards and towards the belt. At places to the south-west the movement is upwards and away from the belt. Thus it appears likely that huge faults extending to a depth of about 400 km. or more can exist in the earth's crust and that deep foci are on such faults. Volcanoes, live and extinct, are found above the line where the fault is at a depth of 100 km., whilst ordinary earthquakes with shallow focus occur near where the fault approaches the surface.

It has been suggested that the high frequency of earthquakes round the Pacific is due to the fact that the crust of the earth below an ocean cools more rapidly than the crust over the continents, where the radioactivity of the granite provides a source of heat.

In various studies of the times of transmission of seismic waves it has been found that the thickness of the continental granite is about 15 km. Thus the occurrence of deep-focus earthquakes implies that the strains in the crust lead to fractures at depths of the order twenty times the probable thickness of the granite. Can it be that the influence of a mere skin extends to such a depth? These foci are also far below the level at which isostatic compensation has been supposed hitherto to be operative. It is clear that they must be taken into account in all speculations as to the history of the globe.

## Obituary

Prof. Henry Fairfield Osborn, For.Mem.R.S.

**P**ROF. HENRY FAIRFIELD OSBORN, who died at his home, Castle Rock, Garrison-on-Hudson, N.Y., on November 6, 1935, was one of the foremost palaeontologists of the United States, and made great contributions to our knowledge of fossil mammals and reptiles. He was born on August 8, 1857, at Fairfield, Connecticut, and began his scientific education in 1873 at Princeton College (afterwards University), where he was influenced especially by President James McCosh, the psychologist, and Prof. Arnold Guyot, the geologist. After graduating in 1877, he studied human anatomy and histology under Prof. William H. Welch, in New York; and in 1879-80 he followed brief courses in embryology

under F. M. Balfour at Cambridge, and in comparative anatomy under Huxley in London. He then returned to Princeton with a biological fellowship, and in 1881 he was appointed assistant professor of natural science. In 1883 he was promoted to the professorship of comparative anatomy at Princeton, where he remained until 1891.

While Osborn was a student at Princeton, great interest was being aroused by the discoveries of numerous strange extinct mammals and reptiles by Cope and Marsh in the rocks of the western United States. At the end of his course, therefore, in 1877, he and his fellow-students, W. B. Scott and F. Speir, decided to undertake a summer trip to Wyoming in search of similar fossils, and they brought back a



small collection of early Tertiary mammalian remains, on which they published a report. In the following year they went again to Wyoming and Colorado to continue their collecting, and in subsequent years one or other of them paid repeated visits to the west for similar field work. Princeton thus began to take a share in making known the remarkable extinct vertebrates which awaited discovery in the western country then becoming more readily accessible.

These researches attracted the notice of the trustees of the American Museum of Natural History and the professors of Columbia College (afterwards University) in New York. The Museum wished to extend its scope and make a representative collection of fossil vertebrates, while Columbia decided to add biology to the subjects to be taught. In 1891, Osborn was therefore invited to become curator of the Department of Vertebrate Palæontology in the American Museum, and at the same time the first professor of biology (afterwards zoology) in Columbia University. He accepted both these appointments, and held them with brilliant success until 1910, when he had thoroughly organised them and had trained a staff to continue his work. Having ample private means, he then retired to devote himself entirely to palæontological research and to the administration of the Museum. Meanwhile, he was nominated research professor of zoology in the University, and he continued to be assistant to the president of the Museum. In 1901 he was elected a trustee and vice-president of the Museum, and eventually from 1908 until 1933 he served as president. At the same time, from 1900 onwards, Osborn was vertebrate palæontologist to the U.S. Geological Survey, and for four years (1900-4) he also held the same office in the Geological Survey of Canada. In 1906 he was nominated secretary of the Smithsonian Institution, Washington, but he decided to remain at New York.

The earlier collectors of fossils in the west had been handicapped by the frequent presence of hostile Indians, who had made detailed geological surveying impossible. When Osborn began his work at the American Museum, conditions were improving, and he took advantage of this circumstance to arrange that collectors in future should devote as much time as necessary to determining the succession of the rocks in which the various fossils occurred. Year after year he sent out his trained assistants to collect in this way, and he frequently accompanied them with help and encouragement. He and his wealthy friends provided adequate funds for the explorations, and thus was accumulated in the American Museum a unique series of fossil vertebrates of which the relative ages were definitely known. Most of these fossils were mammalian remains from the Tertiary formations, and as soon as the most important of them had been examined and described by himself and his colleagues, Osborn greatly facilitated research by publishing his "Correlation between Tertiary Mammal Horizons of Europe and America" (1900). The American Museum then began to take an active interest in the discovery of fossil vertebrates in other parts of the world. In 1898 it had already shared in

the Princeton University's third expedition to Patagonia. In 1906-7, Osborn himself accompanied a party in the Fayum, Egypt. In 1922 he visited central Asia, where American Museum expeditions under Dr. Roy Chapman Andrews had already made important collections of new fossil vertebrates. In 1923 another expedition under Dr. Barnum Brown collected fossil mammals in India. Osborn had, indeed, wisely decided that our knowledge of extinct faunas could best be advanced by direct comparison of the fossils of one part of the world with those of another, and that American palæontology must not be isolated.

While occupied with the planning and direction of the collecting expeditions and the preparation of the fossils in the Museum, Osborn and his staff published a long series of valuable papers on various parts of the collection and on the rocks in which they were found. He also contemplated the publication of several exhaustive memoirs on groups which were specially well represented in America, but he was only able to complete one on the Equidæ or horses (1918) and one on the Titanotheres (1929). Others on the Elephants and the Sauropodous Dinosaurs were left in a forward state of preparation. The published memoirs are noteworthy for their beautiful illustrations and their wealth of valuable facts; but their composite authorship and their peculiar style of composition make them sometimes unsatisfactory for reference.

Osborn also found time to write several books which have contributed to the advance of vertebrate palæontology or spread an interest in the subject. His early work "From the Greeks to Darwin" (1894) has often been reprinted, and it was eventually issued in a revised edition. His "Evolution of Mammalian Molar Teeth" (1907) and "The Age of Mammals" (1910) are technical works of reference. His "Men of the Old Stone Age" (1915) and "Man rises to Parnassus" (1927) are popular works which have had a very wide circulation. His "Origin and Evolution of Life" (1916-17) is semi-popular. His volumes on "Impressions of Great Naturalists" (1924) and on "Cope: Master Naturalist" (1931) contain many interesting personal reminiscences.

Osborn's genial personality and calm sound judgement led to his being appealed to for help in many undertakings beyond his chosen sphere. He took a prominent part, for example, in the foundation of the New York Zoological Society and the planning of its Zoological Park, and he was president of the organisation from 1909 until 1923. He was also well known and much esteemed in England, where he received many tokens of appreciation. He was an honorary D.Sc. of Oxford and Sc.D. of Cambridge. He was a foreign member of the Royal Society, and of the Linnean, Geological and Zoological Societies of London; and an honorary member of the Royal Society of Edinburgh and the Royal Irish Academy. He received the Darwin Medal from the Royal Society in 1918, and the Wollaston Medal from the Geological Society of London in 1926. The death of an old friend and colleague is indeed widely mourned.

A. S. W.



## News and Views

### Henry Fairfield Osborn and the American Museum

PROF. H. FAIRFIELD OSBORN, an obituary of whom appears on p. 784 of this issue of *NATURE*, was a figure in certain respects unique in American science. In virtue of his great possessions, he belonged to a class more frequently encountered in business than in academic circles in the United States, and his personal connexions played no small part in aiding him to raise the American Museum of Natural History, of which he was honorary life president at the time of his death, to the commanding position in the scientific world which it now holds. Under his controlling influence, its scientific achievement, equally remarkable in range and variety, was no less notable than its growth and its efficiency in material equipment; while graded series of publications, ranging from popular expositions to detailed monographic studies, and from ephemeral announcements of recent discovery to the considered conclusions of prolonged research, became a regular and highly valued feature in the organisation of the Museum, placing the latest developments of its work at the disposal of laymen and the scientific world alike. One of the greatest achievements of the Museum under his régime, and certainly the most spectacular, was the organisation of the great scientific expedition to Mongolia. It was unfortunate that after some years of work, which had produced results of the greatest importance to science in palæontology, geology, archæology, and the other branches of research for which provision had been made, clash with Chinese authority should have brought the expedition to a close at a moment when Osborn was about to build up an organisation in China, which promised to emulate within its limits the achievement of the parent institution in New York.

### Chromosome Behaviour and Protein Pattern

It is announced in the *Oxford University Gazette* of November 6, that the curators of the University Chest have been authorised by Congregation to receive from the Rockefeller Foundation a grant of £500 a year for five years for the purposes of research in the application of mathematical analysis to biological problems, to be conducted by Dr. Dorothy Wrinch. Apparently this grant is to enable Dr. Wrinch to continue and develop her researches into relationships between chromosomes and protein aggregates which have been the subject of several notable contributions, three of which appeared in *NATURE* during the past year (134, 978; 135, 788; 136, 68). She graduated at Cambridge in 1916 and was a wrangler in the Mathematical Tripos. Since then she has had a distinguished career in teaching and research, having been successively lecturer in the Department of Pure Mathematics, University College, London; Yarrow scientific research fellow and Bertha Ayrton fellow of Girton College, Cambridge;

and lecturer in mathematics and Susette Taylor fellow of Lady Margaret Hall, Oxford. While holding the two last-named fellowships in 1931-34 she spent part of the time at the Universities of Vienna, Paris, and Prague. So long ago as 1921, Dr. Wrinch contributed a paper to *NATURE*, with Dr. Harold Jeffreys, on "The Relation of Geometry to Einstein's Theory of Gravitation"; and among many other subjects of wide interest with which she has dealt in papers to scientific societies are the theory of probability, principles of scientific inquiry, relations of science and philosophy, and boundary problems of mathematical physics. Her recent work on the structure and behaviour of chromosomes in relation to protein aggregates is a new field of inquiry from which further results of high importance may be confidently anticipated.

### The King of the Belgians

At the general meeting of the Linnean Society of London held on November 7, His Majesty The King of the Belgians was unanimously elected an honorary member of the Society. His Majesty is known to take a keen interest in natural history. When Crown Prince, he made a voyage to the Dutch East Indies in 1928-29, one result of which was a very important collection of specimens for the Royal Museum of Natural History in Brussels. He has also taken an active interest in the preservation of the fauna of Africa by the establishment of Nature reserves. The great Parc National Albert in the Belgian Congo, the area of which has recently been greatly extended, owes much to His Majesty's patronage and influence, and constitutes one of the most important experiments ever made in the conservation of wild Nature.

### American Stratosphere Balloon Explorer II

A NOTABLE achievement falls to the credit of Capt. A. W. Stevens and Earl A. Anderson of the U.S. Army Air Corps, who, according to the reports in the daily Press, have successfully piloted their stratosphere balloon up to the record height of 74,000 feet. The previous record was held by the ill-fated Russian balloon *Osoaviakhim* which probably reached a height of 72,000 feet on January 30, 1934. After the first set-back of last July, when the top of *Explorer II* burst and released 375,000 cubic feet of helium, another occurred on Monday, November 11, when a 20-ft. rent in the envelope, produced during its inflation, had to be repaired at the last moment. The ascent was made at 7 a.m. from a point eleven miles west of Rapid City, and a safe landing was made in the evening at White Lake, South Dakota. Capt. Stevens reported by wireless that at his maximum height the external temperature was  $-55^{\circ}\text{C.}$ , the cosmic ray intensity 150 times that at the earth's surface, and that the sky had become a jet black awning.



### Imperial Airways New Programme

SPEAKING at the annual meeting of Imperial Airways, Sir Eric Geddes outlined the possibilities of, at least experimental, passenger- and mail-carrying operations across the North Atlantic next summer. A 'Mayo' composite aircraft in which a large seaplane, with good 'get off' characteristics, carries a smaller long-distance machine upon its back, releasing it at a suitable height, and also a large flying boat of more normal design are under construction, both of them having sufficient range to fly the Atlantic with adequate reserve. The westward journey will probably be London, Azores, Bermuda, New York, the latter stage being operated in conjunction with Pan-American Airways. Eastwards the direct line New York, Port Botwood (Newfoundland), Cork or Bantry Bay (Ireland), London has been surveyed, although the intermediate stations in Canada and Ireland are not yet definitely settled. The longer route outwards is necessary as stops are needed for refuelling. The prevailing west to east winds make it impossible to fly the more direct route, without landing between Ireland and Newfoundland, with sufficient fuel and still to have an economic load-carrying capacity. On the return journey, this following wind not only reduces the air mileage but also increases the relative speed.

THE distance from Newfoundland to Ireland is about 1,900 miles, and a flying boat with only a little more nominal air endurance will actually have a considerable reserve, owing to the almost constant following wind. There are also envisaged extensions to this route across Canada to Vancouver, Khartoum to Nigeria from the England-South Africa route, and Hong-Kong to Penang from the main Australian route. Sir Eric stressed the fact that there is a great difference between speeds technically possible and those commercially practicable, and stated that there is a greater demand for a reduction in fares than for an increase in speed. Nevertheless, the new aircraft on order will give substantial increases in speed next summer, subject to ground organisation being provided of a suitable standard. For example, it is expected to reach Australia in seven days, South Africa in four days and India in three, with normal schedule working.

### Rebuilding Birkbeck College

IN the murky atmosphere of a Strand tavern on a dreary December evening more than a century ago, the germ of a great ideal first struggled into existence. George Birkbeck, who presided on the occasion, was a man of vision, but it is to be doubted whether even he had more than a glimmering of what the future held for his latest child. Since that night—the gathering of a couple of thousand working men did not disperse until 3 a.m.—Birkbeck College has become an integral part of the body scientific. The appeal launched at the Mansion House on November 7 for funds for rebuilding Birkbeck College is of the highest importance not only to the College alumni but also to scientific workers

throughout Great Britain. The Lord Mayor (Sir Stephen Killick), an old student of the College, presided, supported by the Duke of York, president of the College, accompanied by the Duchess, the Archbishop of Canterbury, the Vice-Chancellor of the University of London (Dr. Eason) and the chairman of the Governing Body (Mr. W. L. Hichens). Owing to the general election, Mr. Ramsay MacDonald, another old student, was unable to attend, but wrote a letter strongly supporting the appeal.

THE Lord Mayor said the present buildings of Birkbeck College are inadequate, and that the University of London has offered a position for a new building on the Bloomsbury site. Generous grants towards the rebuilding fund have been offered by the University, the London County Council and the City Corporation. About half of the £250,000 required has been promised. The Vice-Chancellor contributed interesting information about the work of the College, referring particularly to its 200 post-graduate research workers and to Prof. P. M. S. Blackett's research work on cosmic rays, to which £1,150 has been contributed from the Mond Fund of the Royal Society. As the Archbishop of Canterbury pointed out, the movement to bring the worker to the university rather than the reverse process is an ideal to which the energies of all should be directed. The academic record of Birkbeck staff is high, and an increasing volume of significant research is being prosecuted under their direction; research which, in the words of Mr. Ramsay MacDonald, is fraught with possibilities of the highest importance to our great industrial centres. The appeal merits a speedy and generous response. Let him who hath give; and let him who hath not, proclaim the worthiness of a common cause.

### School and Museum in London Education

IN order to take fuller advantage of the exceptional opportunities afforded by the museums of London of adding background to the curriculum of the schools, the London County Council decided early in the current year to add to the staff of its inspectorate an officer who would serve as a liaison between museum and school. School visits to the museums have long figured in the time-table; but it had become evident that some organisation of objective was necessary to secure the full return for the time which these visits demand. The resolution of the Council has been given effect by the appointment of Dr. Louis W. G. Malcolm to the post; and arrangements have been made already under his supervision for an extension of the system of school visits and lectures in the museums to cover a wide field of subjects of topical and educational interest. In the Imperial Institute, for example, geographical films are being shown and lectures given on the Mediterranean, Malta, Gibraltar, Cyprus and Suez, and these will be followed by illustrations of the industries and occupations of the more distant parts of the Empire. In the London Museum, the history of London from prehistoric to Stuart times is to be demonstrated. Among other



museums at present participating in the scheme are the Victoria and Albert, Horniman and Geffrye Museums. Dr. Malcolm, who was a research scholar in anthropology of Christ's College, Cambridge, and obtained his Ph.D. degree for a thesis on the history and development of medical museums, not only has a wide and varied experience of museum work, but he has also devoted much attention to the practical development of the museum collection as a part of the machinery of education. His work will be supported by a strong and informed committee of the County Council.

#### Research on Carcinogenic Compounds

THE thirty-first Bedson Lecture was delivered by Prof. J. W. Cook, of the Cancer Hospital, London, to the Bedson Club at Armstrong College, Newcastle-on-Tyne, on November 8. Prof. Cook took as his subject "The Synthesis and Biological Effects of Carcinogenic Hydrocarbons", and said it has long been known that certain forms of skin cancer are due to occupational causes, such cases being prevalent among workers in the coal-tar and allied industries, in the shale oil industry and among mule spinners in cotton mills. This is due to the action of a common constituent of coal tar, and shale and lubricating oil, the isolation and identification of which was successfully accomplished about three years ago in the research laboratories of the Cancer Hospital, London. A very valuable guide in the difficult task of separating this substance from the other constituents of the mixtures was provided by the fact that these tars and oils having carcinogenic properties are all strongly fluorescent. An investigation of the nature of this fluorescence spectrum directed attention to the benzenanthracene group of hydrocarbons. Many of these have been prepared artificially in the laboratory, and some have been shown capable of producing cancer in mice. The cancer-producing constituent of coal tar, etc., benzpyrene, belongs to this group. More recently, it has been found possible to bring about the artificial conversion of substances normally present in the human body, namely, cholic and deoxycholic acids, into a hydrocarbon of the benzenanthracene type, methylcholanthrene, and this was found to be more powerfully cancer-producing than any other substance yet investigated. The chemical changes by which it was obtained are of the type which are well known to occur in the body, and it may be that cancer in man is due to some such substance as a bile acid undergoing decomposition in an abnormal manner, with conversion into cancer-producing substances.

#### Chemistry in the Universities and Schools

"THE Teaching of Chemistry" was the subject chosen by Prof. Arthur Smithells, director of the Salters' Institute of Industrial Chemistry, for his Harrison Memorial Lecture to the Pharmaceutical Society on November 12. The chief difficulty of the university professor of chemistry lies in dealing with a subject in which the advance has been of unparalleled rapidity and, most recently, in changes on the

theoretical side which have not only led to the acquisition of tracts of new knowledge, but also have affected science at its very base. Prof. Smithells believes that these advances have placed a great burden on the student, and especially on his memory. The reduction and emendation of the curriculum would result in a gain far exceeding in importance any possible loss in its range. Passing to the teaching of chemistry to those whose dominant interest is its application to some particular calling, reference was made to students of medicine as an example. Prof. Smithells himself had placed such students in a course apart, where he had striven, without any intellectual sacrifice, to invest the teaching throughout with facts and illustrations connected with the medical calling. The teaching of chemistry in schools, after a period of rapid growth, became a mere small-scale replica in contents and form of the early chemical course of a university. This teaching led to the revolt, headed by Prof. H. E. Armstrong, who from then to the present day has stood as the great campaigner against all that has seemed unsound in chemical education, wherever it has appeared, but, above all, in its earlier stages. The influence exerted inevitably by the university teacher has been far beyond what is warranted. Relief of the crowded curriculum has been sought by relegating to the schools so much higher work in science that there is a real danger existing of just that kind of over-balance of one kind of subject, as was the case with classics when science first sought admission to the curriculum.

#### Weights and Balances in Ancient Egypt

AT the Friday evening discourse at the Royal Institution on November 8, Prof. S. R. K. Glanville discussed "Weights and Balances in Ancient Egypt". The actual weights recovered from Ancient Egypt divide into eight main standards, derived from a much larger number in very early times. What we have to go back to prehistoric times and show a gradual fusion of the standards, a process which is completed by the seventh century B.C. The balance may be traced from the Old Kingdom, with a possible example of a balance beam from pre-dynastic times. The New Kingdom balance, which lasted at any rate until the Ptolemaic period, was very efficient, and shows a greater accuracy in its design than the small Roman balance which succeeded it. There is evidence of a standard of exchange in ordinary transactions from the Old Kingdom, though whether this standard was a piece of metal, which could be passed between buyer and seller, is questionable at this period. The explanation of the lack of evidence for such mediums of exchange is probably in the nature of the organisation of the country in earliest times as a huge estate owned by the king, and later as a number of big estates controlled by governors and priesthoods, a condition which to some extent exists to-day. These estates being largely self-sufficing, it was possible to conduct their economic affairs without resort to anything approaching currency. There is, however, evidence of the use in the Middle Kingdom of copper pieces, and of a much more frequent use in the New



Kingdom of silver pieces which gave way to copper as the State grew poorer, the whole standard being backed by gold. It is difficult to decide how far the balance was used for general purposes, as its representation on tomb paintings is almost confined to the weighing of gold, silver and precious stones, either domestically for distribution to the metal workers on private or public estates, or as a registration of income or taxes from within the State or of 'tribute' or prizes of war from abroad.

#### Sewage Purification

MR. JOHN D. WATSON, in his presidential address delivered on November 5 to the Institution of Civil Engineers, dealt with the phases of public works which have engaged his attention for more than half a century, and showed how the development of sanitation and improved water-supplies has brought about a very considerable reduction in the death-rate. He spoke of the Iddesleigh Commission, the reports of which showed that the disposal of sewage into an adequate volume of clean water—either salt or fresh—is sound and proper, not only on the grounds of efficiency and economy, but also on strictly scientific principles. As a matter of principle, purification by land-irrigation is sound and still fairly popular. Percolating filters are now popular, and while this method of purification has a direct relationship to the contact-bed method, it produces a more consistently uniform effluent, is more generally reliable and the operating costs are less. Although almost unknown twenty years ago, bio-aeration or activated sludge is now established beyond question as one of the most useful methods of sewage purification. It has proved itself to be scientifically sound, and, when the plant is well designed, it is economical and freer from nuisance than any method yet discovered. Having stated the most desirable lines for future development and discussed several noteworthy schemes, Mr. Watson emphasised the extent of loss resulting from lack of co-operation, and concluded his address by pointing out that, while the nation owes a great deal to the Ministry of Health, there is still much to be done before the goal is reached when there will be no river-pollution. In his opinion, a central authority is necessary, and this should be the Ministry of Health rather than the *ad hoc* body suggested by the Royal Commission, provided that power is given to set up a research department wide enough to include the excellent work which has been done in recent years by the Water Pollution Research Board.

#### South African Association for the Advancement of Science

THE South African Association for the Advancement of Science held its annual meeting at Paarl on July 1-6. On July 1, Prof. M. M. Rindl, professor of chemistry in Grey University College, Bloemfontein, president of the Association, delivered an address entitled "A Plea for the Establishment of a National Research Council and for the Limitation of a National Research Policy in South Africa". Replying to criticisms of the Association and its policy, Prof.

Rindl said that provision of funds for fostering research in the form of fellowships, scholarships and research grants in South Africa is not ungenerous. Much of this is directly attributable to the persistent agitation of the Association. In its early days, the Association and the Royal Society of South Africa were the only bodies providing research grants from their own funds. Furthermore, the annual award of the South Africa Medal and Grant to a prominent research worker in South Africa has done much to stimulate competition among investigators. As a result of the Association's action, a national committee of intellectual co-operation has been appointed, and it is hoped that the outcome will be the establishment of a National Research Council, and the inauguration of a national research policy on lines similar to those adopted in Great Britain, the Dominions and in many industrialised countries overseas. Another activity of the Association has been to appoint a committee to collect authentic data of the early history of scientific endeavour and industrial achievement in South Africa. With this end in view, the committee is approaching pioneers of science and industry to place on record their reminiscences and the history of the development in the industries which they founded, or with which they have been associated.

At the conclusion of his address, Prof. Rindl presented the South Africa Medal and Grant to Dr. Edwin Percy Phillips, and the British Association Medal and Grant to Miss Margaret Orford. His Excellency the Earl of Clarendon, Governor-General of the Union of South Africa, has graciously accepted the invitation of the Council to become the president of the Association for the year 1935-36. This will be the thirty-fourth annual session and will be held at Johannesburg. For this year the Association is departing from its normal procedure of meeting in July, and the Johannesburg session will be held on October 5-10. Members attending the meeting thus will have opportunity of visiting the Empire Exhibition, which is being staged for several months in Johannesburg.

#### Mellon Institute of Industrial Research

IN accepting the Chemical Industry Medal for 1935, at the meeting of the American Section of the Society of Chemical Industry, at the Chemists' Club, New York, on November 8, Dr. Edward R. Weidlein, director of the Mellon Institute of Industrial Research, Pittsburgh, Pa., described some of the scientific investigations at the Institute. The Mellon Institute is an industrial experiment station, a training school for industrial scientific workers, a centre for research in pure, as well as applied, chemistry, and a clearing-house on specific scientific information for the public. Dr. Weidlein said that the Mellon Institute has shown about 3,600 American companies, either as individuals or as members of industrial associations, that scientific research, properly carried out, is profitable to them. Most of the problems accepted for study during 1911-35 have been solved satisfactorily. The Institute has also



been active in stimulating research in other laboratories and in collaborating with other research establishments, both in the United States and abroad. It is best known, however, by the commercial processes that it has evolved (582 U.S. patents) and by its additions to the literature of chemistry and allied sciences (18 books, 122 bulletins, and 1,727 papers). During the past twenty-four years, the Institute has received more than 10,000,000 dollars from industrial fellowship donors to defray the cost of scientific investigations conducted for these companies and associations. Dr. Weidlein referred to no less than ten new industries that have come from these researches. In conclusion, he said that they hope to occupy the Institute's new building early next year.

#### Relief of Animal Suffering

THE ninth Stephen Paget Memorial Lecture of the Research Defence Society was delivered last June by Sir Frederick Hobday, the Principal of the Royal Veterinary College, who chose as his subject "The Relief of Animal Suffering" (*The Fight against Disease*, 23, No. 3). The attacks of anti-vivisectionists are directed not only against research work for the relief of human suffering, but also against research on diseases of animals, so that the subject of Sir Frederick's address was opportune. After some preliminary remarks on the statistics of the animal population of Great Britain and the diseases that affect them and on the training of the veterinary surgeon, he first mentioned the electric killer. The animal receives a shock of 70 volts by touching it on the head for a few seconds with the instrument connected to a source of electric supply, and it is claimed that the animal is thus rendered unconscious for  $2\frac{1}{2}$  minutes, during which time the blood may be withdrawn. Remarks were then made on articles accidentally swallowed by animals and their treatment, and finally on glanders, mange and other diseases affecting animals, and their prevention and treatment, illustrating everyday cases brought to the veterinary surgeon. At the annual general meeting of the Society, which followed the lecture, the honorary treasurer, Sir Leonard Rogers, pointed out that the expenditure of the Society somewhat exceeds its income, and additional subscriptions and donations would, therefore, be welcome.

#### Artificial Drying of Grass and Other Fodder

IN the agricultural world, much has been heard recently of the high nutritive value of grass and fodder crops when cut at a very early stage, and also of the possibility of preserving these special qualities by artificial drying. The Committee appointed by the Agricultural Research Council to investigate these questions has now issued its report, "The Preservation of Grass and other Fodder Crops" (London: H.M. Stationery Office. 1s. net), which provides an up-to-date authoritative account of the whole subject. After surveying the methods at present available for hay-making, ensilage, etc., the committee shows that the artificial drying of grass in the usual hay stage does not promise to be a

paying proposition. Drying grass cut young at frequent intervals throughout the season, however, has a good prospect of economic success, particularly in districts of moderate or high rainfall on land in good condition. The report then gives a full account of the methods for cutting and collecting young grass, the physical principles of drying grass, the special practical requirements of a farm drier, the cost of drying and the methods of processing and storage. Descriptions are also given of driers now on the market or those shortly to appear there, those suitable for farm as apart from large-scale factory use receiving special attention. The report concludes with a bibliography for those desirous of still further information.

#### Safety in Mines Research

WE have received from the Mines Department the thirteenth annual report of the Safety in Mines Research Board for the year 1934. This contains a large amount of interesting and valuable matter. The report proper, after a general introduction, deals with safety instructions, and then there is an important section (Part 3) on the progress of safety researches, dealing with coal-dust explosions, firedamp explosions, spontaneous combustion of coal, mining explosives, falls of ground, haulage, wire ropes and mine ventilation, while the next part deals briefly with various health researches reported by the Health Advisory Committee of the Mines Department. The report is followed by a number of appendixes which are of great importance, and cover the work of the various local committees; it is interesting to see that the value of protective equipment is becoming more widely recognised by the miners.

#### The Colonial Institute of Holland

WE have received the annual report of the Royal Colonial Institute, Amsterdam (Koninklijke Vereeniging Koloniaal Instituut, Amsterdam), which has now been in existence for twenty-four years. It gives an account of the activities of the Institute, its funds, the museum, and scientific expeditions, and of the affiliated institutes in the Dutch East Indies. A list of the staff and of their publications is given, together with a summary of the research work carried out. The last-named includes investigations on rhinoscleroma, dengue and food-poisoning, and on the mosquito fauna of Holland.

#### Meteor Observations in U.S.S.R.

WITH the object of studying the acceleration of the velocity of a meteor, the Moscow branch of the U.S.S.R. Astro-Geodetical Society has installed a camera of focal ratio  $f2$  behind a two-bladed fan, which interrupts the exposure on a star field nine times per second, at Koutchino, twenty kilometres east of Moscow. Prints of two photographs—one of a meteor and another of a meteor spectrum—together with a note upon meteor observations, have reached us from Moscow. From a typical example of observations collected (to be described in the *Monthly Notices of the Royal Astronomical Society* by



MM. Fedynski and Stanjukowitsch) it appears that the velocity decreases by 37 per cent as the meteor falls from 90 km. to 55 km. in height. The same group of observers conducts observations of meteor spectra with a prismatic camera; forty-seven lines were recognised by M. Fedynski in a meteor of stellar magnitude  $-3$ , of which the strongest were those of ionised calcium. A third exposure, made in a camera distant 1.5 km., enables the observers to compute the height of the meteor at any point on its illuminated path.

#### A Naked-Eye Sunspot

A GROUP of sunspots, large enough to be seen with the naked eye, has been in transit across the sun's disk (Nov. 3-15), in solar latitude  $29^\circ$  south; the time of central meridian passage was Nov. 9.5. The group, which was of 'stream' or 'bipolar' type, consisted of a very large circular spot with smaller followers. The leader, with an area of 800 millionths of the sun's hemisphere (800 millionths = nearly 950 million square miles), was the largest single spot observed since February 1931; the maximum total area of the present group was 1,200 millionths of the sun's hemisphere. On the few occasions when the weather permitted spectroscopic observations to be made at Greenwich, the group was not unusually active. Observations made on Nov. 9-11 show another large stream of spots extending in longitude for nearly 80,000 miles in lat.  $21^\circ$  north. The time of central meridian passage was Nov. 13.3. During the last two or three months there has been a marked increase in the sun's general activity, as shown by the increased frequency of spots—mainly of small or moderate size—dark and bright hydrogen and calcium markings on the disk and prominences at the edge of the disk.

#### Announcements

THE following have been elected as officers of the Cambridge Philosophical Society for 1935-36. *President*: Dr. F. W. Aston; *Vice-Presidents*: Prof. A. Hutchinson, Dr. E. D. Adrian, Sir J. Barcroft; *Treasurer*: Mr. F. A. Potts; *Secretaries*: Mr. F. P. White, Dr. J. D. Cockcroft, Dr. H. Hamshaw Thomas. *New Members of the Council*: Mr. R. A. Hayes, Dr. F. Kidd, Sir G. P. Lenox-Conyngham, Dr. R. G. W. Norrish.

THE fifth German Congress of the Scientific Associations on Corrosion will be held in Berlin on November 18-19. The theme of the Congress will be "The Corrosion of Metallic Materials of Construction by Cold Water". Further information can be obtained from the Verein deutscher Chemiker, Berlin W 35, Potsdamer Str. 103a.

MR. CYRIL C. BARNARD, librarian of the London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1, informs us that, in view of the numerous requests he has received for a copy of the classification used by him at that Library, he is considering the issue of a small edition in the form of a

cloth-bound volume of 144 pp., royal 8vo., at 10s. 6d., containing not only the schedules of the classification but also a full explanatory introduction, local list, index of parasites, and alphabetical subject index. Mr. Barnard can only undertake publication if sufficient promises of support are forthcoming.

THE following appointments have recently been made by the Secretary of State for the Colonies: F. J. Pound, to be agronomist, Department of Agriculture, Trinidad; N. H. Sands, to be agricultural officer, Malaya; F. W. Toovey, to be botanist, Department of Agriculture, Nigeria; W. E. Miller Logan, to be assistant conservator of forests, Gold Coast; A. C. Russell, to be assistant conservator of forests, Gold Coast; T. N. Wardrop, to be assistant conservator of forests, Nigeria; J. B. Alexander, to be geologist, Nyasaland; A. Cawley, to be engineering geologist, Tanganyika; W. H. Reeve, to be assistant field geologist, Tanganyika; B. N. Temperley, to be assistant field geologist, Tanganyika; W. J. B. Johnson, to be canning officer, Department of Agriculture, Malaya; A. A. Abraham, assistant agricultural superintendent, to be agricultural superintendent, British Guiana; G. W. Lines, late superintendent of agriculture, to be superintendent of agriculture, Nigeria; T. H. Marshall, senior agricultural assistant, to be district agricultural officer, Tanganyika; R. J. M. Swynnerton, agricultural assistant, to be district agricultural officer, Tanganyika.

THE Council of the Institution of Civil Engineers has decided that, in future, the Press can attend and report the discussions at any of the ordinary meetings of the Institution. Abstracts or advance copies of the papers to be read are available on application to the Secretary.

MESSRS. EDWARD ARNOLD AND Co. announce the early publication of a new edition of "The Structure of the Alps" by Prof. Leon W. Collet, of Geneva; and also "The Oyster and the Oyster Fishery" by Prof. J. H. Orton, of the University of Liverpool, embodying the Buckland Lectures for 1935.

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

An assistant to the research chemist of the London Shellac Research Bureau—The High Commissioner for India, General Department, India House, Aldwych, W.C.2 (Nov. 26).

An assistant lecturer and demonstrator in physics in the University of Leeds—The Registrar (Nov. 26).

A pomologist to the Royal Horticultural Society—The Secretary, Royal Horticultural Society, Vincent Square, Westminster, S.W.1 (Nov. 30).

A lecturer in geography and education in the University of Dublin—The Registrar (Dec. 2).

A professor of mining in the University of Edinburgh and Heriot-Watt College—The Secretary of the University (Dec. 31).

An assistant master to teach engineering in the Dover Technical Institute—The Principal.



## 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. 798.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

### The Electric Currents Flowing over Rusting Iron

THE electrochemical mechanism of 'rusting' is generally recognised, but our knowledge of the distribution and strength of the currents rests upon somewhat indirect methods. In the corrosion of a horizontal iron surface by filter-paper wetted with sodium bicarbonate solution, it has lately been found possible to study the current flowing horizontally through the paper without any interruption of the circuits. This is accomplished by shunting a small fraction through two non-polarising electrodes of superficially oxidised copper surrounded by filter-paper soaked in the same liquid and separated by waxed paper.

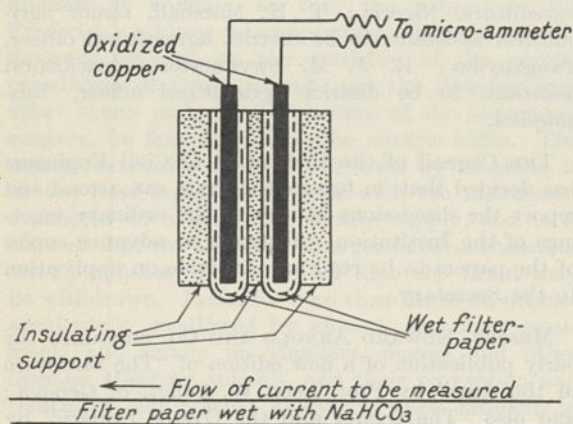


FIG. 1.

The apparatus, shown in Fig. 1, is mounted in a hinged frame, which allows it to be brought down momentarily at right-angles to the filter-paper in which the current is to be measured, and raised again as soon as the deflection of the micro-ammeter joined to the two coppers has been read—thus minimising disturbances to the corroding system. The relation between the deflection and the current to be measured is obtained by calibration on similarly wetted filter-paper strips through which known currents are forced from an external source. The form of the calibration curve indicates a satisfactory absence of polarisation, but calibration must be conducted before and after every experiment—as the sensitivity varies slightly with time; no great accuracy is claimed for the absolute values, but the general shape of the curves connecting current-strength and distance from the seat of corrosion is not in doubt.

Fig. 2 shows a curve obtained for soft iron corroded by  $N/100$  sodium bicarbonate. The iron was abraded, degreased, exposed to dry air for 24 hours, and

then a single scratch line was ruled across the centre just before application of the wet paper. Intense rusting quickly occurred along the scratch-line, and nowhere else. The change of the direction of the current near the scratch-line indicates that here the anodic (corroding) strip is surrounded by cathodic areas on each side. Since the difference ( $di$ ) between the current-strength at two points separated by distance ( $dl$ ) represents the current taken from or given up to the metal, the anodic or cathodic current

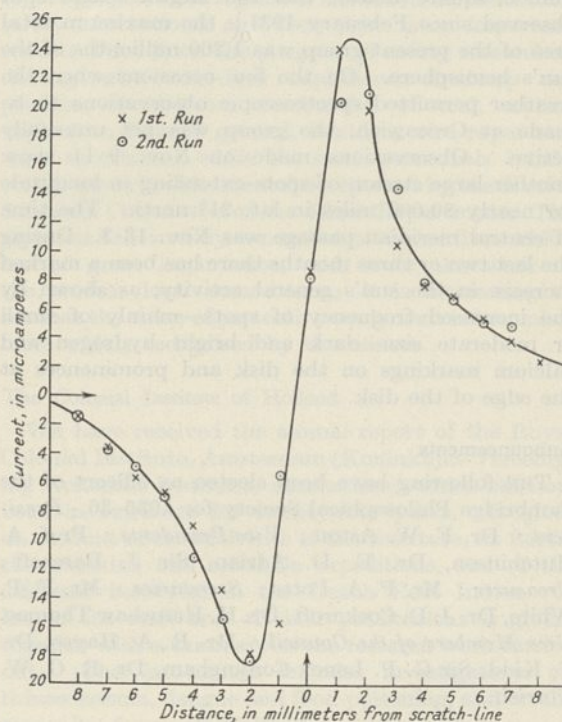


FIG. 2.

density, for a strip of breadth  $B$ , is represented by  $di/Bdl$ . Curve gradients sloping upwards to the right indicate anodic areas, and it will be noticed that there is intense anodic action immediately around the scratch, where corrosion is rapid; gradients sloping downwards to the right indicate cathodic areas, and these are free from attack.

Very similar curves have been obtained with irons of other purities, other surface conditions and other salt concentrations; but on some specimens (notably those of steel), rust appears not only along the scratch-line but also at isolated spots elsewhere; in such cases the curves show irregularities at the rusting points, important rust-spots being associated with



anodic gradients recognisable on the curves. Qualitative experiments without filter-paper on specimens covered with a layer of liquid and without a scratch-line indicate that here also corrosion is connected with electric currents, but the capillary disturbance of the liquid surface at the moment of tapping interferes with serious measurement.

The definite association of corrosion and immunity with well-separated anodic and cathodic areas, respectively, accords with the electrochemical mechanism of corrosion, as developed in previous papers with Bannister, Britton, Hoar, Borgmann, Mears and Lewis<sup>1</sup>.

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<sup>1</sup> *Proc. Roy. Soc., A*, **131**, 355; 1931. **137**, 343; 1932. **146**, 153; 1934. *Trans. Electrochem. Soc.*, **57**, 407; 1930. **61**, 441; 1932. **65**, 249; 1934. *Trans. Faraday Soc.*, **30**, 417, 424; 1934. **31**, 527; 1935. *Korrosion u. Metallschutz.*, **6**, 74, 173; 1930. **11**, 121; 1935.

Absorption of Short Wave-length X-Rays

We have recently had the opportunity of measuring the absorption coefficients of a number of substances for short wave-length X-rays. The radiations were produced at 250 k.v. (constant potential) using a filter of 3 mm. lead, 2 mm. tin and 3 mm. aluminium.

Spectroscopic evidence shows a narrow band of X-rays with a mean wave-length of 59 X.U. The measurements were carried out using a carefully controlled parallel plate chamber equipment with a compensation method of measurement as in setting up such apparatus for standardisation in roentgens<sup>1</sup>. Care was taken to reduce the scattered radiation entering the chamber, and the error in absorption coefficient due to it is estimated at not greater than two per cent. The absorption coefficients of a number of elements are given below.

Element	Form	Mass absorption coefficient $\mu/\rho$	Electronic absorption coefficient $\times 10^{24}$
Lithium	Metallic blocks in petroleum	0.107	0.408
Beryllium	Powder	0.110	0.413
Carbon	Graphite blocks	0.123	0.407
Oxygen	Liquid	0.120	0.398
Magnesium	Metallic blocks	0.121	0.405
Aluminium	Metallic blocks	0.119	0.409
Sulphur	Powder	0.121	0.401
Calcium	Shavings	0.135	0.447
Iron	Sheet	0.138	0.490
Copper	Sheet	0.154	0.558
Selenium	Powder	0.168	0.645
Rhodium	Sheet	0.246	0.928
Palladium	Sheet	0.252	0.887
Tin	Sheet	0.310	1.213
Iodine	Crystals	0.325	1.282
Tantalum	Sheet	0.658	2.70
Platinum	Sheet	0.684	2.83
Lead	Sheet	0.847	3.53

The mean absorption per electron for light elements up to calcium is, for this wave-length,  $4.06 \times 10^{-25}$ , in fair agreement with the predictions of the Klein-Nishina formula<sup>2</sup> ( $4.00 \times 10^{-25}$  for  $\lambda = 59$  X.U.) This result is of some biophysical interest in view of the problems of the physical basis of the effects of such radiations on living materials<sup>3</sup>. The photo-electric absorption coefficient per electron  $\mu_{\tau}$ , defined by  $\mu_{\tau} = \mu_e - 4.06 \times 10^{-25}$  is found by us to vary according to the law  $\mu_{\tau} = kZ^{3.0}$ , where  $k$  is constant and  $Z$  the atomic number of the element<sup>4</sup>.

We have also measured, for the same wave-length, the absorption coefficients of two liquids containing hydrogen, namely, water and ethyl alcohol, as well as deuterium oxide. The values are given below.

Substance	$\mu/\rho$	Form
Water	0.133	Distilled
Ethyl alcohol	0.142	A.R.
Deuterium oxide	0.118	99 per cent purity (Norwegian origin)

For short wave-lengths, the mass absorption coefficient for hydrogen should be approximately twice that of any other light element owing to the low ratio of atomic weight to atomic number. This appears in the results as an increase of 11 per cent in the mass absorption coefficient of water and 18 per cent for alcohol. Deuterium, on the other hand, would be expected to behave as a normal light element and this is verified in the value of  $\mu/\rho$  obtained for deuterium oxide.

It may be observed that absorption measurements of this type serve to count electrons per atom, as distinct from the more usual method of weighing isotopic nuclei.

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<sup>1</sup> Mayneord and Roberts, *British Journal of Radiology*, **7**, 158; March 1934.

<sup>2</sup> Lauritsen and Read, *Phys. Rev.*, **45**, 433; April 1934.

<sup>3</sup> Mayneord, *Proc. Roy. Soc., A*, **146**, 867; Oct. 1934.

<sup>4</sup> Rutherford, Chadwick and Ellis, "Radiations from Radioactive Substances", p. 479.

New Technique for Obtaining X-Ray Powder Patterns

To obtain the X-ray diffraction pattern of a flat specimen such as is met with in metallurgical practice, the specimen may be mounted in a circular camera and inclined at a small angle to the beam. This is illustrated in Fig. 1. With the usual diaphragm, we have observed that diffraction lines making a small

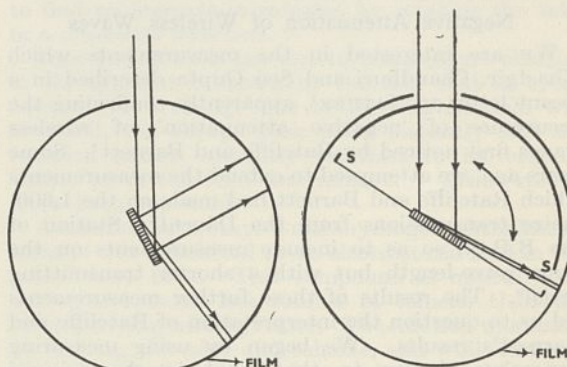


FIG. 1. FIG. 2.

angle with the surface of the specimen are particularly sharp, but become broader as the angle between the diffracted beams and the surface of the specimen increases.

For a measurement one requires all the lines to be sharp, and so a camera according to Fig. 2 was devised, which can be used to record all or, if desired,



only a few reflections. In this camera, a shutter in which two slits, *S*, are cut, is arranged to rotate with the specimen, so that diffracted beams only reach the film when they make a small angle with the specimen surface.

To make full use of the principle, as wide a parallel beam as can be obtained from the focus of the X-ray tube is utilised. Very good results are obtained by means of a multiple diaphragm system as shown in Fig. 3.

If only a few lines, for example, within a region of  $12^\circ$  to  $15^\circ$ , are desired, the specimen may be kept stationary or, perhaps, oscillated over the region.

A useful application of the principle is to obtain a narrow intense beam of polarised monochromatic X-rays. A single crystal of copper cut with its plane surface at an angle of about  $40^\circ$  to the (311) plane is used as a polariser<sup>1</sup>, and is irradiated by a wide beam of copper *K $\alpha$*  radiation (defined by a multiple diaphragm).

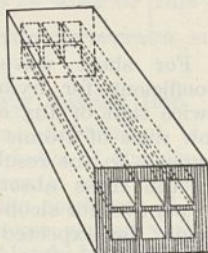


FIG. 3.

The advantages of the new method described above may be summarised as follows:

- (a) a flat specimen such as is met with in metallurgical practice is used—this is an important point;
- (b) the intensity of each line in the photograph can be calculated without difficulty—this is not so with the usual rod-shaped specimens;
- (c) the sharpness of the lines can be controlled;
- (d) in the case where the specimen is maintained stationary or oscillated over small angles, there is a much decreased time of exposure owing to the more efficient use of the available radiation.

Further details will be given elsewhere:

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<sup>1</sup> George, *NATURE*, **136**, 180, Aug. 3, 1935.

### Negative Attenuation of Wireless Waves

WE are interested in the measurements which Khastgir, Chandhuri and Sen Gupta described in a recent letter to *NATURE*<sup>1</sup>, apparently confirming the occurrence of 'negative attenuation' of wireless waves first noticed by Ratcliffe and Barnett<sup>2</sup>. Some years ago, we attempted to extend the measurements which Ratcliffe and Barnett had made on the 1,600-metre transmissions from the Daventry Station of the B.B.C., so as to include measurements on the same wave-length but with a shorter transmitting aerial<sup>3</sup>. The results of these further measurements led us to question the interpretation of Ratcliffe and Barnett's results. We began by using measuring apparatus similar to that used in the original investigation, and consisting of a tuned loop circuit with a Moullin voltmeter placed directly across the tuning condenser. With this apparatus we reproduced the curve of Ratcliffe and Barnett quite closely. We then had occasion to make measurements with an apparatus in which the signal produced a deflection in a galvanometer attached to the output of an amplifier, this deflection being matched by injecting a calibrated E.M.F. into the loop circuit. This method

of measurement showed no sign of the 'negative attenuation' effect. Closer investigation of the disagreement led us to the conclusion that the measurements made by the Moullin voltmeter method were vitiated by the fact that, owing to the flow of grid current, the damping which the voltmeter produced in the loop circuit was a function of the signal amplitude. The increased damping for the larger signals caused the signal strength to be progressively underestimated as the apparatus approached nearer to the emitter, and gave the appearance of 'negative attenuation'.

We were able to show that the magnitude of the apparent 'negative attenuation' effect was accounted for by the measured values of the grid current. We now believe that the apparent 'negative attenuation' observed by Ratcliffe and Shaw<sup>4</sup> with a wave-length of 30 metres is due to the same cause.

In the discussion of a paper read to the Institution of Electrical Engineers<sup>5</sup>, attention was directed to the possibility of errors of this kind when using the Moullin voltmeter method.

When measuring with the injected E.M.F. method we have not been able to observe any 'negative attenuation' on 1,600 m. wave-length from the Daventry emitter, on 360 m. from Brookman's Park, or on 1,600 m. from an experimental emitter at Cambridge. We are therefore surprised that Khastgir, Chandhuri and Sen Gupta have observed the effect, and we wonder whether they, too, can have been misled by using the Moullin voltmeter method. We consider that their curves would have been more convincing if they had observed more points on the all-important rising part of the curve. It is unfortunate that the only measurement shown on this part of the curve is that at the origin; if for any reason this was in error, the whole nature of the curve would be altered.

<sup>1</sup> *NATURE*, **136**, 605; Oct. 12, 1935.

<sup>2</sup> *Proc. Camb. Phil. Soc.*, **23**, 288; 1926.

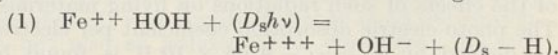
<sup>3</sup> *NATURE*, **125**, 926; 1930.

<sup>4</sup> *NATURE*, **124**, 617; 1929.

<sup>5</sup> *J.I.E.E.*, **70**, 543; 1932.

### Photochemical Reactions connected with the Quenching of Fluorescence of Dyestuffs by Ferrous Ions in Solution

IT has been found recently that ferrous ions exert a strong quenching effect on different fluorescent dyestuffs in solution<sup>1</sup>. According to previous theoretical discussions<sup>2</sup>, in the elementary process of quenching, the light quantum ( $h\nu$ ) is transferred from the excited dyestuff molecule ( $D_s h\nu$ ) to the  $Fe^{++}$  ion by a collision of the second kind. Unlike the case of direct irradiation, when the Franck-Condon principle is observed, we can gain here some energy from the potential energy of the heavy particles. Thus in this case the hydration energy of the ions formed in the process and the binding energy between dyestuff and H-atom can be used according to:



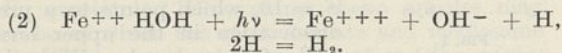
By irradiating different dyestuffs such as brilliant-cresylblue, methyleneblue, thionine, uranine (in water),



chlorophyll (in 60 per cent  $\text{CH}_3\text{OH}$ ) in an ( $\text{H}_2\text{SO}_4$ ) acid solution of  $\text{FeSO}_4$  with the visible radiation of a strong carbon arc (oxygen being excluded) a considerable change in colour or bleaching is produced by the action of light, due to the formation of the reduced dyestuffs. The formation of these leuco-dyes takes place irreversibly, when the  $\text{Fe}^{+++}$  ions formed simultaneously are removed from the solution (for example, precipitated by hydrolysis). But with certain dyestuffs (for example, brilliant-cresylblue, methyleneblue, thionine) in acid solution the process is completely reversible in the dark, the  $\text{Fe}^{+++}$  formed being reduced by the leuco-dye. With these reactions it is proved that in general the binding energy between the radicals formed and the dyestuff can contribute an important part of the energy for the primary process of sensitisation (Reaction 1).

In analogy with other cases we have also been able to find the direct (unsensitised) photo-chemical process by irradiating an ( $\text{H}_2\text{SO}_4$ ) acid solution of ferrous sulphate ( $\frac{1}{2}$  molar) with ultra-violet light (from a strong mercury arc) which is strongly absorbed by the ferrous sulphate.

If oxygen is excluded, molecular hydrogen is formed in this process, with simultaneous formation of  $\text{Fe}^{+++}$  ions according to the electron affinity spectrum of Franck and Haber<sup>3</sup>:



The quantum efficiency with respect to formation of molecular hydrogen was found to be of the order  $\sim 0.1$  ( $20^\circ \text{C.}$ ) and was practically independent of the concentration of the acid within the range  $0.08$ – $0.25$  molar  $\text{H}_2\text{SO}_4$ , but was strongly dependent on the initial concentration of ferric salt present in the solution. These facts indicate that a reverse reaction, the reduction of  $\text{Fe}^{+++}$  by H atoms



plays an important part, competing with the recombination of the H atoms giving molecular hydrogen.

The reactions discussed above may be of some interest for certain biological problems.

The fact that by sensitisation in the presence of  $\text{Fe}^{++}$  ions it is possible to produce H atoms from water with the radiation of the visible spectrum (in spite of the binding energy  $\text{H} - \text{OH}$  being  $115 \text{ k.cal.}$ ) may be of importance for the assimilation process of green plants (regeneration of the chlorophyll). Noack<sup>4</sup> recently found a relatively high content of ferrous compounds, present in simple inorganic form, in the chloroplasts of green plants.

On the other hand, the reversible bleaching of dyestuffs with light in the presence of the  $\text{Fe}^{++}/\text{Fe}^{+++}$  system can be regarded as the most simple model for the visual process.

I would like to thank Prof. F. G. Donnan for his continuous interest and valuable discussions.

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<sup>1</sup> J. Weiss, *Naturwiss.*, **23**, 64; 1935.

<sup>2</sup> J. Franck and H. Levi, *Z. phys. Chem.*, B, **27**, 409; 1935.

<sup>3</sup> J. Weiss, *Naturwiss.*, **23**, 610; 1935.

<sup>4</sup> J. Franck and F. Haber, *Sitzungsber. Preuss. Akad. Wiss.*, **13**; 1931.

<sup>5</sup> K. Noack, *Z. f. Botanik*, **23**, 957; 1930.

## Optical Rotatory Power of Solutions in an Electric Field

PREVIOUS work has shown that a relationship exists between the rotatory power of an optically active solution and the electric moment of the solvent. It has been found that, in general, the rotation varies in the opposite sense to the electric moment of the solvent throughout a series of solvents derived from the same parent hydrocarbon. An explanation of this observation has been advanced in terms of dipolar association between solvent and optically active solute, and numerous results have been brought forward in support of this hypothesis.

These observations suggested the possibility that an electric moment induced in the solvent molecules by an external electric field might have an effect similar to that of a permanent moment. Previous experience had shown that solvent influences are best observed with optically active compounds of simple molecular structure with a strongly polar group or groups situated near the asymmetric centre. For this reason, 2-*l*-menthyl-3-nitro-hydrogen phthalate was considered a suitable optically active solute, while solvents with zero or very small permanent electric moment were thought to be most advantageous for the proposed investigation; accordingly benzene and toluene were employed as solvents. Indeed, when an external electric field was applied to the solution, changes in rotatory power were observed. The tube with two parallel platinum electrodes, containing the solution, was placed in a Schmidt and Haensch half-shadow polarimeter reading to  $0.01^\circ$ . Rotations as large as  $0.59^\circ$  were obtained for the solution; the electric field was varied between about 500 and 11,000 absolute units. The rotation (change of rotation) increased at first slowly with increasing field, reached a maximum at about 4,000 absolute units and remained then constant, an effect which distinguishes this phenomenon clearly from the Kerr effect; but the two phenomena have in common that the effect is enhanced when the angle between the direction of the field and the plane of polarisation of the light is increased by rotating the tube in an anticlockwise direction. We expected this effect, that is, a decrease of the rotation, but we were surprised to find an increase in rotation by rotating the tube in a clockwise direction.

That the effect is not due to temperature changes in the solution is shown by the fact that in every case where a change due to the electric field was recorded, the change took place instantly and the rotation almost instantly returned to its original value, when the field was removed. These results have been repeated.

A solution of 2-ethyl-3-nitrohydrogen phthalate in toluene was submitted to an electrostatic field in the polarimeter tube. This compound is optically inactive and much less soluble in toluene than the corresponding menthyl ester. The solution was made by heating the ester and toluene, and while hot was poured into the tube; when under the influence of the field it was about 2 per cent with respect to the ester. The rotatory power was again a function of the potential difference between the electrodes, reaching a maximum at about 3,000 volts with both direct and alternating electric fields. It was very difficult to repeat these results, as the solution seemed to change continuously during the experiment. With the same field strength, the polarimeter readings were very erratic, for example, at one observation the



application of a field of 14,300 volts caused an instantaneous rotation of  $\alpha = +3.01^\circ$ , but in a few seconds, whilst the field was still on, it dropped to  $\alpha = 0.35^\circ$ . After the solution had been standing for three days, even the most powerful field had no effect on it; however, with a fresh hot solution rotational changes were again observed. The effects obtained with the ethyl ester appear to be distinct from those exhibited by the menthyl ester.

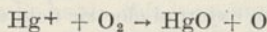
It is hoped to continue these investigations.

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### Separation of the Mercury Isotopes by a Photochemical Method

WHEN a mixture of mercury vapour and oxygen is irradiated with the mercury resonance line  $\lambda 2537$ , the mercury becomes oxidised. Since excitation is a necessary stage in the oxidation, Mrozowski<sup>1</sup> has suggested that it should be possible to produce a separation of the mercury isotopes by exciting them selectively. If the reaction consists of the primary photochemical process



only the atomic species which are excited by the incident light should be oxidised.

In my experiments the light from a mercury arc was passed through a Mrozowski filter<sup>2</sup> consisting of a column of mercury vapour in a magnetic field. This transmitted only the hyperfine structure components of the resonance line corresponding to the isotopes 200, 202. After an irradiation of between 10 and 30 minutes, the isotopic composition of the remaining mercury or of that recovered from the oxide was examined by the method of absorption of single hyperfine structure components<sup>3</sup>. The results of the experiments show:

(1) The separation is in every case only partial, so that besides the primary process, secondary reactions must take place.

(2) An addition of nitrogen assists the separation ( $p_{\text{O}_2} : p_{\text{N}_2} \sim 1 : 1$ ,  $p_{\text{O}_2} \sim 1$  mm. Hg).

(3) It has been possible to obtain samples in which the ratio  $\frac{P_{200} \cdot 202}{P_{198} \cdot 199 \cdot 201 \cdot 204}$  was modified by a factor of four.

More detailed information will be published in the *Helv. Phys. Acta*.

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<sup>1</sup> S. Mrozowski, *Z. Phys.*, **78**, 826; 1932.

<sup>2</sup> S. Mrozowski, *Bull. Acad. Pol.*, **A**, 464; 1930.

<sup>3</sup> K. Zuber, *Helv. Phys. Acta*, **8**, 370; 1935.

### Dissociation Energy of Carbon Monoxide

In a former communication<sup>1</sup> we suggested 8.41 volts as the most probable value for the energy of dissociation of carbon monoxide. This was based upon a predissociation which we found in the upper level  $B^1\Sigma$  of the Angström bands<sup>2</sup> and in the upper level  $b^3\Sigma$  of the third positive group<sup>3</sup>, at a height of 11.08 volts above the normal state of the molecule.

Both predissociations we ascribed to the dissociation state  $^3P$  (oxygen) +  $^1S$  (carbon). To fix the dissociation energy with certainty, however, it is necessary to find another place of predissociation caused by a different state of the dissociation products.

An attempt in this direction was made by Schmid and Gerö<sup>4</sup>. They found predissociation in the higher level of the Herzberg bands at 0.48 volt above the predissociation mentioned above. This difference may be compared with that between two dissociation states of the molecule. As Fig. 1 shows, the difference between  $^3P + ^1S$  and  $^1D + ^1D$  is 0.53 volt, that between  $^1S + ^3P$  and  $^1D + ^1S$  is 0.46 volt. Schmid and Gerö believe that here the former difference must be taken, hence assuming an error of 0.05 volt, which is much larger than the triplet splitting in the atomic energy states concerned. Therefore we believe that the dissociation energy of carbon monoxide was still left uncertain.

In examining the fourth positive group of CO, we found a sudden disappearance of the band lines in the bands with  $v' = 10$ , which points to a predissociation in the upper level

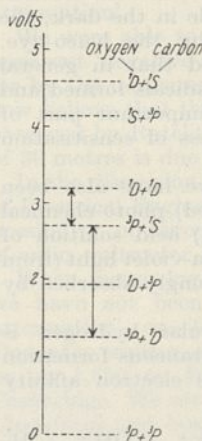


FIG. 1.

$A^1\Pi$  of these bands. With the known band constants, the height of the dissociation state which causes this predissociation is calculated to be 9.66 volts above the normal state of the molecule. Comparing this predissociation with that in the upper level of the Angström bands at 11.08 volts, we find that the difference 1.42 volts corresponds exactly with that between the  $^3P + ^1D$  and  $^3P + ^1S$  states. Therefore we are sure of the following results: (1) the predissociation in the  $A^1\Pi$  level is caused by  $^3P + ^1D$ ; (2) the predissociation in the  $B^1\Sigma$  level is caused by  $^3P + ^1S$ ; (3) the dissociation energy of CO is 8.41 volts.

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<sup>1</sup> D. Coster and F. Brons, *Physica*, **1**, 648; 1934.

<sup>2</sup> D. Coster and F. Brons, *Physica*, **1**, 155; 1934.

<sup>3</sup> F. Brons, *NATURE*, **135**, 873; 1935. L. Gerö, *Z. Phys.*, **95**, 747; 1935.

<sup>4</sup> R. Schmid and L. Gerö, *Z. Phys.*, **96**, 546; 1935.

### A New Technique in Cookery

THE leading article on "Food, Farmer and Future", by Prof. H. E. Armstrong, in *NATURE* of October 12, p. 565, encourages me to invite attention to what, I believe, is a new technique in the art of cooking.

It is commonly held that meat should be roasted in an oven at a temperature of 300°–500° F. and that the oven should be very hot for the first fifteen minutes so as to 'seal up the nutritive juices', particularly in the case of brown meat such as beef or mutton. It was, therefore, with some trepidation that my wife permitted a Sunday joint, a 6 lb. shoulder of mutton, to be put at 9 p.m. on a Saturday night into an oven thermostatically controlled at 212° F. She did not encourage me to experiment



with an expensive joint and the mutton cost  $5\frac{1}{2}d.$  per pound. As things turned out this was fortunate, for we found that, despite its cheapness, the joint after fifteen hours cooking was delicious beyond all expectation.

The next experiment was with a boiling fowl which, when roasted in the same way for fifteen hours, was found to be as tender as a chicken and as full-flavoured as a turkey. Further tests with beef and mutton have confirmed the superfine quality of meat cooked at a low temperature, and the cooking of fish and other comestibles is now being studied.

It is important to observe that this method of cooking has been made practicable by the development of the heat-insulated thermostatically controlled oven. Strangely enough, however, it does not appear to have been discovered by the cookery schools or by the experts who advise the stove manufacturers.

In my household, the adoption of the new technique results in a saving estimated at not less than one penny per head per day: when it is realised that for the population of Great Britain a saving of one penny per head per day amounts to £70,000,000 a year, it is evident that scientifically directed experimental inquiry into the cooking of foodstuffs is of considerable economic importance.

In the great renaissance promised by Prof. Armstrong we may find perhaps the answer to Rumford's question: "How many cheap articles may there be of which the most delicate and wholesome food might be prepared, were the art and the science of cooking them better understood?"<sup>1</sup>

A. F. DUFTON.

The King's Lodge,  
Hunton Bridge,  
Herts.  
Oct. 14.

<sup>1</sup>"Essay on the Construction of Kitchen Fire-Places and Kitchen Utensils", 1802.

### *Dementia nomenclatorica americana*

FOLLOWING upon the protests against the proliferation of nomenclature in the Foraminifera that have appeared in NATURE, I observe that in the fascicle of Protozoa in the "Zoological Record" for 1934 three hundred and fifty-four new genera, species and varieties are added to the nomenclature.

American protozoologists are not the only offenders (if offence it be), for no less than seventy-three of these new species are recorded in Part 3 of the "Discovery" Reports on the Foraminifera, published in 1934.

Now comes a letter from Dr. Hans E. Thalmann, the most diligent and accurate bibliographer of the Foraminifera since Dr. C. D. Sherborn, in which he says:

"With great interest I read a few weeks ago your article in NATURE and I would be more than glad if many of our American colleagues would read it earnestly as well. My 'Bibliography of Foraminifera for the year 1933' (at present in press) contains not less than 390 papers dealing with Foraminifera—and therein are published not less than about 40 new genera and subgenera, 390 new species and varieties. The manuscript for the year 1934 so far counts about 340 papers, 25 new genera, more than 300 new species. I am sure that more than 80 per cent of these so-called new species can easily be placed amongst already published forms, and that most of all the new generic names since 1927 have only subgeneric value. This *dementia nomenclatorica americana* is not

only a serious problem to-day but will burden the poor minds of future workers in Foraminifera. It is really to be deeply deplored that at present only a few systematists and taxonomists realise the fact that nomenclature is *not* a science, but should be an aid to science."

EDWARD HERON-ALLEN.

Large Acres,  
Selsey Bill,  
Sussex.

### Estimation of Ascorbic Acid by Titration

SOME time ago I observed an increase in the ascorbic acid value of cabbage on cooking<sup>1</sup>. McHenry and Graham<sup>2</sup> have found a similar increase in cauliflower, carrots, parsnips, beets and potatoes, though not in cabbage, and have expressed the view that the increase on boiling was due to the setting free of bound ascorbic acid, possibly from an ester. Van Eekelen<sup>3</sup>, however, is of the opinion that the apparent increase is due to the destruction of an oxidase present in these vegetables.

Working with Darjeeling cabbage obtained from local markets, I have repeatedly obtained a very much increased ascorbic acid value by boiling for 10 minutes before extraction with 20 per cent trichloroacetic acid. The value obtained in the cold is about 13 mgm. per 100 gm. vegetable, and increases to 40 mgm. per 100 gm. after boiling. Even boiling with water alone yields an appreciably richer extract than that obtained with cold trichloroacetic acid.

It is evident that at least in this case no destruction of an oxidase is concerned, because in the cold the vegetable was ground up under 20 per cent trichloroacetic acid. The view of McHenry and Graham may appear to be more plausible.

B. AHMAD.

Department of Biochemistry  
and Nutrition,  
All India Institute of Hygiene,  
Calcutta.  
Sept. 26.

<sup>1</sup>Ahmad, *Biochem. J.*, **29**, 275; 1935.

<sup>2</sup>McHenry and Graham, *NATURE*, **135**, 871; 1935.

<sup>3</sup>Van Eekelen, *NATURE*, **136**, 144; 1935.

### Presence of Roes in New Zealand Marlin Swordfishes

IN view of the scarcity of data on the breeding of marlin swordfishes, the following note may, perhaps, be of interest. Swordfishing has been a popular sport in this locality, the Bay of Islands, New Zealand, since 1911. Yet in spite of the fact that many fishermen and scientific workers have examined the fish caught, primarily to distinguish the sexes and, if possible, discover secondary sexual characters, no swordfish with ovaries containing roe had been discovered. With the view of increasing our knowledge of the breeding habits of these fish, I examined systematically a number of them, and on February 28 of this year dissected a Striped marlin, *Makaira (Tetrapturus) mitsukurii*, Jordan and Snyder, weighing 238 lb., which contained well-filled, firm ovaries measuring approximately 37 cm. in length and 5.5 cm. in diameter in the widest part. The ova were separate and measured 0.004 inches. On April 3, I examined the roes of another Striped marlin of similar proportions. These fish seemed to exhibit no outstanding sexual characteristics.



In the previous month, however (March 12), a Black marlin, *Makaira (Tetrapturus) mazara*, Jordan and Snyder, had been caught, of the roes of which I have samples. This fish, weighing 436 lb., had roes containing ova of about the same size as those previously mentioned, but departed from all Black marlin previously caught in that it possessed a black dorsal band extending downwards for about six inches, the remainder of the sides and belly being silvery. Black marlin usually seen in this locality are of a dark, blackish-purple colour, fading gradually to a white ventral line.

Russell,  
New Zealand.  
Aug. 10.

V. W. LINDAUER.

#### Cleopatra's Temple at Armant

THERE existed at Armant until the year 1861 an extremely interesting temple built by Cleopatra the Great in honour of the birth of her son Caesarion. This was completely demolished between the years 1861 and 1863 and the materials were taken and

used in the construction of a sugar factory; but, prior to that date, it had been visited and described by many travellers and fortunately, a number of drawings, plans and photographs of it were taken by them. We are engaged upon a reconstruction of this temple for publication and we should be very grateful for any help which readers of NATURE may be able to give us to make this as complete as possible. Any information about unpublished descriptions, plans, drawings or photographs of it would be of the greatest value.

A large number of travellers toured this part of Egypt in the eighteenth and nineteenth centuries, when the diary habit was strong, the standard of draughtsmanship high, and towards the end of the temple's existence, photography was just becoming popular. We believe that there may well remain important records in private collections which would be of great assistance in making some restitution for the vandalism of the last century.

ROBERT MOND.  
OLIVER H. MYERS.

200 Euston Road,  
London, N.W.1.

#### Points from Foregoing Letters

DR. U. R. EVANS illustrates an experimental arrangement which enables him to investigate the electric currents flowing over an iron surface in contact with bicarbonate solution during the process of rusting. The results obtained show intense anodic action immediately around a scratch where rusting is rapid, while the cathodic areas are free from attack.

Measurements by Dr. W. V. Mayneord and J. E. Roberts of the absorption of short wave-length X-rays (59 X.U.) indicate for elements of low atomic weight good agreement with the theoretical predictions of Klein and Nishina. For heavier elements the photoelectric absorption per atom is proportional to the fourth power of the atomic number. Owing to its large electronic content per unit mass, hydrogen has a larger absorption coefficient than other light elements. Deuterium proves, however, to be, from this point of view, the 'normal' light element.

A new technique for obtaining X-ray powder photographs from flat specimens is described by R. A. Stephen and R. J. Barnes. The principle also finds an application in obtaining an intense beam of monochromatic polarised X-rays.

Khastgir, Chandhuri and Sen Gupta have recently confirmed the negative attenuation of wireless waves, first described by Ratcliffe and Barnett. J. A. Ratcliffe and F. W. G. White point out, however, that upon further investigation they have found that the original results were due to the use of a Moullin voltmeter, which vitiated the experiments. They inquire, therefore, whether the results obtained by the Indian experimenters may not be similarly explained, and further suggest that more points might suitably be obtained by them on the rising part of the curve.

Dr. J. Weiss directs attention to a possible analogy between the reversible photochemical reaction involved in the bleaching of dyestuffs such as methylene blue by visible light in the presence of ferrous ions, and processes taking place in the retina; also between the production of hydrogen under the same conditions, atoms from water (in spite of the high

energy needed) and the assimilatory process in green plants. In addition to these sensitised reactions in which the potential and binding energy of the heavy particles play a part, J. Weiss states that he has detected the *unsensitised* photochemical process by irradiating an acid solution of ferrous sulphate with ultra-violet light from a mercury lamp.

By placing a solution of the optically active and strongly polar compound 2-*l*-menthyl-3-nitro-hydrogen phthalate in benzene or toluene, in an electric field, Prof. J. Kunz and A. McLean have observed changes in the optical rotatory power. The change in rotation reaches a maximum when the strength of the field is 4,000 absolute units, which distinguishes the phenomenon from the Kerr effect. The authors ascribe the effect to the electric moment induced in a solvent by the electric field. Anomalous effects were observed with 2-ethyl-3-nitrohydrogen phthalate.

Taking advantage of the fact that ultra-violet light of wave-length 2537 excites and oxidises mercury atoms of mass 200 and 202 but not those of mass 198, 199, 201 and 204, Dr. K. Zuber has succeeded in producing a partial separation of ordinary mercury into fractions richer in those two groups of isotopes. The presence of nitrogen assists in their separation.

The structure of the fourth positive group of bands in the spectrum of carbon monoxide provides, according to F. Brons, definite confirmation that the dissociation energy of carbon monoxide is 8.41 volts, as has previously been suggested by Coster and Brons.

The amount of ascorbic acid (vitamin C) found in Darjeeling cabbage after boiling for ten minutes is greater (as in the case of other vegetables) than the amount obtained by extraction in the cold with 20 per cent trichloroacetic acid. This, B. Ahmad considers, supports the view of McHenry and Graham, who ascribe the increase to the setting free of ascorbic acid from an ester compound, as against van Eekelen's opinion that the increase is only apparent and is due to the destruction of an oxidase ferment.



## Research Items

### Archæology in Australia

MR. D. S. DAVIDSON, who from April until July, 1930, was engaged in archaeological reconnaissance in the Katherine River-Victoria River region of North Australia for the Museum of the University of Pennsylvania, points out in a discussion of the problems to which his investigations have given rise (*J. Roy. Anthropol. Inst.*, 55, pt. 1) that very few serious attempts at excavation have been made, the few of any importance being those sponsored by the South Australian Museum. The absence of pottery and the nomadic habits of the aborigines make the location of a site a matter of difficulty, but the desert areas offer compensation in the preservation of objects perishable elsewhere. The use of caves in the wet season and of rock-shelters has provided material for investigation, but the aboriginal practice of burying implements and personal belongings for safe-keeping is a disturbing factor in stratigraphic study. Of the caves examined, some were still in occupation. It was not possible to estimate the antiquity of the material found. Natives must have inhabited the area for thousands of years, but the cave deposits give the impression that they might have been built up in a few centuries. The classes of objects found were not numerous. One of the problems of the future will be to distinguish important localised types. A tentative classification suggests that the 'pirioid' type of adze point appears to antedate the use of quartzite spear-heads, while these quartzite spear-heads quite definitely antedate the type of blade which is a product of the pressure flaking technique. This appears to be a fairly recent product as its use is only now spreading to north and central Australia, among the tribesmen of which the technique appears to have been unknown previously, while the former, the quartzite spear-head still in use, is the only one of the two occurring archæologically.

### Serbian Gypsy Cult of the Anvil

DR. ALEXANDER PETROVIĆ, in continuation of his study of the gypsies of Serbia and Bosnia, has described their cult of the anvil (*J. Gypsy Lore Soc.*, Ser. 3, 14, Pt. 4). The gypsies of Rogatica make their own anvils, buying good iron or steel. Prayer precedes the making; and when the anvil is made it is wrapped in rags and brought into the tent where none may see it, until the appointed day, when the maker gives a feast and a sheep or hen is slaughtered. The anvil is exhibited after dinner, surmounted by three lighted candles, of which one has been saved from the preceding feast of St. Elias. After prayer, the anvil is struck for the first time with a hammer, and those present offer gifts of coin, gold if possible, with exclamatory wishes of good luck. During the rest of the day, neighbours come in to look at the anvil and make similar gifts. In olden times payment for any work done was not given to the smith, but placed on the anvil. On St. George's Day it is decorated with young boughs; and on St. Elias's Day and New Year's Day a lighted candle is stuck in the hole, again with an expression of good luck. When a young boy was apprenticed one of his fingers was placed on the anvil and struck three times with the hammer. The anvil was definitely regarded as sacred.

An old anvil is never thrown away, but kept in the house "like an old man or an old woman". In cases of theft, suspected persons swear their innocence by the anvil, which is set up in the yard in front of the house of the injured party, surmounted by a lighted candle, some salt and a piece of bread. At Mirijevo, near Belgrade, an axe takes the place of the anvil. As sacred, the anvil and everything connected with the forge were believed to have healing powers. The water in the tub by the anvil, in which the heated iron is plunged, is holy and is given as medicine to both cattle and human beings. A similar cult and oath are found among other gypsies in connexion with the fiddle and money. It is thus evident that the Serbian gypsies venerate and regard as holy that by which they earn their living.

### Noise and Efficiency in Works

REPORT No. 70 of the Industrial Health Research Board ("Conditions of Noise", by H. C. Weston and S. Adams) describes an experiment that has been made to test the effect of continual noise upon the efficiency of weavers. Noise is first defined as unpleasant or disturbing sound, such as obtains in the weaving sheds. Two groups, of the same efficiency, worked first for six months and then for a year in the same conditions and with the same materials. One group, of ten men, was exposed to the usual noise. The other, also containing ten men, was given ear-defenders which reduced the intensity of noise by 15 decibels or half the apparent loudness. At first the increased personal efficiency in the protected group was considerable. It became less so afterwards, but the average increase remained as high as  $7\frac{1}{2}$  per cent in the latter part of the experimental period. A similar experiment in 1932 rated the increase at 12 per cent, but possibly the conditions were more favourable. The workers liked wearing the ear-defenders, and even those accustomed to the noise and immune from its effects in respect of irritability and distraction were increased in efficiency. It is impossible, however, to infer from this experiment the value of decreased noise in cases where the work is different and the initial noise less.

### Japanese Bopyrids

S. M. SHINO describes a large number of Bopyrids in two papers, Bopyrids from Tanabe Bay (1 and 2) (*Mem. Coll. Sci., Kyoto Imp. Univ.*, B, 8, No. 3, 1933 and 9, No. 4, 1934). Twenty-eight species are described, eighteen of which are new. It is a most interesting collection and several peculiar features are pointed out. Of the branchial parasites, a large number inhabit hermit crabs, but several other groups are parasitised, including two *Peneopsis* and a *Solenocera*. The abdominal parasites are not so numerous. *Bopyrina giardi* Bonnier is recorded from *Hippolyte* sp., its general constitution being largely in accord with the characters given by Bonnier for the European form, but there are certain differences, notably that of the male cephalon being fused with the first thoracic segment in those from Japan, whilst it is separate in those from Europe, and anal spines are present in the latter, absent in the former. Four females, each carrying a male, were found in



the branchial cavity of one *Hippolyte*. The male has a coloured pattern on both dorsal and ventral surfaces. A common species inhabiting the left branchial cavity of the hermit-crab *Clibanarius bimaculatus* is a new species of *Pseudione*, *P. clibari-cola*. It never occurs in the right cavity, which is sometimes occupied by another type of Bopyrid, also a new species, *Pseudione asymmetrica*, and this is never found on the left side. Sometimes both species are found in the same individual.

#### Movements of Copepods

THE importance of copepods in the ecology of fresh- and salt-waters is well established, but little is known of the actual mechanism of their swimming movements or of their methods of feeding. A recent paper by A. G. Lowndes ("The Swimming and Feeding of certain Calanoid Copepods", *Proc. Zool. Soc. London*, Part 3, 687-715; 1935) is therefore especially welcome. By a variety of methods, including the polygraph process and ultra-rapid photography with exposures up to 1/30,000 of a second, the movements of the appendages were examined in seven of the commoner marine species and three species of fresh-water copepods. Much evidence is brought forward to show that feeding cannot be regarded as purely automatic or non-selective. In this connexion the observation that *Diaptomus gracilis* caught in a pool, the waters of which were green with unicellular algæ, had been feeding on desmids on the bottom is of special interest. In this paper the author supports the theory that the Centropagina are a more primitive group of copepods than the Calanina. The theory is favoured partly on the grounds that their predatory method of feeding can be regarded as more primitive than the more highly specialised filter feeding. All observations were made with the animals living free in a large body of water approximating so far as possible to their natural environment. Much information is given on the rate of movement of limbs and the actions of the animal. It cannot be too strongly stressed that observations of this nature should prove invaluable in the elucidation of the habits and migrations of copepods as shown by field collections.

#### Growth Records on Fruit Trees

ONE of the difficulties encountered in pomological research is the amount of time and labour involved in the collection and recording of large numbers of data relative to the growth and fruit production of apple trees. A census method which reduces to a minimum the labour of recording summer growth has been developed by M. C. Vyvyan at the East Malling Research Station (*J. Pomol. and Hort. Sci.*, 13, 202; 1935). Various well-defined growth structures on the tree are classified into categories such as bearing or non-bearing, short or long, growing or non-growing, etc., each of which is denoted by a letter of the alphabet as a distinguishing symbol. The recorder examines each growth from the apex to the base of the tree or sample branch and calls out the corresponding symbols in order. These are then recorded and the numbers in each category counted simultaneously by the use of an ingenious combination of typewriter and reset counters. The result is a typewritten map of the whole tree forming a permanent record of the various growths and their positions, and this can be expanded at successive periods as growth proceeds.

#### Prediction of Rubber Yield

ONE of the chief problems confronting the rubber research worker is the length of time needed before reliable results as to the yield capacity of the plant can be obtained. The tapping test that is usually employed, conclusive as it is, is only applicable when the latex system is sufficiently developed, that is, a period of seven or more years has to elapse before comparative tests and selection of clones can be carried out. Genetical work is in consequence seriously hampered. A new method, however, has recently been evolved by H. Gunnery (*J. Rubber Res. Inst.*, 6; 1935), by which the yield can be accurately predicted at an early stage in the life-history of the plant. A detailed study of the anatomical structure showed that two distinct types of sieve tubes occur, one of small, the other of large diameter. The latter are invariably associated with latex vessels of wide bore, that is, occur in trees of high-yielding capacity, while the small type of sieve tube is found in low-yielding trees in conjunction with small bore latex vessels. Further, the type of sieve tube is constant in all parts of the plant and at all ages. By means of qualitative analyses of the phloem of young *Hevea* seedlings, therefore, low-yielding individuals may be eliminated at a very early stage, and much valuable time saved in all work of a selective nature.

#### Glacial Geology of Yorkshire

IN "The Glacial Geology of Holderness and the Vale of York" (published by the author, 61 Carr Lane, Acomb, York, 1935, price 4s.; cloth 5s.), Mr. Sidney Melmore gives a scholarly and conscientious review of the glacial problems in an important area. The boulder clays, buried cliff and raised beaches of Holderness, the Speeton shell-bed, the Kelsey Hill deposits (with list of fauna), the moraines and drift and high-level flanking deposits of the Vale of York, the Kirkdale bone cave, the Leeds hippopotamus, the relation between rivers and joints in the country rock, and many other topics of interest are treated from a historical point of view. The author's method of approach gives full credit to the achievements of the pioneers, Sedgwick, Buckland, Phillips, Prestwich, and to other workers such as Dakyns, Reid, Lamplugh. His quotations at the chapter headings alone would form an interesting short history of the progress of investigation. The division of the matter into numerous small chapters makes for freshness and easy reference; and the two dozen maps and diagrams are all that could be desired.

#### Effect of the Moon on Barometric Pressure

"THE Lunar Atmospheric Pressure Inequalities at Glasgow", by R. A. Robb and T. R. Tannahill (*Proc. Roy. Soc. Edinburgh*, 4, Part 1, No. 9), is a paper dealing with the effect of the moon on barometric pressure at Glasgow Observatory deduced from an analysis of a record, extending from 1868 to 1912, of hourly values of atmospheric pressure recorded photographically, and checked by daily control readings of a standard barometer at 10h, 12h, 14h, 18h and 22h G.M.T. A rough examination of these records had shown a strong diurnal variation, an effect at variance with determinations of the harmonic coefficients at other places made by Chapman, who found the semi-diurnal coefficient to be the chief one, giving an amplitude of 0.012 at Greenwich, 0.083 at



Batavia and 0.060 at Hong-Kong. In order to reduce accidental variations, Robb and Tannahill rejected all days on which the difference between the pressure at two successive upper transits of the moon exceeded 0.1 inches of mercury. Nine groups of observations were obtained by dividing the 45 years into three equal periods, into three seasonal groups—winter (Nov.-Feb.), equinoctial (March, April, Sept. and Oct.) and summer (May-Aug.), and three groups for which at the initial lunar upper transit the lunar semi-diameter was equal to or less than 14.99', 15'-15.99' and equal to or greater than 16.00'. The hourly inequalities for these groups and for the total data were corrected for any known variations with solar time that might, owing to the selection of data, have been only partially eliminated. The harmonic analysis of the corrected hourly inequalities gave for the whole period the following values for the first three Fourier terms:

$$0.0640 \sin(\theta + 267^\circ) + 0.0156 \sin(2\theta + 285^\circ) + 0.0089 \sin(3\theta + 292^\circ),$$

where the amplitude is in millibars and  $\theta$  is reckoned from upper lunar transit. Estimates of the probable errors of the coefficients appeared to establish the reality of the first two, and the preponderance of the diurnal over the semi-diurnal variation at Glasgow accordingly appears to be a real phenomenon, for which no satisfactory explanation is offered.

#### Dielectric Constants of Liquids at Radio Frequencies

In a paper published in *Hochfrequenztechnik und Elektroakustik* (46, 92; 1935), Dr. D. Doborzynski describes a somewhat novel method of determining the dielectric constant of non-conducting liquids at radio frequencies. The innovation consists in making use of the carrier waves of known frequencies received from broadcasting stations in place of a local source of oscillations. A tuned receiving circuit is set up with a main variable condenser in parallel with another variable condenser of small capacitance. For a fixed setting of the main condenser, the four frequencies required are those corresponding to the maximum and minimum settings of the small condenser, first with this in air, and next with it immersed in the liquid under examination. These frequencies are determined by simple interpolation over a small portion of the scale of the main condenser. Since it is known that, at the present time, most broadcasting stations attain a frequency constancy of an order better than 3 parts in  $10^4$ , it is considered that in the neighbourhood of 1,000 kc./sec., the above four frequencies can be determined to within  $\pm 0.25$  kc./sec., resulting in an overall accuracy of the dielectric constant determination of better than one per cent. The method has been applied to the measurement of the dielectric constant of benzol and nitrobenzol at 20° C., the values obtained being 2.29 and 34.5 respectively. The possibility of extending the method to conducting liquids is now being explored.

#### Radioactivity of Actinium

ALTHOUGH actinium was discovered in 1899 by Debierne and has been much studied since, all attempts to find any effect due to the radiation from actinium itself have so far failed. The fact that the direct descendant of actinium is radioactinium, an

isotope of thorium, indicates that a  $\beta$ -particle must be emitted in the disintegration of actinium, and since this has not been discovered experimentally it has been assumed that it is emitted with very low energy. The discovery by Sargent in 1933 of the relation between the decay constants of  $\beta$ -emitters and the upper limits of their energy spectra made the behaviour of the actinium  $\beta$ -particle seem anomalous. The modification of the tube counter devised by Libby, in which a screen is substituted for the usual solid wall, makes it possible to detect electrons of very low energy, and D. E. Hull, W. F. Libby and W. M. Latimer (*J. Amer. Chem. Soc.*, 57, 1649; 1935) have in this way detected the  $\beta$ -radiation of actinium. The radiation is half-absorbed in 0.0023 gm./sq. cm. of aluminium and is easily deflected in a magnetic field. The maximum energy of the  $\beta$ -particles is about 220,000 electron-volts, which fits well on the lower Sargent curve. The paper contains full details of the chemical methods of purification of the actinium, the most difficult problem being the removal of radioactinium. Co-precipitation with thorium perhydroxide was the method finally adopted. The radiation was identified as due to actinium itself by the excellent agreement between the theoretical and experimental growth curves.

#### Thermal Data for Purine Derivatives

THE importance of the thermal data for purine derivatives in biochemistry is recognised, so that some recent accurate determinations in this field are of interest. R. D. Stiehler and H. M. Huffman (*J. Amer. Chem. Soc.*, 57, 1734; 1935) have measured the heats of combustion and heat capacities of adenine, hypoxanthine, guanine, xanthine, uric acid, allantoin and alloxan, and from the results have calculated the heats of formation, entropies and free energies. All the compounds except adenine had been previously burned by earlier workers, and discrepancies of 0.1-2 per cent with the older data are found. The measurements were made with the best modern technique and the results may be summarised as follows. The free energy values are believed to be accurate to 300-600 gm. cal. The data are at 298.1° Abs. The heats of combustion, in k.cal., are at constant pressure and the water liquid, per mole.

	Heat of combustion	Free energy $\Delta F^\circ$ (in gm. cal.)
Adenine	663.74	70,420
Hypoxanthine	580.20	17,250
Guanine	596.89	10,220
Xanthine	516.02	-40,730
Uric acid	458.84	-91,460
Allantoin	409.55	-107,470
Alloxan	273.58	-182,880

When the free energies are compared, some interesting facts are brought out. In going from adenine to hypoxanthine and from guanine to xanthine, both of which involve the same type of deamination in different parts of the six-membered ring, decreases of 53,170 and 50,950 gm. cal., respectively, are observed. In the changes adenine to guanine and hypoxanthine to xanthine to uric acid, all of which reactions involve the addition of an oxygen atom and a shift of a hydrogen with the corresponding opening of a double bond, the free energy decreases are, respectively, 60,200 gm. cal., 57,980 gm. cal. and 50,730 gm. cal. These changes indicate that, in the crystal at least, the bond energies are distinctly affected by their positions in the compounds.



## British Medical Association

### ANNUAL MEETING AT MELBOURNE

THE one hundred and third annual meeting of the British Medical Association was held in Melbourne, Australia, during the week commencing September 9, under the presidency of Sir James Barrett of Melbourne. This is the first occasion on which the Association has met in Australia. In spite of its remoteness from the Old World, the meeting was one of the largest, if not actually the largest, in the history of the Association. The total number of registered attending members was nearly 1,500; and there were more than 300 overseas visitors. Of the many distinguished visitors from Great Britain may be mentioned Lord Horder, Sir James Purves-Stewart, Sir Thomas Dunhill, Sir Ewen Maclean, Sir William Willcox, Sir Henry Gauvain, Prof. Edwin Bramwell, Prof. Hey Groves, Prof. A. M. Drennan, Mr. H. S. Souttar, Dr. J. S. Fairbairn, Dr. Robert Hutchison, Dr. S. Watson Smith (the retiring president), Dr. E. Kaye le Fleming and Dr. E. W. Fish. Members of the Association from South Africa, Egypt, India, Ceylon, Canada, New Zealand, Holland, China and Japan were present.

The adjourned annual general meeting took place on September 10 in the Town Hall, in the presence of Their Excellencies the Governor General of the Commonwealth, Sir Isaac Isaacs, and Lady Isaacs, and His Excellency the Governor of Victoria, Lord Huntingfield, and Lady Huntingfield. The principal events of the meeting were—an opening address by Sir Isaac Isaacs; induction of the new president, Sir James Barrett, who delivered his presidential address on the subject of hospital policy in Australia; the transmission to His Majesty the King of a message of loyalty from the Association, to which a reply was received before the meeting ended; and presentation of the flag of the City of Melbourne to the Association by the Lord Mayor.

A meeting of the Royal Australasian College of Surgeons took place on September 12, under the presidency of Mr. R. B. Wade. Honorary fellowships were conferred on Prof. Hey Groves and Mr. H. S. Souttar; and Prof. Hey Groves delivered the first Hamilton Russell Memorial Oration, entitled "The Romance of Surgery".

Before describing the discussions of the scientific sections, it is appropriate to mention the 'museum' which was housed in the University Anatomy School. The remarkably comprehensive and beautifully displayed collection was assembled specially for the occasion by a committee of which Prof. F. Wood Jones was chairman and Dr. E. S. J. King secretary. The exhibits embraced almost the entire range of human pathology as well as certain aspects of anthropology, parasitology, radiology and public health. Many of the exhibits were designed to form an illustrative accompaniment to some of the sectional discussions. On four mornings during the week, demonstrations of special subjects in the museum were given by the exhibitors.

The Section of Medicine, presided over by Lord Horder, discussed obesity, anæmia, and, on the third day in conjunction with the Section of Surgery, thyreotoxicosis. Other subjects dealt with in

occasional papers were diabetic gangrene, hæmolytic jaundice and gallop rhythm of the heart. The most interesting discussion was that on thyreotoxicosis along with the surgeons, a meeting which had an attendance of nearly six hundred, easily a record for a sectional meeting. Lord Horder and Sir Thomas Dunhill opened the discussion. The principal point emerging, and one which was particularly stressed by Lord Horder, was that the pathogenesis of thyreotoxicosis is still unknown, and that the beneficial results of thyroidectomy do not necessarily justify the conclusion that the condition is one of primary thyroid dysfunction.

The Section of Surgery, with Sir Thomas Dunhill as president, discussed hydatid disease, the surgery of the pancreas, prostatectomy, cancer of the colon, and, along with the Section of Medicine, thyreotoxicosis. Apart from the last, the most notable debate was that on hydatid disease, opened by Prof. H. R. Dew. Almost all aspects of this subject were embraced in the course of the discussion; which was well supplemented by the excellent collection of specimens of hydatid lesions and the life-history of *Tænia echinococcus* which were available for study in the special museum already described.

The Section of Obstetrics and Gynaecology, under the presidency of Dr. J. S. Fairbairn, discussed Cæsarean section, placenta prævia, the late toxæmias of pregnancy, and the remote results of puerperal sepsis. With respect to Cæsarean section, there was a decided opinion, voiced particularly by Dr. J. Bright Banister, that this operation was often too lightly undertaken without adequate reason, and that there was need of careful formulation of the indications justifying the operation.

The Section of Radiology and Radio-Therapeutics, with Mr. H. M. Moran presiding, discussed radiation treatment of cancer of the breast and of cancer of the tongue, radiological diagnosis of diseases of the lung, diagnosis of bone tumours, radiological education and skiagraphic examination of the stomach and duodenum. The work of the section was well supplemented and enhanced in value by a series of skiagrams illustrating the several subjects, which were displayed in the museum. The discussion on the diagnosis of bone tumours, opened by Dr. H. R. Sear, was of particular interest, as it emphasised the importance of recognising various types of metastatic tumours which might simulate primary tumours of bones.

The Section of Diseases of Children, with Dr. Robert Hutchison as president, discussed hare lip, infant feeding, pink disease and intussusception. The discussion on pink disease, opened by Drs. A. J. and I. J. Wood, provided a very complete epitome of existing knowledge of this illness, the pathogenesis of which is, however, still unknown.

The Section of Neurology and Psychological Medicine was presided over by Prof. Edwin Bramwell. Its first session was devoted to a consideration of the diagnosis, prognosis and treatment of brain tumours fifty years ago, and now. Prof. Bramwell's opening paper on this topic provided an excellent



survey of the growth of our clinical knowledge of brain tumours. Advance has come principally through the use of special methods of clinical investigation, from the introduction of the ophthalmoscope up to our present-day use of such methods as ventriculography and encephalography. The second session of the section discussed the psychoses of adolescence, and the malarial treatment of neurosyphilis, the latter subject being illustrated by exhibits in the museum.

The Section of Ophthalmology, under the presidency of Dr. A. J. Ballantyne, discussed glaucoma, false binocular projection and abnormal retinal correspondence, idiopathic cyclitis and several minor subjects. On all the topics, the discussions were of considerable interest, and contained original work or ideas.

The Section of Orthopædics, presided over by Prof. Hey Groves, discussed fractures of the neck of the femur, osteoarthritis of the hip and knee, fractures of the spine, and the role of physiotherapy in orthopædic practice.

The Section of Oto-Rhino-Laryngology, under Mr. F. Muecke, considered maxillary and nasal sinusitis, chronic suppurative otitis media, sphenoidal sinusitis in relation to the pituitary gland and actinotherapy in laryngeal tuberculosis.

The Section of Pathology and Bacteriology was presided over by Prof. A. M. Drennan. At its first session various aspects of pathological calcification and bone disease were discussed, the principal paper being one on the pathology of osseous tissue by Prof. Drennan. A paper on leukæmic infiltrations was read by Prof. J. B. Cleland; and one on the neural components of teratomata, by Dr. R. A. Willis, this being amplified by photographs and maps exhibited in the museum. The second meeting of the section was largely devoted to bacteriology. A discussion on anaerobes in disease was opened by Prof. H. A. Woodruff with an informative paper on anaerobic infections in animals; and Dr. F. M. Burnet introduced a discussion on virus diseases, stressing the frequent occurrence of mild, but immunising, attacks of these and other infections. A new method of hæmoglobin estimation, based on the formation of globin picrate, was described by Dr. Bolliger.

The Section of Pharmacology, Therapeutics and Anæsthesia, under the presidency of Sir William

Willcox, discussed hypnotic drugs, urinary anti-septics, premedication and basal narcosis, gas anæsthesia, and spinal anæsthesia; and Prof. W. A. Osborne contributed a paper on a vaso-constrictor principle in the frog's skin.

The Section of Public Medicine, under Sir Henry Gauvain as president, dealt with tuberculosis, industrial and tropical medicine, and racial problems. At its first meeting the subject of pleural effusion in artificial pneumothorax was introduced by an informative paper by Dr. D. B. Rosenthal; and Mr. M. P. Susman opened a discussion on tuberculous empyæma. At the second meeting of the section, which was combined with the Section of Medical Sociology, the principal subject was racial pressure problems in Australia and its neighbourhood, opened by Sir R. W. Cilento.

The Section of Medical Sociology, with Dr. E. Kaye le Fleming as president, discussed the Australian medical aerial services, the social aims of mental hygiene, and along with the Section of Public Medicine, racial pressure problems opened by Sir Raphael Cilento. Sir James Barrett spoke of the difficulties of agricultural and pastoral activity in the Northern Territory, pointing out that on parts of the south coast of Java, which has a population of forty million people, areas resembling northern Australia are reported to be practically empty, and that for successful agriculture a rainfall of at least ten inches in the dry season is essential. Sir James Barrett then quoted an article by Mr. Wynne Williams, from the last number of the *Economic Record*, to the effect that apart from Queensland, Northern Australia is economically incapable of carrying a large population of any race. The difficulty is not physiological but entirely economic.

The Section of Dermatology was presided over by Dr. S. Watson Smith. The principal subject for discussion was the incidence of skin diseases in Australia, opened by Dr. Herman Lawrence. A main point brought out was the exceptionally high incidence in Australia of keratosis, rodent ulcer and epithelioma—called by Dr. Lawrence the "epithelial triad" and attributed by him largely to sunlight. An account of staphylococcal skin infections by Dr. Ivan Connor indicated the value of treatment by toxoids. Dr. J. C. Belisario contributed a paper on fungus infections.

## Lumière and the Invention of Cinematography

A BRILLIANT gathering took place on the evening of November 6 at the Sorbonne, in honour of M. Louis Lumière, father of the cinema and of many other inventions in the field of photography.

The great hall of the University of Paris was resplendent with high officials, including the French President, M. Lebrun, the Diplomatic Corps, distinguished academicians and representatives of numerous scientific and industrial organisations.

M. Mario Roustan, Minister of Education, presided, and speakers vied with each other in paying tribute to the qualities which have enabled M. Lumière to devote half a century of an active and fruitful life to promote applied science.

M. Armbruster, president of the Renaissance Française, who took the initiative in organising the celebrations, supplied a historical outline. He mentioned how Lumière, son of a photographer, of Besançon, developed with his brother a successful manufacturing photographic plant at Lyons, which became known throughout the world. He recalled the first public presentation, on December 28, 1895, of moving pictures in the basement of a Paris café, at 14 bd. des Capucines, amidst much scepticism and sarcasm—which, however, did not prevent the rapid success and growth of the enterprise.

M. Ch. Fabry, the distinguished physicist, spoke of the numerous applications of Lumière's work. M. Ch. Delac quoted figures to show the great



economic importance of the cinema industry. M. Georges Lecomte, the well-known writer, enlarged upon the aesthetic value of the cinematographic art.

Sir Robert Mond, dean of the distinguished foreign delegates present, outlined the historical development of the photography of movement, and expressed the high regard in which Louis Lumière is held throughout the world.

Historically, for the beginning of cinematography, one may go back to the animated drawings devised by the Belgian physicist Antoine Plateau in 1830, which were used in the phenakiteoscope. Improved by Clerk Maxwell in 1869 and enlarged by the American, Horner, the apparatus became known as the zoetrope. Molteni, in 1850, had his choreutoscope, consisting of a glass disc on which six different positions of a moving object were drawn, so that on turning the disc the appearance of movement was produced. In 1893 Edison devised his kinetoscope, consisting of an endless film about 20 metres long, moving at such a rate that 45 images were presented per second. It had the drawback of being visible to only one person at a time.

On the photographic side, we find the American Muybridge in 1872 utilising a series of thirty cameras to photograph a galloping horse. The astronomer Janssen devised a photographic revolver in which a circular photographic plate turns round, so that 48 pictures can be taken in 62 seconds; the physiologist Jules Marey developed his chronophotograph and M. Demeny his phonoscope.

All these separate inventions and improvements do not, however, detract from the great merit of Louis Lumière, that of having devised an apparatus which will both photograph an object in motion and

reproduce it afterwards upon a screen so as to give the impression of movement, in the form in which we see it to-day.

The invention of the moving picture apparatus, though the most spectacular of Lumière's inventions, forms but part of his numerous activities. In 1899 he made an apparatus for taking 'rotary' photographs, so as to be able to make a complete tour of the horizon. In 1901 he devised a 'photogramic' method of projection, and in 1907, after numerous trials, he perfected the Lumière method of colour photography still used throughout the world.

During the War, Lumière had to divert his inventive genius in other directions. He devised a method of heating the cockpit of aeroplanes, and he improved artificial limbs for mutilated soldiers. To-day, at the age of seventy-one years, we find him still active in research and invention. Recently he gave before the Academy of Sciences an exhibition of stereoscopic cinematography. At his villa at Neuilly-sur-Seine, M. Lumière has installed several laboratories that enable him to carry out his investigations in cinematography and related matters.

No account of Louis Lumière would be complete without mention of his brother Auguste, by two years his senior, who has been a constant collaborator, though specialising in the fields of chemistry and biology. The original patent for a cinema apparatus in 1895 was, in fact, taken in the joint names of Auguste and Louis Lumière, but the elder brother has made it clear that in this particular case the originator of the idea was Louis. Both brothers are members of the Paris Academy of Sciences, and have received numerous honours from scientific bodies in France and elsewhere.

## Human Genetics and Human Ideals\*

**T**WO widely held opinions on human genetics may be summarised as follows: (1) It is essential in the interests of national hygiene that the unfit should be sterilised; (2) some races are superior to others, the members of which cannot rise to the highest levels possible to humanity.

Both theories are largely based on analogical reasoning from the breeding of domestic animals. Although the laws of heredity are the same in men as in other mammals, the analogy is suspect because our domestic animals are far more genetically homogeneous than any human groups, having been established by intense inbreeding and selection. We must, therefore, examine the evidence for these propositions in detail.

### ABNORMALITIES AND STERILISATION

Human abnormalities which are genetically determined fall into five main classes:

(1) Those due to autosomal dominant genes, which determine the abnormality in all cases; for example, lobster claw, cleidocranial dysostosis. Here the abnormality is handed down only by affected

persons, and to about half their children, regardless of sex.

(2) Those due to autosomal genes with manifestation in some, but not all cases. For example, blue sclerotics are due to a dominant gene with 100 per cent manifestation. A fraction of the patients develop bone fragility, deafness due to otosclerosis, or both. Huntingdon's chorea, due to a dominant gene, may not develop until the age of seventy years, though the average age is thirty-five. Such abnormalities run in a family, are handed down to less than half the progeny of affected persons, and often skip a generation.

(3) Those due to sex-linked genes. These are often manifested wholly, or almost wholly, in males and transmitted by females, for example, hæmophilia. But they may be incompletely recessive in heterozygous females, and affect a proportion of them, as with Leber's disease (atrophy of the optic nerve).

(4) Those due to autosomal recessive genes. These are not hereditary in the ordinary sense. They are very rarely handed down from ancestor to offspring, but occur in one or more children of a pair, both of whom are heterozygous. They are very much more frequent in the offspring of parents who are related to one another, for example, of first cousins, than in the general population. They include amaurotic

\* Substance of a Sir Halley Stewart Trust Lecture delivered by Prof. J. B. S. Haldane, F.R.S., in the Memorial Hall, Farringdon Street, London, on November 5.



idiocy, some kinds of deaf mutism, and xeroderma pigmentosum, a skin affection two thirds of the victims of which die of cancer in less than fifteen years.

(5) Those due to the co-operation of many genes. It is highly probable that many of the milder forms of mental defect are of this kind, but the analysis is still incomplete.

No far-reaching eugenical programme can be framed until we know the relative frequencies of these five classes. They are not known at present.

Sterilisation of the unfit would be very effective against type 1, moderately so against types 2 and 3, slightly so against type 5, and wholly ineffective against type 4. Here the possible eugenic measures are the discouragement of inbreeding, and the termination of marriage, or at any rate breeding, in couples who have produced one defective child. In order to deal effectively with types 2 and 3 by sterilisation, it would be necessary to sterilise large numbers of fit persons. It is doubtful whether the sterilisation of all mental defectives would reduce the number in the next generation by as much as 15 per cent.

In all cases, other measures than sterilisation are available, for example, continence and birth control for mentally normal persons, and segregation for defectives.

#### RACIAL COMPARISONS

When we say that race *A* is superior to race  $\bar{B}$  in a given respect, we may mean one of five things:

(a) Members of race *A* have had a better chance than those of race *B* of displaying the character in question. For example, the pre-Columbian inhabitants of America were severely handicapped in their progress to civilisation by the lack of domesticable animals.

(b) All members of race *A* are superior to all members of race *B*. No case of this kind is known.

(c) No member of race *B* can possibly reach the level attained by some members of race *A*. This may be true in some cases, but is certainly not scientifically proved.

(d) The median performance of race *A* is superior to that of race *B*. This is probably true with reservations. Thus it is likely that, in Europe, Europeans are more socially efficient than Negroes; but the converse seems to be true in West Africa (the so-called white man's grave).

(e) Race *A* produces more exceptional individuals, for example, great musicians, than race *B*. This is also probably true in some cases, but as it may be due to greater variability, implies no superiority in the mass of the race.

It is emphasised that innate psychological characteristics of races overlap. Thus there is no evidence for an innate psychological characteristic found in all Negroes, but no Europeans. The so-called races of western Europe (Nordic, Alpine, Mediterranean, and so on) overlap in physical as well as psychological characteristics.

Our knowledge of the effects of human race-crossing is slight. In animals, such a cross may be advantageous in the first generation, but harmful in later generations, but there is no clear evidence as to whether this is true in man, though some facts seem to support this hypothesis.

Great caution is required in the application of our existing knowledge of human genetics, and far more extensive information is needed.

#### Educational Topics and Events

CAMBRIDGE.—On behalf of a body of subscribers, an offer of £540 has been made to the University to form a fund in memory of Dr. J. E. Marr, Woodwardian professor of geology. This fund is to be used to provide grants for the study of geology in the field.

The Council of the Senate recommends the approval of the plans for a new high-tension laboratory for the Cavendish Laboratory prepared by Mr. Charles Holden. The new laboratory will cost about £15,500.

OXFORD.—Henry Balfour has been granted the title of professor during his curatorship of the Pitt-Rivers Museum.

An exhibition to illustrate the work of Robert Hooke (1635-1704), in the Museum of the History of Science, will be opened by the Dean of Christ Church, on November 20, at 2.15.

The course of lectures on the scientific contributions of members of the Oxford Colleges has been continued by Dr. R. T. Gunther at New College and at All Souls. Although neither College was primarily endowed for the training of men of science, yet their early successes were remarkable. The physicians Bentley and Walter Bayley of New College, and Linacre, Warner, Bartlot, Recorde, Sydenham, Needham, Millington and Mayow of All Souls all achieved fame in various ways before a long period of quiescence in the eighteenth century. In the nineteenth century, the brothers Duncan of New College restored the Old Ashmolean as a zoological museum, while Acland of All Souls effected its removal to the new University Museum that he founded in the Parks. New College owns the house and observatory of Halley, Bradley and Bliss, and has attached to it the Savilian professorships of astronomy and geometry, which were held by Charles Pritchard, founder of the University Observatory, and H. H. Turner, who inaugurated the Seismological Department.

A COURSE of eight lectures on tropical hygiene for men and women outside the medical profession proceeding to the tropics will be given at the London School of Hygiene and Tropical Medicine, commencing on December 2. The lectures will be given by Lieut.-Colonel H. B. Newham, H. H. Clay and Sir Malcolm Watson. Further information can be obtained from the Organising Secretary, Ross Institute of Tropical Hygiene, London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1.

ACCORDING to the recently issued report of the Commonwealth Fund Trustees, there were 150 applications for fellowships in 1935, and thirty-one appointments were made. These comprised twenty-four ordinary fellows, two Dominion fellows and five service fellows. The fellowships are offered to British subjects, and are tenable at certain American universities for two years. The same number is being offered for 1936. Women are not eligible for appointment. Further information may be obtained from the Secretary, Commonwealth Fund Fellowships, 35 Portman Square, London, W.1.



## Science News a Century Ago

### Auroral Display seen at Oxford

SOON after 8 p.m. on November 18, 1835, a vivid auroral display was witnessed near Oxford by the Rev. J. Guillemard, of St. John's College. A rapid succession of rays of light began to shoot up first in the east, and after vanishing there, appeared in nearly the same form in the west. When the display was over, a part of the sky filled with a faint silvery light diffused over a bank of clouds. (*Proceedings of the Ashmolean Society*, 9.)

### The Duke of Sussex and the Royal Society

IN 1830, the Duke of Sussex accepted the presidency of the Royal Society in succession to Davies Gilbert; he held the office for eight years. On November 20, 1835, after the first autumn meeting of the Society, a correspondent, "F. R. S.," wrote to the editor of *The Times*: "On the recommencement of the annual session of the Royal Society, last night, it appeared that Mr. Lubbock had resigned his office of treasurer, for no other reason than the total want of co-operation in the objects and business of the society on the part of the Royal President, who on the alleged grounds of ill-health had not attended a single meeting of council. . . ."

"Now, however, on the eve of the annual election, on St. Andrew's day, and according to the approved precedent of the last three or four years, a pathetic letter will be read to the general meeting, apologizing for past neglect, tendering a reluctant resignation, and in the hoped event of its non-acceptance, making large professions of improved conduct in the future.

"The shortness of the notice, and the utter unpreparedness of the society on the present occasion, preclude any other alternative than a sullen and indignant re-election and thus another blank session will accelerate the downward course of the society in scientific usefulness and consequent public estimation.

"It may not be too late in the course of the present session to avert so deplorable a result by some influential members taking measures for vindicating the paramount ascendancy of science over rank, by making such a choice on a future election as shall atone for the original sin of not having placed a Herschell in the chair once occupied by a Newton and a Davy."

### Trial of a Cornish Pumping Engine

A CENTURY ago, the pumping engines employed in the mines of Cornwall were among the finest of their kind. Quoting from the *Falmouth Packet*, the *Mechanics' Magazine* for November 21, 1835, said: "A steam-engine, lately erected on a copper mine in this neighbourhood [St. Austell], has been reported to have raised at an average rate of performance, upwards of ninety millions of pounds weight one foot high, with a bushel of coal. The correctness of this statement was questioned by rival engineers and others, and so seriously, that a challenge for a public trial was given and accepted. It took place last week, in presence of a number of most experienced mine agents from different parts of the country, and the result of twenty-four hours' trial was the unprecedented performance of lifting 125½ millions of pounds weight one foot high, with every bushel of coal consumed! The engine is of large

size, the cylinder being 80 inches diameter. The principle is that of Boulton and Watt but improved in economising the heat when generated, so as in the greatest possible degree to apply it to the end of producing steam, and maintaining it until its work is performed. The engineer's name is West."

### 'Luminous' Appearance of *Oenothera*

DR. BUCKLAND discoursed in the Old Ashmolean Museum at Oxford on November 22, 1835, on the 'luminous' appearance of the flowers of *Oenothera*. It continued uninterruptedly for a considerable length of time; it did not appear to resemble any electric effect; and the opinion which seemed most probable was, that the plant has a power of absorbing light, and giving it out in peculiar circumstances. (*Proceedings of the Ashmolean Society*, 9.)

## Societies and Academies

### LONDON

Royal Society, November 7. F. W. G. WHITE and L. W. BROWN: Some measurements of the reflection coefficient of the ionosphere for wireless waves. The Breit and Tuve technique for ionospheric investigation is employed, the sender-receiver system being calibrated so that the reflection coefficient may be determined for a wave of any frequency within the range 2·80–6·50 Mc/s, from the relative amplitudes of the direct and the singly reflected atmospheric waves. Examples of measurements, made at noon during the period November 1934–May 1935, show that the total absorption suffered by the waves is very much dependent upon the critical phenomena at the transition of reflection from one region to another. The influence of the absorbing regions is estimated from the results. Estimates, based upon Appleton's theoretical formula, of the collisional frequency of the electrons with gas molecules in the  $F_2$  ionised region of the upper atmosphere, are made. The collisional frequency is of the order  $5 \times 10^3$  per second at a height of approximately 250 km. above the surface of the earth. J. P. GOTT: The electric charge collected by water-drops falling through a cloud of electrically charged particles in a vertical electric field. Measurements were made of the charge collected by a large water drop falling through a jet of the cloud containing equal numbers of positively and negatively charged cloud particles in a vertical electric field maintained between two horizontal field plates. When the upper plate was positive, the drop collected a negative charge, and when the upper plate was negative the drop collected a positive charge. This is in agreement with a theory proposed by Wilson in connexion with the mechanism of thunderclouds. The quantitative agreement is as close as could be expected from the experimental arrangement. The experiments also afforded a test of the mechanism suggested by Elster and Geitel. If any charge was collected by the operation of this mechanism, it was too small to be observed.

### PARIS

Academy of Sciences, October 14 (*C.R.*, 201, 629–692). CHARLES ACHARD, AUGUSTIN BOUTARIC and JEAN BOUCHARD: The comparative action of ordinary alkaloids and genalkaloids on the fluorescence



of uranine solutions. The genalkaloids are alkaloids in which the amino group has been converted into an amino-oxide, and, while possessing the same therapeutic actions as the original alkaloids, are less toxic. The alkaloids examined have an inhibiting effect on the fluorescence of uranine solutions, but the genalkaloids do not possess this property. The authors regard the marked attenuation of the toxic effects of the genalkaloids as due to the disappearance of their antioxygen properties. PIERRE DE VANSAY : General bathymetric map of the oceans. CLAUDE CHEVALLEY : The theory of bodies of classes. JEAN BRAÏTZEFF : The generalisation of preceding results relating to Dirichlet series. F. MARTY : The role of the idea of the hypergroup in the study of non-Abelian groups. NICOLAS LUSIN : A new method in the theory of descriptive functions. ANDRÉ CHARRUEAU : Remark relating to a thin circular rod, articulated at its two extremities and submitted to a normal and uniform pressure. BERNARD LAFFAILLE and FLORIN VASILESCO : The *flambage* of thin cylindrical plates. S. SLOSKINE : The question of the plane movement of heavy fluids. WILLEM UYTERHOEVEN and CORNELIS VERBURG : The effects of the periodic variation of the concentration of the neutral atoms of the vapour in a sodium lamp with alternating current. An oscillogram is reproduced showing the variation of the current, electromotive force and intensity of the yellow light. A theoretical explanation is given accounting for the observed facts. RAYMOND ZOUCKERMANN : The explosive potential of hydrogen with high-frequency current. A discussion of the effects of impurities in the hydrogen, especially mercury vapour, on the explosive potential and appearance of the discharge. FÉLIX TROMBE : The paramagnetism of metallic gadolinium above its Curie point. The ferromagnetic Curie point of gadolinium is  $16^{\circ}\text{C}$ ., the paramagnetic Curie point is  $29.5^{\circ}\text{C}$ . The paramagnetic moment of the metal is 39.28 Weiss magnetons, practically identical with the moment calculated from the oxide by Cabrera, 39.25. LÉON BLOCH, EUGÈNE BLOCH and CHOONG SHIN-PIAW : The absorption spectrum of selenium dioxide. A description of a new series of absorption bands in the ultra-violet. V. KUNZL : A new method of focalisation in spectrography with X-rays. MME. THÉRÈSE GRIVET-MEYER : The absence of notable gamma emission in the collision of rapid neutrons with protons. F. BOURION and MLE. O. HUN : The cryoscopic determination of the total hydration of the ions of sodium nitrate. M. BOBELSKY and MLE. R. COHEN : The conditions of formation of trivalent manganese chloride in hydrochloric acid solutions and on its decomposition in the presence of complex catalyts. RENÉ DALMON, JEAN CHÉDIN and LOUIS BRISSAUD : The nitration of cellulose by nitric anhydride. Nitrogen pentoxide in organic solution (carbon tetrachloride) is capable of nitrating cellulose to the maximum (14.1 per cent nitrogen) with a very good yield. ADOLFO T. WILLIAMS : The absorption spectra of metallic and organic colloidal solutions and the absorption of metallic films. For organic substances, the structure of the absorption spectra in colloidal solution is much the same as in true solution. EDMOND BAUER and MICHEL MAGAT : The Raman spectrum of liquid heavy water. The frequency 170-176 is nearly the same in  $\text{H}_2\text{O}$  and  $\text{D}_2\text{O}$ , but the bands 350-500  $\text{cm}^{-1}$  and 500-700  $\text{cm}^{-1}$  are clearly displaced towards the lower frequencies. JACQUES LEFOL : The hydrates of monocalcium silicate. RAYMOND ROHMER : The system, water-sul-

phuric acid-nickel sulphate. ROBERT VANDONI : The disengagement of nitrogen monoxide during the decomposition of the nitrocelluloses. The gases arising from various modes of decomposition of nitro-cellulose contain nitrous oxide in important proportions, usually higher than the proportion of free nitrogen. JULES JARROUSE : The oxidation of diphenylpyruvic acid. JEAN GRARD : Cellulose triacetate. Details of method of preparation. ALEXANDRE DAUVILLIER : The determination of atmospheric ozone. A comparison of the spectrographic and chemical methods. The results by the two methods, while not identical, agree fairly well, considering that the collection of one sample is local and that the concentration of ozone near the soil may vary rapidly. PIERRE CAPPE DE BAILLON : A new strain of *Baculum artemis*. GUILLAUME VALETTE : Study of the fixation of quinine on *Paramecium* by means of the microscopical examination of the fluorescence. Cells of *Paramecium caudatum* show a maximum quinine absorption in the neighbourhood of the digestive vacuoles. EMILE CESARI, JEAN BAUCHE and PAUL BOQUET : A strain of *Vipera aspis* with white venom. GILBERT RANSON : The determinism of the seasonal fixation of *Navicula fusiformis*. Its experimental culture in ostreaculture. GASTON RAMON : The favourable effect of certain lipid substances on the immunising action of antigens. MAURICE DOLADILHE : Contribution to the study of the globulins of the blood in relation with its alexic power. ALEXANDRE BESREDKA, ISRAËL MAGAT, PIERRE LAVAL and PIERRE BESNARD : Intracutaneous vaccination against Pearce-Brown epithelioma.

#### CAPE TOWN

Royal Society of South Africa, September 18. I. DONEN : Studies in deciduous fruit (3). The chemical changes in Kelsey and Gaviota plums during growth. The life of the Kelsey and Gaviota plum on the tree may be divided into three stages. During the first stage the growth of the stone predominates over that of the flesh. The rate of growth, and of increase of all constituents of the flesh, except alcohol-insoluble residue, is comparatively slow. The concentration of total solids, alcohol-insoluble residue and nitrogen falls rapidly during this period, but acid concentration remains high. Starch is present in the plum at the beginning of this stage only. The second stage of growth commences when the stone is fully developed. It is characterised by a rapid rise in the rate of growth of the plum and in the rate of increase of total solids, sucrose, nitrogen and acid per fruit. These rates of increase finally reach a maximum value at the end of this stage. The third stage of growth is a period of maturation. The rate of accumulation of constituents per plum falls rapidly. Sucrose and nitrogen accumulate in the flesh so long as the plum remains on the tree. D. G. HAYLETT : Studies on droppings on Waltham Cross grapes (*Vitis vinifera*). J. L. B. SMITH : Some interesting new fishes from South Africa. Two noteworthy additions, one of a genus, the other of a family, new to the South African marine ichthyofauna list are described and figured. *Scymnus brevipinnis*, n.sp., is a shark from deep water off Algoa Bay. Species of this genus have hitherto been recorded only from the North Atlantic and from Japan. *Taeniolabrus marleyi*, n.sp., recently obtained at Durban, is a member of the little-known family Trichonotidæ, hitherto recorded only from the Indo-Australian region.



## Forthcoming Events

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

## Sunday, November 17

BRITISH MUSEUM (NATURAL HISTORY), at 3 and 4.30.—M. A. Phillips: "Reptiles".\*

## Monday, November 18

BRITISH MUSEUM (NATURAL HISTORY), at 11.30.—H. W. Parker: "Reptiles of the Galapagos Archipelago".\*

UNIVERSITY COLLEGE, LONDON, at 5.—Dr. Phyllis M. Tookey Kerridge: "The Physiology of Hearing" (succeeding lecture on November 25).\*

UNIVERSITY OF LEEDS, at 5.15.—Dr. W. F. P. McIntock: "The Gravitational Method of Investigating Geological Structure".\*

ENGINEERS' GERMAN CIRCLE, at 6.—(at the Institution of Mechanical Engineers, Storey's Gate, Westminster, S.W.1).—Robert Kronfeld: "Neuzeitlicher Segelflug" (Modern Methods of Gliding and Soaring).\*

ROYAL SOCIETY OF ARTS, at 8.—Dr. Bernard Smith: "Geological Aspects of Underground Water Supplies" (Cantor Lectures. Succeeding lectures on November 25 and December 2).

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Dr. G. N. Humphreys and E. Shackleton: "The Oxford University Ellesmere Land Expedition, 1934".

## Tuesday, November 19

UNIVERSITY COLLEGE HOSPITAL MEDICAL SCHOOL, at 5.—Sir Walter Langdon-Brown: "The Integration of the Endocrine System" (Victor Horsley Memorial Lecture).\*

EUGENICS SOCIETY, at 5.15.—(in the rooms of the Linnean Society, Burlington House, Piccadilly, W.1).—J. V. Quilliam, Mrs. C. B. S. Hodson and Dr. C. P. Blacker: "Voluntary Sterilisation—The Work of the last Two Years".\*

CHADWICK PUBLIC LECTURE, at 5.30.—(at the London School of Hygiene, Keppel Street, W.C.1).—Prof. R. C. McLean: "The Bacteriology of the Atmosphere".\*

BRITISH PSYCHOLOGICAL SOCIETY, at 6.—Dr. J. N. Langdon: "Monotony and Industry".

UNIVERSITY OF LEEDS, at 8.—(in the Philosophical Hall, Park Row, Leeds).—R. A. Watson Watt: "The Weather House".

## Wednesday, November 20

ROYAL METEOROLOGICAL SOCIETY, at 5.—J. Edmund Clark, Ivan D. Margary and C. J. P. Cave: "Report on the Phenological Observations in the British Isles, December 1933 to November 1934".

## Thursday, November 21

ROYAL SOCIETY, at 4.30.—A. R. Ubbelohde, J. W. Drinkwater and A. Egerton: "Proknocks and Hydrocarbon Combustion".

D. T. A. Townend and E. A. C. Chamberlain: "The Influence of Pressure on the Spontaneous Ignition of Inflammable Gas-Air Mixtures. (4) Methane, Ethane, and Propane—Air Mixtures".

HALLEY STEWART TRUST LECTURE, at 6.—(in the Memorial Hall, Farringdon Street, London, E.C.).—Prof. Julian Huxley.\*

CHEMICAL SOCIETY, at 8.—Discussion on "Some Aspects of the Interaction between Gases and Solids", to be opened by Prof. E. K. Rideal, followed by Dr. J. K. Roberts and Dr. R. M. Barrer. Other speakers: Prof. A. J. Allmand, Dr. R. C. L. Bosworth, Dr. A. Farkas, Prof. W. E. Garner, Prof. J. E. Lennard-Jones and Dr. H. W. Melville.

## Friday, November 22

ROYAL SOCIETY OF MEDICINE (NEUROLOGY SECTION), at 8.30.—Prof. E. D. Adrian: "Electrical Activity of the Cortex".

Dr. J. H. Quastel: "Enzymic Activity of the Brain".

INSTITUTION OF PROFESSIONAL CIVIL SERVANTS, at 5.30.—(at the Royal Society of Arts, John Street, Adelphi, W.C.2).—H. A. Tripp: "The Problem of Road Casualties".\*

INSTITUTE OF FUEL, at 6.—(at the Institution of Electrical Engineers).—Kenneth Gordon: "Development of Coal Hydrogenation by the I.C.I., Ltd."\*

ROYAL INSTITUTION, at 9.—Prof. John Read: "A Musical Alchemist".

## Saturday, November 23

ROYAL INSTITUTION, at 3.—Dr. Lawrence Binyon: "Chinese Painting" (succeeding lecture on November 30).

## Official Publications Received

## Great Britain and Ireland

New Forest Association. Annual Report and Statement of Accounts, 1935. Pp. 19+4 plates. (Brockenhurst: Capt. C. Sutton, Hon. Sec., Estate Offices.) [2510]

Department of Scientific and Industrial Research. Report of the Forest Products Research Board with the Report of the Director of Forest Products Research for the Year 1934. Pp. vi+75+2 plates. (London: H.M. Stationery Office.) 1s. 6d. net. [2610]

Air Ministry: Aeronautical Research Committee: Reports and Memoranda. No. 1660 (Spin. 206): Slots and Interceptors in Spins. By S. B. Gates, H. B. Irving, R. P. Alston and A. V. Stephens. Pp. 29+20 plates. (London: H.M. Stationery Office.) 2s. 6d. net. [2910]

Agricultural Research Council. A Report by a Committee on the Preservation of Grass and other Fodder Crops. (A.R.C. Report Series, No. 1.) Pp. iii+35. (London: H.M. Stationery Office.) 1s. net. [3010]

Proceedings of the Royal Irish Academy. Vol. 42, Section B, No. 15: The Metamorphic Rocks of Inishowen, Co. Donegal. By Dr. William J. McCallen. Pp. 407-442+plates 6-11. 2s. Vol. 42, Section B, No. 16: Larval Stages of the Euphausiids *Nematoscelis megalops* (G. O. Sars) and *Stylocheiron longicornis* (G. O. Sars) taken off the South-west Coast of Ireland. By Winifred E. Frost. Pp. 443-458+plates 12-15. 1s. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.) [3110]

Battersea Polytechnic. Report of the Principal for the Session 1934-35. Pp. 39. (London: Battersea Polytechnic.) [3110]

Medical Research Council. Special Report Series, No. 204: Medical Uses of Radium; Summary of Reports from Research Centres for 1934. Pp. 45+2 plates. (London: H.M. Stationery Office.) 1s. net. [3110]

## Other Countries

Report of the Aeronautical Research Institute, Tôkyô Imperial University. No. 128: JS-Diagrams for Combustion Gases of Correct and Weak Mixtures. By Keikichi Tanaka and Seichi Awano. Pp. 283-297+15 plates. (Tôkyô: Kôgyô Toshô Kabushiki Kaisha.) 2.05 yen. [2810]

Colony and Protectorate of Nigeria. Annual Report on the Geological Survey Department for the Year 1934. Pp. ii+36+7 plates. (Lagos: Government Printer; London: Crown Agents for the Colonies.) 3s. 6d. net. [2910]

New Zealand: State Forest Service. Annual Report of the Director of Forestry for the Year ended 31st March 1935. Pp. 19. 9d. Leaflet No. 26: The Properties and Uses of Kauri (*Agathis australis*). By Alex R. Entrican. Pp. 14. (Wellington: Government Printer.) [2910]

Western Australia. Report of the Royal Commission appointed to Investigate, Report and Advise upon matters in relation to the Condition and Treatment of Aborigines. Pp. 24+3 plates. (Perth: Government Printer.) [3110]

Koninklijk Nederlandsch Meteorologisch Instituut, No. 102: Mededeelingen en Verhandelingen, No. 36: Het Klimaat van Nederlandsch West-Indië. Door Dr. C. Braak. Pp. 120. (s-Gravenhage: Rijksuitgeverij.) 1.00 f. [1110]

Department of Mines: National Museum of Canada. Bulletin No. 74 (Biological Series, No. 20): Botanical Investigations in Wood Buffalo Park. By Hugh M. Raup. Pp. iii+174. 50 cents. Bulletin No. 75 (Anthropological Series, No. 16): Folk-Songs of Old Quebec. By Marius Barbeau. Song translations by Regina Lenore Shoelman. Pp. iii+72. 25 cents. (Ottawa: King's Printer.) [1110]

Canada: Department of Mines: Bureau of Economic Geology: Geological Survey. Memoir 176: Geology of Southern Saskatchewan. By F. J. Fraser, F. H. McLearn, L. S. Russell, P. S. Warren and R. T. D. Wickenden. (No. 2373.) Pp. ii+137+5 plates. 50 cents. Memoir 179: Lode Gold Deposits of Fairview Camp, Camp McKinney and Vidette Lake Area, and the Dividend-Lakeview Property near Osyoos, B.C. By W. E. Cockfield. (No. 2392.) Pp. ii+38. 25 cents. Memoir 181: Barkerville Gold Belt, Cariboo District, British Columbia. By G. Hanson. (No. 2396.) Pp. ii+42. 25 cents. (Ottawa: King's Printer.) [1110]