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Native Races and Nationalism in Africa

THE development of nationalist ideas as an effective political force in eastern Asia and, more particularly, in India, has afforded a justification for those who hold that a like course of events may be anticipated sooner or later among the native races of Africa. Negro Africa, that is, Africa south of the Sahara, they would maintain, is an unsurpassed forcing house for ideas such as have inspired the more loudly vocal element in recent and current political agitation in India. For these regions of Africa are the meeting-place of two utterly diverse races, white and black, who are poles apart in physical character, mental outlook, tradition and culture, and of whom, while one, everywhere numerically the inferior, is politically and economically dominant, the other is rapidly transcending the limitations as well as outgrowing the opportunities of tribal code and indigenous culture. The natural division thus existing in the community, and reinforced by social and political barriers, must inevitably, it is held, give rise to a group consciousness on the part of native peoples, which unless checked or diverted, will tend to the more unstable and politically dangerous forms of racialism and nationalistic ideation.

Fortunately, diagnosis of possibilities in the trend of the development of native outlook is not entirely a matter of speculation. In Africa south of the Zambezi, where conditions are most favourable to the rise of nationalism, the Union of South Africa has for a guide in its approach to the native question experience of native reaction to a variety of European contacts extending over a long period of time ; while the mining industry for nearly half a century has brought native administration into contact with the problems which arise out of the employment of labour on a large scale. But we may go even a stage further than general considerations, which emerge from an investigation of past history, and lay our finger on specific movements and events of recent occurrence pointing in the direction of an emergence of a sense of the solidarity of native interests, which if racial rather than national in character, is none the less significant of growth towards a feeling of community and of the power of a common direction in action and sentiment. This at least would appear to be the salient lesson to be learned from the valuable survey of recent happenings and tendencies in South, East, and West Africa, given by Lord Hailey in his address on "Nationalism in Africa" before the Royal Empire Society on January 19, when he summarized his study of the situation, as well as the results of observations made on his recent tour through Africa. His conclusions were the more worthy of careful note, since he was at pains to point out that while well aware of the opinion which views, not without alarm, the possible trend of development in native African political opinion towards nationalism, he himself is not among the prophets, but merely records as an observer.

In another matter Lord Hailey had taken his stand with no little wisdom. He refrained from any attempt to define nationalism, assuming that the character of this political and economic attitude or doctrine was sufficiently familiar to his audience to need no definition ; but he indicated that he meant by 'nationalism' the governing force of a uniting will directed to national advancement in combination with certain social and economic factors, such as had manifested itself in European history during the period beginning in

the eighteenth century and had appeared recently in Asia. Taking advantage of this elasticity in his point of view, he was able to bring under consideration aspects of native activity which on a stricter interpretation of the term might have to be excluded, and while admitting variety in the meaning of 'nationalism', enabled him to seek for such evidence as would indicate that native self-consciousness was becoming an "effective factor"—a new phenomenon, creating a new problem. Hence, as he pointed out, it is not merely opposition to Government that gives a movement significance in this sense, but rather such events as would testify to the growth of racial feeling or afford proof that the natives of different tribes or areas could combine on a common basis. For such an exhibition of growing consciousness it is natural to look to circumstances in which the material factor is more prominent, as for example in the curtailment of land, or the creation of unequal economic conditions. In taking, therefore, the Union of South Africa as his natural starting point, Lord Hailey is in accord with the view that the occasion and opportunity for the development of nationalism will most probably be found south of the Zambezi.

Before passing on to note some of the more important events and tendencies, to which in Lord Hailey's opinion this special significance may be attached, it is perhaps worth while to point out that whereas the white population of the Union of South Africa is determined at all costs to protect from native intrusion the white civilization which has been built up there, the native population, on its side, at least in so far as represented by the more thoughtful and influential of its leaders, is equally convinced that segregation and conservation of the elements of native solidarity is fully as necessary for the well-being of the native community. It is from the promoters of this movement and from this line of thought that nationalism in South Africa, if or when it comes, will draw its strength. On the other hand, in the labour movements to which Lord Hailey referred, it is perhaps not so much racial feeling as the colour bar which has been operative. The two are by no means identical; and in view of the wide area and varied tribal units from which recruits are drawn, labour perhaps has been often of too heterogeneous a character to warrant it being regarded as of great significance in a racial sense, although naturally of evidential value in relation to the ability of the native to combine.

It was this heterogeneity, perhaps, as much as any single factor, which led to the collapse of the famous (or infamous) Industrial and Commerical Union, which was initiated under Soviet influence and at one time numbered 250,000 members. Nevertheless, it has to be remembered that it was held by those who investigated the movement officially after the riots at Port Elizabeth in 1922 that it did afford some evidence of Bantu racial consciousness. The members, however, were either detribalized, or not at the moment under tribal control, the mine labour, numerically the most important, being, as already mentioned, recruited from tribes at a distance. It is also to be noted in this connexion that in East Africa such trouble as has occurred from time to time in riots at Nairobi and elsewhere, as a rule, has been caused for the most part by detribalized natives. Except under abnormal conditions, tribal institutions favour the settled order. This is a fact which should not be overlooked in estimating the character and motives of movements which appear to lead in the direction of nationalism.

Of the circumstances affecting the solidarity of the native communities in the Union, by far the most important has been the question of land. It touched every member of tribal and rural community alike. As vital to native existence, it unified Bantu opinion throughout the Union in a common cause and to a degree scarcely witnessed before if at all. So far back as 1913, when Botha's land legislation was introduced into Parliament, this question was responsible for the formation of the short-lived African National Congress. It endured as a source of unrest until further legislation in 1936, when the question was complicated by the proposal, which was carried, to abolish the Cape Franchise, the restricted but highly valued native vote. Although, as Lord Hailey points out, this in itself produced no lasting effect or permanent organization, it did much to promote unity by bringing together members of the native races for discussion and protest with a common aim. An African convention in 1935 set up an organization to achieve reforms by constitutional means, but it is too soon to pronounce on its merits.

While Lord Hailey does not appear disposed to attach too great weight to the movement towards Separatist Churches, such movements are frequently an outlet, sometimes a source and inspiration, for nationalist movements of a formidable character. One of the most serious

difficulties of the Kenya administration which assumed something like nationalist proportions was the Kikuyu female circumcision controversy.

A brief reference to conditions in other parts of Africa must suffice. In East Africa, circumstances not unlike those of South Africa, though on much smaller scale, have produced similar reactions in the formation of associations for the advancement and formulation of native interests. In the older colonies of West Africa, the education of natives on European lines has produced an intellectual class which seeks wider recognition of native rights through existing constitutional means. Nor is it necessary that the French and Belgian colonial empires should detain us, for in the former, as Lord Hailey points out, everything is directed to France—an orientation which finds expression in the representation of colonial interests in the legislature of the mother country by a native deputy; while under Belgian rule, both in the colony and the mandated territory, commercial rather than political development of native resources is the aim. Lord Hailey might perhaps have added that under French rule, in actual practice something very much in the nature of the indirect rule of the British dependencies is the result.

In pursuit of his intention to act as an observer only, Lord Hailey, while noting that the trend towards the nationalist idea is approved by some, but strongly condemned by others, made no attempt to sit in judgment. Nevertheless, the question is one that will be posed by the mere efflux of time, and insistently will demand an answer. It will have been noted that the movements to which attention has been directed have all been separatist in character. They have emphasized the fission in the community, which results from the association of black and white. Is this inevitable? This raises a large question, which involves the whole future of the African races. It is obvious that neither under the policy of indirect rule nor of segregation, as in South Africa, will the African peoples stand still. The rapid advances of the last few years are a sufficient negation of any such conception. It is the belief of those who hold to the advantages of indirect rule, as well as of those who see the possibilities of advance under other systems, that the future of Africa lies in the co-operation of the two races. For this, and to determine the lines upon which it should be pursued, the assistance of the more advanced and intellectual members of the African peoples must be secured. If, as many think, the movement towards racial or national self-consciousness is an inevitable phase of development in Africa, time should be taken by the forelock, and this force, great as it must and will be, should be harnessed to the constructive task of building up a united community, rather than weakening the social structure of Africa by setting a gulf between the elements which should co-operate.

Unsolved Soil Problems

Fifty Years of Field Experiments at the Woburn Experimental Station

By Sir E. John Russell and Dr. J. A. Voelcker; with a Statistical Report by W. G. Cochran. (Rothamsted Monographs on Agricultural Science.) Pp. xvi+392+4 plates. (London, New York and Toronto: Longmans, Green and Co., Ltd., 1936.) 21*s*. net.

CROP husbandry, the first occupation of man, which must ever remain essential to the maintenance of human life, has been pursued through all the ages as an art and a craft. The bearing of science upon it is a very recent development which is probably still only in its initial stages. Crops grow in vital association with two media, the air and the soil. It is barely a century ago that, following the discovery of photosynthesis, the main facts about the relationship of the crop to the air became generally known. The essential facts about the relationship of the crop to the soil are still clouded in mystery. In spite of all the development in the study of plants on one hand and of soils on the other, very little is known of the relationship of one to the other, and we are still largely dependent upon empirical experiments in order to determine the effect upon the plant of any particular treatment of the soil. Moreover, as this account of the Woburn experiments shows very clearly, the successful conduct of empirical experiments is beset with great difficulties.

Field experiments to test the effect upon the crop of applications to the soil began about a century ago with the work of Boussingault in France. The now classical Rothamsted experiments

were commenced shortly after, and in 1876 the Woburn Experimental Station was commenced by the Royal Agricultural Society on land given for the purpose by the Duke of Bedford. The Woburn Station was originally designed to deal with the specific problem of determining the increased value of animal manure following the feeding of concentrated food. Prior to the beginning of these experiments, it had been the practice in many districts for an incoming tenant to compensate the outgoing tenant for that part of the money spent upon concentrated foods which was deemed to have passed to the manure and which therefore became the property of the incoming tenant. The passing of the Agricultural Holdings Act in 1875 made such compensation compulsory. J. B. Lawes, moreover, had for some time previously been concerned with the fact that there was no scientific basis for assessing the residual manurial value of feeding stuffs, and he gave invaluable assistance in the initiation of the Woburn scheme. A number of other field experiments were started at Woburn, and their progress over fifty years is reviewed in this book.

The story of the experiments is in a sense three times told in this book. In the first part Dr. Voelcker, who succeeded his father as the Director of the Woburn Station, gives a categorical account of the work. In the second part Mr. W. G. Cochran gives a statistical examination of the results, and in the third part Sir John Russell summarizes the results in their bearing upon agriculture.

A first reading of an account of the Woburn experiments is disappointing, and in a certain sense this book is the story of failures. This sense of disappointment and of apparent failure arises, however, from the fact that many of the experiments at Woburn have not given the results that were anticipated, and the real value of the book lies in a full consideration of that fact. The residual manurial experiment which dominated the beginning of the Woburn work was designed to compare the effects of feeding cotton cake containing 6·6 per cent nitrogen and maize meal containing only 1·7 per cent, but whether fed to bullocks under cover or sheep folded on the land, there ensued no evidence of the superiority of the cake over the corn, and the result is frankly admitted by the authors to be both disappointing and mysterious. The ploughing-in of green manure has figured prominently in the experiments, and the results suggest that green manuring and the ploughing-in of legumes are by no means certain to benefit a succeeding wheat crop.

The Woburn experiments, however, have by no means all led to negative results. From the beginning there have been continuous barley and wheat plots, differently manured on a plan not unlike that of the classical experiments at Rothamsted. These plots have been valuable in confirming the chief findings of the Rothamsted plots.

The outstanding result of the continuous barley experiments at Woburn is the development of acidity in the soil following the continuous application of ammonium sulphate. This has resulted in a complete failure of the barley crop. The oxidation of the ammonium radical to nitric acid means that an application of ammonium sulphate is virtually an application of sulphuric and nitric acids, and the Woburn plots will always remain the classical demonstration of this fact. The effect has not been seen at Rothamsted because of the relatively large supply of calcium carbonate in the soil. Sir John Russell rightly says that in the whole range of British field experiments there has probably been nothing more striking than this effect of ammonium sulphate on the Woburn barley.

One great lesson from the book under notice as a whole is the fact that the conduct of field experiments is by no means the straightforward procedure that it was thought to be at the time the Woburn experiments began. The necessity for statistical treatment of results was not thought of in those days, and consequently, even in the continuous barley and wheat experiments, the design of the experiment has been such as to limit what the statistician can do with the results. This is a fact which is fully admitted by the authors, who also point out that another lesson from these experiments is that, once a continuous experiment has been designed, modifications at a later date should be avoided. The results of the barley and wheat experiments would have yielded more to the statistician if it had not been for changes in the scheme of manuring.

The supreme difficulty in field experiments, which has led to the modern methods of design giving results that can be dealt with statistically, is the variation of soil. Apart from certain warp soils, there is almost certainly no such thing as a soil that is uniform either horizontally or vertically. The Woburn soils seem to be particularly unfortunate in their variation. A section on the soils at Woburn is contributed by Dr. E. M. Crowther. It gives an account of the effect of the treatments upon the organic matter and exchangeable bases and will be read with much interest by soil chemists. The soil is a light sandy loam derived from drift overlying Lower Greensand. The variations are particularly marked in the subsoil.

Everyone interested in field experiments will be grateful for this book and for both the positive and the negative results of the Woburn experiments. They each have their value, and whatever may be the future of Woburn, the work already carried out there will certainly remain classical.

Thirty Years for the Public Health

The Last Thirty Years in Public Health: Recollections and Reflections on my Official and Post-Official Life. By Sir Arthur Newsholme. Pp. 410 + 13 plates. (London: George Allen and Unwin, Ltd., 1936.) 15*s*. net.

TO the many who read, enjoyed and appreciated the first volume of reminiscences of Sir Arthur Newsholme, published a little time ago under the title of "Fifty Years in Public Health", the appearance of this second instalment of what he calls his "Recollections and Reflections on my Official and Post-Official Life" will be much welcomed. Both volumes are written with enthusiasm, which is not at all surprising since they have reference exclusively to activities in the field of public health, and from the day he entered it until this very moment, it is probable that there has been nothing that Sir Arthur has been so enthusiastic about as public health. Public health administration, public health progress, public health organization—these, it is safe to believe, since there are his works—this and a multitude of others—for evidence, have been, in effect, his unique concern. Probably it is because of this that his career has been so successful.

It is because of it that these two books—that of fifty years and this of thirty years—have so much of value: not only immediately, to those of this and Newsholme's own generation of health workers, but also historically as well. As a matter of fact, so very unwilling has Sir Arthur been to devote space to references to himself, his own life and activities, and so anxious to refer to the public health problems that were tackled and the schemes that were evolved during the period of which he writes, that in spite of what he himself says, it is much more of a historical than a personal document he has produced.

The years with which in this present volume Sir Arthur deals are those from 1908 to the present. In the volume he divides the period into two—the first, 1908–1919, when he was, as he claims, "at the head of the Medical Department of the State's Central Health Organisation"; the second from 1919 to the time of writing, when, though he seems to have worked very hard, he had opportunities at any rate for having a much more interesting time than ever before, whether at Brighton, as the greatly trusted Medical Officer of Health, or at Whitehall as the immediate successor of Sir William Power and in the line of giants like Sir John Simon, Sir George Buchanan and Sir Richard Thorne Thorne.

That Sir Arthur was really happy following his transplantation from Brighton to Whitehall may be doubted. What he has to say here and there in Part 1 of the volume under the heading "Official Life in Whitehall" does not convince that he was. Since while Medical Officer of the Local Government Board—which preceded and was absorbed by the Ministry of Health—he was able to see launched schemes in which he had for long been deeply interested, it might have been supposed that there was real reason for happiness. Among matters on which he had written and spoken much and also attempted to set moving long before he left local for central administrative circles were tuberculosis and venereal disease control and infant and child welfare. During his period of service at Whitehall, schemes in regard to these were well established, or the ground at least was well prepared for their establishment. Similarly, it should be remembered, and in the volume there is included, very properly, a reminder, that it was very largely due to the efforts of Newsholme that there was recognition of the need for securing that both on behalf of the child and of the mother herself greater attention should be given to motherhood and to maternal welfare. It is in Part 1 of the volume that Sir Arthur deals with matters such as these and the years 1908–19, that he spent at Whitehall. That there is very much more that he would like to say of this period is very clear.

At the same time, however, there is more than a hint that there was much more that he would have liked to have got done and some things that perhaps he would have liked to have seen done in a different way. Also there is full evidence that the part he played in the progress made was one of extreme importance.

The remaining parts of the book reveal mainly that while at the head of the Government Health Department Sir Arthur added vastly to the already great reputation he enjoyed throughout the world of public health. Under the headings "Recollections of American Public Health and Social Work" and "The Increasing Socialisation of Medicine", he shows that instead of passing into retirement on the day he left Whitehall, actually he entered upon a new phase of his career. From a variety of directions came invitations and demands for assistance, guidance and advice. Acceptance of these invitations and the meeting of these demands, the record indicates, caused him to make or renew contacts all over the world, but more particularly in the United States, and brought him, it cannot be doubted, a wonderful new measure of happiness.

In the American chapters Sir Arthur tells of the years spent at Baltimore as lecturer in the School of Hygiene of Johns Hopkins University. He gives also much interesting and valuable information with regard to public health administration in the United States and makes generous reference to American achievements in public health and tropical medicine.

In the third and final part of the book, which Sir Arthur devotes to a discussion of the increasing socialization of medicine, he has again much to say of things American. Probably, however, the most interesting chapters in this part are those relating to the visit paid to Soviet Russia in 1933. To an extent in these he fills in gaps left in the description given in another book of his, "Red Medicine; Socialised Health in Soviet Russia", written in collaboration with Dr. J. A. Kingsbury, at that time secretary of the Milbank Fund. Obviously what he saw in Russia impressed him, though not always favourably. He recognizes, however, the value attached to the social work now in progress in that country, and believes that developments even more valuable, from some of which the nations as a whole may have something to learn, are certain to take place.

As a matter of fact, these would appear to be the conclusions that in general Sir Arthur would wish to have drawn from what he has written in this book and its predecessor. In his life-time, he finds, almost incredible advances have been made, with unparalleled additions to human knowledge, that, having been applied, have resulted in profound improvement in the health and living conditions of the people as a whole. Great as has been the progress and the improvement, however, he still believes in the possibility of advances even greater and more important—believes, indeed, that the best is still to come.

An indefatigable worker and possessed of an enthusiasm for public health that has never flagged, the contributions that Sir Arthur himself has made to the progress that the past has shown and that the future holds are vast. It is good that he has written this book about these things. It has great value and great interest not only for those engaged or concerned in health work, but also for the more general reader.

Diesel Engineering

(1) Elements of Diesel Engineering:
an Introductory Manual easily understood, covering the whole field of Design, Working, Maintenance and Repair of Stationary, Marine, Aircraft and Road-Transport Types of Diesel Engines. By Orville Adams. Pp. xvi+478. (London: Constable and Co., Ltd., 1936.) 18*s*. net.

(2) Diesel and other Internal-Combustion Engines:
a Practical Text on the Development, Principles of Operation, Construction, Details and Performance of Stationary and Portable Diesel, Gas and Gasoline Engines. By Prof. Howard E. Degler. Pp. vii+237+5. (Chicago: American Technical Society; London: Crosby Lockwood and Son, Ltd., 1935.) 10*s*. 6*d*. net.

(3) Diesel Engines:
Excessive Lubricating Oil Consumption. By P. H. Smith. Pp. ix+85. (London: Constable and Co., Ltd., 1935.) 3*s*. 6*d*. net.

IN addition to publications arising from its importance from scientific, technical and commercial points of view, the Diesel engine has to a quite considerable extent encouraged the production of books suitable for the instruction of drivers and others whose livelihood may depend on a broad, though not necessarily deep, knowledge of its principles, details and operation. The need for this class of book arises, to some degree, from the restriction of the practical training given to those placed in charge of machinery, more particularly that used for transport.

(1) It is expressly in order to assist the practical man in this position as well as to enlarge the field of view of the engineering student, and to help both to a fuller understanding of the operation and working principles of the Diesel engine, that "Elements of Diesel Engineering" has been written. The development and application of this type of engine are recognized in America as offering the most promising future for the mechanically-minded young man, and large numbers of students have come forward to prepare themselves to take advantage of these possibilities. While to the trained engineer there is a strong family resemblance between the various internal combustion engines, and differences in detail are readily recognizable as functional, the change from one cycle of operations to another, from one system of fuel supply to another, or from a familiar to a new method of ignition involves for the average driver a complete break with the tradition to which he has become accustomed.

This introductory manual, written in non-technical language, offers practical information of a descriptive and critical nature as to the construction, operation and maintenance of the Diesel engine and discusses the main features of its various parts and the qualities and properties of suitable fuels and lubricants. Although thermodynamics is not dealt with, the thermal principles are explained and mechanical theory also receives attention. Of great value are the numerous illustrations, which are clear and well produced.

(2) In the same category may be mentioned "Diesel and other Internal-Combustion Engines" which has been prepared with a similar end in view. In smaller scope it deals with all the types and gives more prominence to thermodynamic and other theory, but in an explanatory rather than an analytical manner.

(3) In a virile little book, Mr. Philip H. Smith, out of his wide experience as inspecting engineer to Lloyd's underwriters, deals with the excessive consumption of lubricant which characterizes the Diesel engine. The remedies and palliatives which he recommends as having been tried and proved effective are for application to engines in service; but his remarks and conclusions are worthy of the closest attention by designers, who have the greater opportunity of developing them under favourable conditions.

The sphere of the Diesel engine was described in a lecture last year to the Royal Society of Arts by G. Mackenzie Junner, editor of the *Commercial Motor*, entitled "The Oil Engine and its Influence on Road, Rail and Air Transport" (*J. Roy. Soc. Arts*, July 24, 1936). On the road, owing to its greater cost, the Diesel engine is advantageous over the petrol engine only in cases of heavy loads or long mileage. In rail transport it has to compete with its very economical rival the steam engine, but the author can point to notable advantages in that it is immediately available when wanted and can be shut down with equal promptitude, thus saving wages and fuel costs preparatory to and following the period of useful operation. In the air its merits, though as yet far from fully developed or manifested, lie in its less inflammable and less volatile fuel, in the absence of sensitive carburetters and ignition systems and in its immediate readiness for service without a prolonged period of warming up. Of these three spheres of employment, the paper offers a general survey of considerable interest.

A New Natural History

Natural History
Edited by Dr. Charles Tate Regan. Pp. 896+16 plates. (London and Melbourne: Ward, Lock and Co., Ltd., 1936.) 25*s*. net.

DR. TATE REGAN is to be congratulated on having succeeded in giving the student and the intelligent reading public a really well-balanced and accurate account of zoological natural history in one volume of less than a thousand pages. He is fortunate in having as his collaborators a panel of experts, each of whom is an acknowledged authority on the subject with which he is concerned. He himself deals with fishes; mammals are in the safe hands of Mr. R. I. Pocock; Mr. W. B. Alexander, of Oxford, is responsible for the bird section and Mr. E. G. Boulenger, director of the Aquarium at the London Zoo, for reptiles and amphibians, while invertebrates are split into insects and those other than insects, and are dealt with by Miss D. Aubertin and Mr. G. C. Robson respectively. A systematic arrangement of sections has been adhered to by each author, which makes the whole an easy book of reference.

The most modern system of classification has been applied in every case and it will doubtless come as a shock to many readers to find, for example, that such old and familiar friends as the lion, tiger, leopard and jaguar no longer belong to the genus *Felis* but have been translated to a new and very select genus *Panthera*, while several of the other cats such as the so-called clouded leopard and the serval have been exalted to entirely new genera. Each section has a useful introductory chapter which deals with the main attributes of the order concerned and also with related forms which have become extinct.

Apart from the letterpress, which meets both the needs of the general reader and the serious student, the volume is illustrated throughout with a collection of more than a thousand photographs of, in most cases, living animals taken by expert animal photographers in Nature and in zoos all over the world. In addition, there is a number of coloured plates reproduced from pictures by famous animal artists. Here is indeed a book of great scientific accuracy and detail which also has a popular appeal and which at the price is highly concentrated value. G. M. V.

Manual of Public Health:
Laboratory Practice. By Prof. J. R. Currie and contributors. Pp. xix+378. (Edinburgh: E. and S. Livingstone, 1936.) 21*s*.

IT is an ambitious project to attempt to survey the whole of laboratory practice appertaining to public health in one volume, including as it does such varied subjects as chemistry, bacteriology, protozoology, helminthology, entomology and meteorology, but on the whole we think the author and his collaborators have succeeded.

The sections on protozoology, helminthology and entomology are excellent, and the respective authors, Dr. Staig, Miss Jepps and Dr. Mears, have written adequate summaries, as completely up-to-date as could be expected in subjects which are in a state of flux, and the numerous illustrations, many of which are original, increase the value of these sections. In meteorology, all the essential subjects appear to have been dealt with. In the introduction, it is suggested that the medical officer of health should be reasonably well informed on public health chemistry, and the section on chemistry conveys, we think, sufficient information to ensure this. The description of the quantitative test for benzoic acid does not, perhaps, mention all the precautions necessary, and the Werner Schmidt method for fat in milk might have been dealt with in less cumbersome form.

The section on bacteriology is the weakest in the book and is very 'sketchy', though the author to some extent disarms criticism by stating that a preliminary training in the subject is assumed, and the purpose of the article is to show how to get under way with the procedure required. Some of the details of the Rideal-Walker test of disinfectants are inaccurate, and under 'water' it would have to be almost sewage to show the presence of *Cl. welchii* in so small a quantity as 5 c.c.

The book is well produced, has adequate and excellent illustrations throughout, and a good index.

Great Earthquakes
By Dr. Charles Davison. Pp. xii+286+12 plates. (London: Thomas Murby and Co., 1936.) 17*s*. 6*d*. net.

THIS volume may be regarded as a sequel to the author's monograph, "The Japanese Earthquake of 1923" (1931), about the great Japanese earthquake of September of that year. Eighteen other important earthquakes of the last two centuries are now described. Most of the shocks caused serious loss of life and extensive damage, but the selection is primarily of those which have been investigated in such detail that the results are of value towards an understanding of the nature and origin of great earthquakes.

The earliest shock of the series is the Lisbon earthquake of November 1, 1755, in which the greater part of the city was destroyed and the loss of life ran into tens of thousands; the latest is the shock off the Sanriku coast of Japan on March 3, 1933, when more than three thousand people were drowned by the sea-waves due to the earthquake. Among the best known of the other shocks are the Mino-Owari (Japanese) earthquake of 1891, the Assam earthquake of 1897, the San Francisco earthquake of 1906, the Italian earthquake on December 28, 1908, in which Messina and Reggio were destroyed, and the Hawke's Bay (New Zealand) earthquake in February 1931.

For each earthquake are given details of the nature and effects of the shock in the surrounding regions, of the loss of life and material damage, of the earth movements and other phenomena accompanying the disturbance, and descriptions of the aftershocks. The geographical distribution of the intensity is generally shown by maps of the isoseismal lines. The seismic history of the various regions is a valuable feature, having been prepared from works which are not easily accessible.

The Annual of the British School at Athens
No. 34: Session 1933–1934. Pp. ix+198+49 plates. (London: Macmillan and Co., Ltd., 1936.) 50*s*. net.

THE thirty-fourth issue of the "Annual of the British School of Archæology at Athens" differs from its predecessors in omitting formal matter and the useful annual review of archæology in Greece by the Director which have appeared in these volumes hitherto. In future this material will be issued separately to subscribers to the funds of the School. The present volume, therefore, contains only papers, two in number, by members of the School. Mr. R. F. Cook discusses "Fikellura Pottery"—a group of ceramics, possibly better known under the name "Samian", which is not adopted here for good and sufficient reasons, as set out by the author. The second paper is on "Lakonian Vase Painting" by Mr. E. A. Lane. It carries further and adds to the study of material which has previously been the subject of investigation by a former member of the School, Prof. J. P. Droop, to whose conclusions, more especially in chronology, alternative suggestions are sometimes made. Both papers are very fully and admirably illustrated.

The B.D.H. Book of Reagents for 'Spot' Tests and Delicate Analysis
Fifth and enlarged edition. Pp. viii+96. (London: British Drug Houses, Ltd., 1936.) 2*s*. 6*d*.

THE latest developments of chemical analysis have led to a demand for spot tests which can be carried out quickly and in large numbers and afford direct evidence of the presence of minute traces of various substances. The reagents are all organic substances. In this monograph these substances are listed, together with the elements for which they are agents. A selection, seventy-one in number, has been made from the many which have been proposed after careful trial in the B.D.H. laboratories. It is believed that all these reagents are now made in Great Britain, a testimony to the success of the Safeguarding of Industries Act. Each test is described in sufficient detail with references to the original literature: many of them are of quite extraordinary delicacy.

The Field of Clinical Science

LORD NUFFIELD'S GIFTS TO OXFORD

By Prof. T. R. Elliott, C.B.E., F.R.S.

MEDICINE as a charity for the sick poor has for hundreds of years been entrusted with the gifts of kindly minded men and women. But the great advances in recent times of medical knowledge, whether directly won or derived from kindred sciences, have shown such promise of abundant help for all, rich and poor alike, that the gifts are now directed with a broader hope upon medicine itself. Such gifts, and they have followed one another in an astonishingly rich profusion since the beginning of this century, do not derive from a purely intellectual interest in science. Their aim is practical, for the welfare of humanity; they are guided by the sense that medicine itself, the instrument, must be sharpened with a keener power of penetration into the tangled problems of disease. Merely to multiply hospitals is not enough, for there is still substance to justify the indignant comment of Tristram Shandy's father on the physicians' motto, *Ars longa, vita brevis*, "Life is short, and the art of healing tedious; and who are we to thank for the one and the other but the ignorance of quacks themselves—and the stage loads of chymical nostrums, and peripatetic lumber, with which in all ages they have at first flattered the world, and at last deceived it".

The practical art itself can make little true progress unless medicine is brought closer and still closer to the discipline of scientific thought. But the word 'science' in itself carries no reference to laboratories and their modern uses. It simply connotes exactness of knowledge. Plato in his Republic defined 'opinion' as a faculty wandering between ignorance and knowledge, and too often resting near the former state. It is not the traditional reliance on doctor's opinion, but proof of every clinical rule and determination of the laws co-ordinating the phenomena of disease that are needed if the subject is to take rank as a science.

There are faint-hearted people within medicine who feel that the complications of each individual patient and his disease are so manifold that the clear generalizations of an exact science can never be applicable in practice, and that the latter must always remain at the level of an individual art. Others who are outside of the clinical group believe that discoveries of far-reaching value, the issue of a science that is creative as well as exact, will so rarely have their parentage among clinicians that it is fruitless to attempt to foster their birth in other homes than those of the ancillary sciences, such as physiology, biochemistry, and bacteriology. If both these views were true, clinical medicine might remain a useful art but it could never gain the exactitude and fruitfulness of a science. Good judges have decided otherwise, and laid plans for the embodiment of their views. To the practical English mind it is important to note the origin of these plans and their subsequent vigorous growth.

In 1913 the Royal Commission on University Education in London published its final report. Lord Haldane was chairman, and associated with him were Lord Milner, Sir Robert Morant and others, none of whom held medical qualifications. The great fracture of the War has broken the continuity of memory in many affairs, and it often escapes notice that many of the recent developments in London were foreshadowed in and owed their origin to the arguments of that report. In dealing with the teaching of medicine, Lord Haldane and his colleagues concluded that clinical medicine is capable of being treated scientifically, and that for this purpose the subject should be dealt with by men of the kind spoken of as university professors, who would do for medicine what other men do for physiology or chemistry. In order to enable each of such clinical professors to develop his subject by both teaching and research, it was proposed to equip him with a 'hospital unit' or service of beds, laboratories and assistants, all under his general control.

Soon after the War, in 1919, Sir George Newman announced a grant from the Board of Education for the immediate establishment of a number of such clinical units in certain medical schools of London, and their directors were afterwards given the status and responsibilities of professors in the University. The primary conception owed much to the examples already given by Germany and the United States, and at the outset it was nourished by great gifts from the Rockefeller Board. But time has proved its strength; and the Regius professorships of medicine in Great Britain, which are among the oldest established of all our university chairs, are now being one by one transformed into posts held by men who do

not aim at individual reputation in practice but seek to establish their subjects on a broader basis as an exact science. Lord Nuffield's gift of £2,000,000 to the University of Oxford for a school of advanced teaching and research in the clinical subjects emphasizes both the momentum of this change and the hopes that ride by its side.

Exactness in medicine as a science, whether curative or preventive, has all too short a range of ascertained knowledge. The vastness of the unmapped stretches, where disease must be met and somehow or other dealt with as it arises day by day, makes the science seem so small and the art of medicine almost the only means for ready action. Who can best be entrusted with the duty of riding out to extend the borders of the known? Physiologists and biochemists have claimed the honour, justly pointing to the work they have already done. But to Lord Nuffield and his advisers it seemed right to choose men who belong to a different group, clinicians, and his choice lacks neither precedent nor good argument.

In the same year as that in which the Royal Commission outlined its plan for medical education in Great Britain, research in medicine was suddenly given State recognition and endowment on a great scale by those decisions of Government which created what is now known as the Medical Research Council. Though always devoting the greater part of its resources to laboratory work by bacteriologists, chemists and others not in direct contact with the sick, the Council from the outset resolved to foster research by actual clinicians. It was happy in its first choice of a man to be given full opportunities for such work. Sir Thomas Lewis, with his beds, laboratories, and assistants at University College Hospital, London, has given knowledge of the highest value to medicine by his studies of diseases of the heart and blood vessels. So emphatic a success justified the Council in developing similar posts for clinical research in other medical schools; and with the assurance of such possibilities for work in front of them, even before the advent of Lord Nuffield's endowments for clinical research, some of the ablest of the younger men in hospitals have chosen for their life's work research in that particular field which Sir Thomas Lewis by his recent writings and addresses has sought particularly to identify under the name of clinical science.

Neither the name nor the idea is new. But the steady advocacy and the proof of its importance have created a group of workers who will make of it almost a new science in Britain. Including as it does all exact knowledge concerning human disease, it is in that respect nothing more than the science of medicine, to which so many workers in the past have added from their various points of view. The fresh impress is in the emphasis on the possibility, and the need, of developing a science directly related to medicine and dealing with the clinical phenomena of disease.

The accepted medical sciences, as distinct from clinical science, comprise all those biological studies which contribute to the understanding of disease and which were originally developed by medical men because they felt the need for such ancillary knowledge. Physiology, bacteriology and the rest have shown such vigorous growth that each now prospers with the independence of a pure science. The separation was inevitable; but thereby clinical medicine lost much of its own repute for scientific work, while the ancillary sciences acquired the term of being 'fundamental' because they revealed the main facts and laws of the working of the healthy body through which the disturbances wrought by disease might be analysed. For argument, let it be granted that in the future the deepest discoveries of far-reaching importance will be made by research in these separate studies. Such discoveries cannot be used at once in practical medicine. Some intermediate group of workers, equally trained in exact scientific judgment, must test and prove the way in which they may be applied to the management of human disease. The physiologist has learned that what is true for the frog may be untrue for the cat; and even what is true in healthy man may not be true in disease. If life must be measured in terms of life, then medicine must be measured in terms of medicine. That is the responsibility of clinical science.

The British school of physiology has a world-wide eminence. Its great discoveries regarding the nervous control of the viscera and blood vessels were among its earliest achievements, and little has been added to the details of that analysis in the last thirty years. Time moved on, and still almost nothing was gained from that great store of knowledge until at last clinicians themselves began to test by experiment its applicability to diseased states in man. In this direction clinical science is complementary to the fundamental sciences, and as essential as they are for the progress of practical medicine. But the clinician is the first to be aware of the insistence of a medical problem and to define it: in the end, only he can test the accuracy of the proposed solution. The needed discovery will often be his own, but if it chances to be made by a laboratory worker in other biological sciences, it is plainly to the advantage of the latter in so far as public support of their sciences is concerned that the applicability of such discovery to practical medicine should be proved with the least possible delay. Indeed,

those aspects of pure physiology and pathology which require experiments on animals would not be accepted as justifiable if they did not yield knowledge that finally gives help to both man and the animals.

There should, therefore, be no jealousy between clinical science and the sister subjects. Each relies on the other where medicine is concerned. For the fundamental sciences there may be fears that such great gifts as those of Lord Nuffield, opening too wide an irrigation channel over the new fields, may compromise their hopes of support. But the clinical work must be done, and the study of medical patients is costlier in all forms of maintenance than that of any other laboratory work. It cannot be stinted. For clinical science in its newer aspect there is a human need of intellectual sympathy and encouragement. Its work and its own proper discoveries tend to be disregarded in the domains of pure science, unless they happen to contribute facts or laws that are seen to be important also in those fields of work. The science must therefore stand in its own ground if it is to gain adherents and fulfil the responsibilities which are proper to it.

Some events in the history of medical progress more than a hundred years ago may be looked at in this reference. Thomas Young, whose intellect devised a theory of light and colours and went far in deciphering Egyptian hieroglyphics, was a physician. After years of study he wrote a book on consumption of the lungs, and to that subject even his great scientific powers could contribute nothing beyond a device for identifying pus cells in sputum by the coloured rings produced by the uniformly sized globules when the sputum was squeezed into a thin layer between two glass plates. Three years later, Laennec in Paris published his epoch-making observations on the use of the stethoscope and of physical signs for exact analysis, as proved by subsequent necropsy, of diseased states of the lungs. These discoveries were missed even by the inquiring genius of Thomas Young, and yet they were so great as to make all his treatise idle reading. Though demonstrably true, they are barely noticed in the history of scientific thought because they belong only to clinical medicine. They derived nothing from and contributed nothing to other sciences; but they had the exactness of proved knowledge and in that sense became a part of medical science.

Much of the best in medicine is knowledge of this type, gained by direct observation of the phenomena of sickness; but being self-contained and not linked by any clear laws with the generalizations of other sciences, it tends to be judged as falling below that which would entitle it to the rank of a science and being little more than the furnishing of a practical art. The exclusiveness of such a judgment might well be challenged. On the other hand, Young's observation on the sputum, though it added nothing to medical knowledge and only introduced an ingenious device, would by modern custom probably be spoken of as scientific because it was derived from the established body of mathematical and physical knowledge. The present fashion is to assume that there is nothing scientific in medicine unless it has been either derived from or re-affirmed by experimental tests in laboratories of the fundamental sciences.

Certainly in the past, medicine has taken a first but only half-hold of many discoveries, and then let them slip unproved out of her grasp because she lacked the technique of experiment and proof that has been the foundation of the biological sciences. The control of rickets and the whole range of modern progress in nutrition have thus tended to pass to the credit of physiology. But physiologists have their own problems to solve, and it is essential to the advance of a pure science that its quests should not be limited by the narrow horizon of what is visibly capable of practical use. There will be a long and wasteful delay in the progress of both the science and art of medicine unless the means are strengthened for prompt study of clinical questions by every available form of science, and equally for the testing and transference into clinical knowledge of any hopeful new discovery in physiology or the other sciences. Every part of such work will be scientific, while its direct concern with the questions of human disease is stated in its name of clinical science.

Engineering and metallurgy derive the whole of their scientific thought from the fundamental studies of physics, chemistry and mathematics. Geology derives still more widely. Yet in these subjects an independent science exists, and is creative in its own field. Clinical science in England at the moment makes use largely of the physiological approach to medical problems. With such methods clinical workers have made advances that are momentous in their own science, though some of them are of little import to physiology. The analysis of the different forms of irregularity of the heart-beat, their relationship to failure of the heart, and the appropriate therapy by digitalis provide one such instance. The delightful success of American work on the treatment of pernicious anæmia is almost entirely due to clinical research, while it has given to physiology new knowledge about the ripening of red blood cells that includes a process of such fantastic strangeness that no sane physiologist would have allowed himself even so much as to dream of its possibility. Each science learns from and helps the other.

Physiologists have taught all the 40,000 medical men in Great Britain. These practitioners of medicine are busy with their own technical art, and that is neither physiology nor clinical science, though it is inspired by each. Year by year their work grows more effective, thanks to progress in scientific knowledge of disease. Lord Nuffield's gift will augment the number of those aiding this advance by work in clinical science, and still leave them few in comparison with those in the other medical sciences whose work is less directly related, and therefore less immediately applicable, to the treatment and prevention of disease.

Chemical Exploration of the Stratosphere*

By Prof. F. A. Paneth

STUDENTS of the history of astronomy may remember that those of the natural philosophers in old Greece who favoured a geocentric conception pictured the universe as being built up of several spheres surrounding the earth. According to Aristotle, the sub-lunar world consisted of the four elements, each tending to its "natural place"; innermost was the core of the earth, surrounded by layers, first of water, then of air, and fire, wherever found, trying to rise to the top layer. Next came the realm of the "quinta essentia", the substance of the celestial bodies; but these were not supposed to circle in one and the same sphere. In order to explain the movements of the planets, Aristotle saw himself compelled to assume not less than fifty-six spheres in the sky, all concentric with the earth.

It looks somewhat like a revival of these old ideas that to-day science speaks of many concentric layers in the earth, sea and atmosphere. Since the development of modern seismology and geochemistry, it is known that the earth consists of at least four regions: a core of liquid iron in the centre, then a medium shell of, probably, sulphidic ores, covered by two outer shells of rocks of different densities. Fairly recently, in the early part of this century, it was discovered by Teisserenc de Bort that the thermal qualities of the atmosphere show a break when the height of about 11 km. (in our latitudes) is attained. In the lower part, called the 'troposphere', the temperature decreases regularly with increasing altitude until, at the height mentioned, about − 53° C. is reached. From here onwards, however, the temperature remains nearly constant at any height accessible to direct meteorological measurements. We have obviously entered a layer of the atmosphere in which different physical conditions prevail: the 'stratosphere'.

For a while it was assumed that the constant temperature of the stratosphere might extend to the top of the atmosphere. But from 1922 onwards it became clear that the structure of the atmosphere is much more complicated. We now know from indirect evidence, interpreted by Lindemann, Dobson and Whipple, that in regions at present beyond the reach of any thermometer, between 30 km. and 40 km., the temperature of the atmosphere begins markedly to increase again, and that this warmer layer is responsible for the reflection of sound waves; that at about 100 km. and again at 300 km. there exist strata of ionized air which play a role in the reflection of radio waves (Kennelly-Heaviside and Appleton layers); and that in the highest parts of the atmosphere a gaseous mass of about 1,000° C. is to be assumed. However complicated this may sound (even if we add that oceanographers nowadays distinguish between a 'troposphere', the upper layer of the sea in which the temperature decreases with descent, and a 'stratosphere' of fairly constant temperature below) we may still console ourselves by the thought that the modern scientific picture of the onion-like structure of the earth, sea and air is yet much less involved than the speculation of the ancient philosophers, and that its exploration advances quickly, thanks to the co-operation of various sciences.

While the temperature and the electrical state of the stratosphere have been the subject of many investigations, its chemical composition has seldom been studied. But so early as 1912, Tetens pointed out that a chemical investigation of the composition of the stratosphere would be the best, if not the only, means of deciding the question raised right at the beginning by the discovery of the stratosphere: Does the constancy of temperature mean that there is no convective motion of air masses; does it prove the absence of winds?

It is not difficult to see why the chemist should be able to settle this question. If it were possible in a long vertical tube containing a homogeneous

* From the Friday Evening Discourse at the Royal Institution delivered on November 6.

mixture of two gases of different densities to prevent every disturbance from outside, then we should expect the relative proportion of the gases no longer to remain constant throughout the length of the tube, but the heavier gas to concentrate near the bottom, the lighter near the top. This is a consequence of Dalton's law, which states that the variation with height of the density of each gas is the same as if it alone were present. The conclusion has never been experimentally verified, as it is scarcely possible to keep vertical gas columns of sufficient lengths—100 m. would be a good start—free from all disturbances. Only as a historical curiosity it may be mentioned that in the classical book on acoustics by Chladni (1802), an experiment is quoted by a Vienna professor who succeeded in separating the nitrogen and oxygen of atmospheric air in a vertical tube of not more than five feet length, simply by leaving it alone for one year!

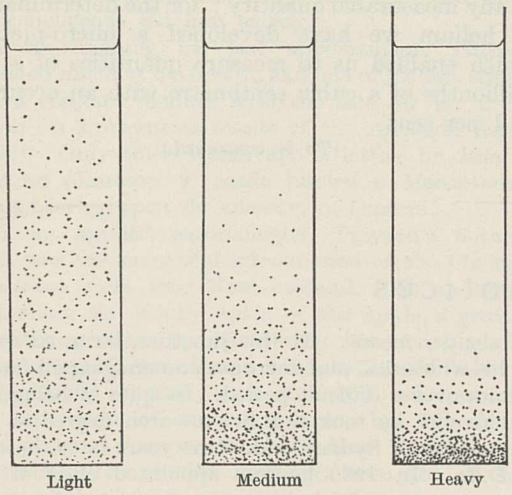

Fig. 1.

DISTRIBUTION UNDER GRAVITY OF PARTICLES OF DIFFERENT DENSITIES SUSPENDED IN WATER.

Thanks to the great development of the kinetic theory of gases we can, however, predict in every detail what is bound to happen in long vertical columns; and on a reduced scale it is possible to test the conclusions in a model experiment. Einstein was the first to point out that little particles suspended in water are subject to the same two conflicting tendencies as the molecules of a gas; on one hand they try to settle down, due to the force of gravity; on the other, their tendency to diffuse drives them asunder in all directions, including the one opposed to gravitation. As a result their equilibrium distribution must follow the same well-known 'barometric altimetry formula' for the decrease of concentration with height as does atmospheric air; with the one difference that, owing to the enormous contrast between the weight of visible particles and that of gas molecules, the phenomenon of thinning out with height must become perceptible at much smaller distances. The density of oxygen, for example, decreases to half its original value if we ascend to a height of about 5,000 m.; in a suspension of microscopic particles in water, the concentration should fall to half the initial value within a minute fraction of a millimetre, the rate of decrease depending, amongst other factors, on the specific weight of the particles.

Einstein's predictions have been tested experimentally by the French physicist Perrin and others. Fig. 1 illustrates on an enlarged scale what has actually been seen under the microscope. Each of the three suspensions, of heavy, medium and light particles, shows the regular decrease of concentration with height, following the barometric formula; but the one with the heaviest particles displays the phenomenon within the shortest range. If we mix the three emulsions by stirring, the particles will at first be homogeneously distributed throughout the whole column of water; but as soon as we leave them undisturbed—that means subjected no longer to large-scale mixing, but only to the forces of diffusion and gravitation—the height distribution peculiar to each of them will be restored, and so the percentage concentration of the heavier particles will increase near the bottom, of the lighter particles near the top.

Let us apply this knowledge to the atmosphere. It consists of a complicated mixture of gases.

TABLE 1.

COMPOSITION OF THE TROPOSPHERE (PER CENT BY VOLUME).

Nitrogen	78·08	99·99
Oxygen	20·95	
Argon	0·93	
Carbon dioxide	0·03	
Neon	$1{\cdot}8 \times 10^{-3}$	
Helium	5×10^{-4}	
Krypton	1×10^{-4}	
Xenon	1×10^{-5}	
Ozone	variable; $> 1 \times 10^{-6}$	
Radon (average near ground)	6×10^{-18}	
Hydrogen	doubtful; $< 1 \times 10^{-4}$	

In Table 1 the composition of atmospheric air is given. The content of water vapour, as is well known, is so variable that I have omitted it entirely; the table refers to dry air. The carbon dioxide, ozone and radon content, for different reasons, is also far from being constant. But the other gases are apparently present in the percentage given wherever in the whole troposphere a sample of atmospheric air may be collected. (Statements to the contrary in the older literature,

by Wigand, Tetens and E. Erdmann and H. Lange, were based on very few inaccurate experiments and can be regarded as disproved; it is most unfortunate that they should still be quoted.*) This equal distribution is perfectly understandable as an effect of the frequent stirring of the troposphere by winds; but if it be true that in the stratosphere no mixing beyond the slow one due to diffusion takes place, we should expect to find there a partial separation of the gases according to their different densities. A careful chemical analysis of air samples taken at various heights in the stratosphere is, therefore, a means of testing the question of the stillness of the stratosphere air.

As to the chemical analysis of air, we may confine ourselves to the determination of a few representative constituents. By far the easiest measurement is that of oxygen, and this gas has, therefore, been chosen by most laboratories; its absorption can be effected by phosphorus, heated copper or pyrogallic acid, or it may be removed by catalytic combustion with hydrogen. Its density, however, is only slightly greater than that of air (see Table 2) and for this reason it is not nearly the best for the present purpose; but the determination of the heavier argon is not so simple, and that of the minute traces of the very heavy gases, krypton and xenon, quite impossible in small air samples. As a specimen of a gas lighter than air, helium is the most suitable, since the lightest known gas, hydrogen, is not present in any measurable quantity; for the determination of helium we have developed a micro-method which enabled us to measure quantities of a few millionths of a cubic centimetre with an accuracy of 1 per cent.

* See, for example, NATURE, **137**, 459 (1936).

TABLE 2.
DENSITIES OF THE ATMOSPHERIC GASES.

	Formula	Molecular weight (O = 16·000)	Density (Air = 1·000)
Helium	He	4·002	0·1381
Neon	Ne	20·183	0·6963
Nitrogen	N_2	28·016	0·9670
Oxygen	O_2	32·000	1·1053
Argon	A	39·944	1·377
Carbon dioxide	CO_2	44·00	1·529
Ozone	O_3	48·000	1·624
Krypton	Kr	83·7	2·868
Xenon	X	131·3	4·525

(*To be continued.*)

Obituary Notices

Dr. R. J. Tillyard, F.R.S.

THE death of Dr. R. J. Tillyard took place in Australia on January 13, as the result of a motor-car accident on the road between Canberra and Sydney. Since Tillyard was one of the best known entomologists of the present day, his decease will come as a shock to his colleagues in many parts of the world.

Born on January 31, 1881, Robin John Tillyard was the son of J. J. Tillyard, of Norwich. His education was at Dover College and Queens' College, Cambridge, where he gained a mathematical scholarship. He became senior optime in 1903 and graduated M.A. in 1907. Ill-health, especially rheumatism, led him to seek a livelihood abroad, and he went to Australia in 1904 as mathematics master at Sidney Grammar School. In 1909 he married Miss Patricia Craske, a daughter of Mr. W. R. Craske, J.P., of Borstal, Rochester.

On gaining a Government studentship at the University of Sydney, Tillyard relinquished the career of schoolmaster and in 1915 became Macleay fellow of the Linnean Society of New South Wales, an office which he held until 1920. A short period before the Great War he became involved in a railway accident which incapacitated him for a long time and permanently altered his bodily figure. During these years he had a young family to provide for on slender means. At this juncture, he owed much to his wife's skill and devotion in managing all family affairs over a difficult period. In spite of being still an invalid, he took a B.Sc. research degree at the University of Sydney and, some years later, became a D.Sc. In 1920 he was appointed chief of the Department of Biology at the Cawthron Institute, Nelson, New Zealand. Tillyard remained at Nelson until 1928, when he became Chief Commonwealth Entomologist for Australia—a new and highly paid post with more exacting duties. He held this post for six years but, owing to health reasons, he had to retire, the Federal Government granting him a proportional pension.

Tillyard's early researches were concerned with dragonflies and, beginning from about 1905, he published a long series of papers on these insects, mostly in the *Proceedings of the Linnean Society of New South Wales*. His most important original study in this field is his paper "On the Rectal Breathing Apparatus of Anisopterid Larvæ" which was published by the Linnean Society of London (1916). It is a work of outstanding merit and secured for him the Crisp Medal and Award of that Society. About 1915 he became interested in the wonderful Neuroptera of Australia, publishing many papers on these insects. His work on the Chrysopidæ showed with remarkable clarity how the intricate venation

of these creatures is prefigured by the tracheation. After publishing his well-known book "The Biology of Dragonflies" (1917), Tillyard completed a study of venation and its bearings on the phylogeny of the Holometabola. The outcome were his papers on the "Panorpoid Complex" wherein, by a closely reasoned analysis, he claimed that under this title were to be grouped all the higher orders other than the Coleoptera and Hymenoptera.

Tillyard's many contributions on fossil insects placed him as the foremost authority on the subject in his day. The rich beds of Upper Triassic and Lower Permian age in Australia, and of Lower Permian date of Kansas, provided him with a wealth of material. In a relatively short time, Tillyard did much towards changing our knowledge of Permian and Triassic insects from being the most fragmentary into becoming among the most complete of any geological period. He also made many remarkable accessions to our knowledge of the affinities of various orders in bringing to light generalized or annectant types. With so extensive an output of work to his credit, it is scarcely surprising that here and there his conclusions led him astray.

After resigning his last appointment, Tillyard regained much of his health, and one of his last efforts was a conjoint memoir with the late Sir W. T. E. David on Proterozoic fossils of the Adelaide Series (1936). Only three weeks ago a letter by him in NATURE (January 9) made known a Mecopteroid insect bearing upon the ancestry of Diptera.

As an applied entomologist, Tillyard's notable work was the successful introduction of the Chalcid, *Aphelinus mali*, into New Zealand. As an agent controlling the woolly aphis of the apple, it greatly benefited growers by minimizing the necessity for insecticides. Tillyard was a whole-hearted believer in biological control, and initiated schemes for the repression of noxious plants, by introduced phytophagous insects, for both New Zealand and Australia. The results, however, have not, so far, borne out his earlier expectations.

Tillyard's predominant interest was in insect phylogeny and, in this connexion, he published papers on almost all the lower orders and especially on the more primitive forms. Altogether, he must have published about two hundred papers. The great part of this work is of high quality and will aid and stimulate those who come after him. He also found time to write a large text-book on the "Insects of Australia and New Zealand" (1926), profusely illustrated from drawings made by his wife.

For a number of years past Tillyard was keenly interested in psychical phenomena. At one time, these matters absorbed his attention to an extent which perplexed some who knew him. He believed in the necessity for proper scientific analysis of such manifestations and took every opportunity of gaining first-hand experience.

At the time of his death, Tillyard was an honorary fellow of Queens' College, Cambridge: he graduated Sc.D. (Cantab.) in 1920 and became F.R.S. in 1925. He is survived by his wife and four daughters.

A. D. IMMS.

Sir David Semple

WE regret to record the death, which occurred on January 7 at the age of eighty years, of Sir David Semple. Sir David graduated with honours at Queen's University, Belfast, and also took a diploma in public health before entering the Army Medical Corps, as it then was, as early as 1883. After service in India and elsewhere, he became associated with Almroth Wright as assistant professor of pathology at the Army Medical School at Netley from 1904 until 1909, and the good work he then did in bacteriological research opened up a varied and valuable career. Much of his earlier work was in connexion with anti-typhoid inoculation and other immunological researches, and this led to his appointment as a member of the committee for investigation of enteric fever in India from 1905 until 1909; this committee did important work which led to enteric being dethroned from its unenviable position of constituting by far the most important cause of sickness and mortality in the British Army in India.

In 1905 the first Pasteur Institute of India was founded at Kasauli in the Himalayas, not far from Simla, under a committee which had been largely instrumental in raising funds for its establishment, and David Semple's reputation already stood so high that he was selected as the first director during the early critical years, 1900–5. Here he did what was probably his most important work in introducing the use of carbolized hydrophobia-infected rabbits nervous system in graduated doses; for this has enabled the vaccine to be preserved and sent for use to hospitals and dispensaries all over India, with the great advantages of enabling the treatment to be carried out without the delay and expense of sending the patients many hundreds of miles to a central Pasteur Institute.

In 1905 Semple was called upon to occupy the more important post of director of the newly established Central Research Institute of India, also at Kasauli, which was now organized as the headquarters of the newly established Bacteriological Department of the Government of India for general medical research purposes. He had now completed more than twenty years service in the Royal Army Medical Corps, as it had now become, so he retired from that service with a pension, and served in his new post until 1913. During a portion of that time he was a member of the Central Malarial Committee and of the Scientific Advisory Committee for Medical Research under the Government of India. His work was now mainly of an administrative nature, and he did much to help and encourage younger research workers attached to the Research Institute. On retiring from service in India under the age rules in 1913, he was fortunate enough to find fresh administrative employment in Egypt as Director-General of the Public Health Department from 1913 until 1918, when he eventually returned to England to a well-earned rest.

Semple was of a retiring disposition, but a sound patient worker, and it was only those who had the privilege of his friendship who fully appreciated his worth.

Prof. K. K. Mathur

PROF. KRISHNA KUMAR MATHUR'S premature death on July 18, 1936, at the age of forty-three years, has deprived India of an eminent geologist and educationist. After finishing his secondary education, Mathur joined Agra College, where he came in close contact with the inspiring personality of Prof. N. C. Nag. Later he continued his studies at the Imperial College of Science and Technology, where he took the associateship of the Royal School of Mines in mining and mining geology, and the B.Sc. degree in mining, with first-class honours, of the University of London. There, too, he stood first among the successful candidates of his group and was awarded the De la Beche Medal.

Soon after his return to India, Prof. Mathur's services were secured by the Benares Hindu University as the University professor of geology in the year 1921. There he soon established himself as a great teacher and administrator. The Department of Geology owes its growth and development to Prof. Mathur, who was its head from the very beginning. His personality attracted students from all parts of India. At Benares he built up a school of geology, which is all-India in its character. His indomitable spirit in the face of hardship and his great love for the science of geology were a source of great inspiration to his students, who are spread far and wide in India, some of them holding important offices. His colleagues in the University held him in the highest esteem, and when he was appointed principal of the College of Science, constituted in 1935, everyone was indeed very happy at the selection.

In the field of research Mathur's principal contributions comprise the petrology of the Deccan Trap igneous activity. He carried out investigations of the various differentiates and threw much light on the genetic processes leading to the formation of the different types. His presidential address to the Geology Section of the Bombay meeting of the Indian Science Congress in 1934 on this subject will continue to be a valuable work of reference for a long time to come. His research activities also extended to stratigraphy, mineralogy and colloidal chemistry.

Amongst the scientific workers in India, Mathur held a prominent position. He was vice-president of the Geological, Mining and Metallurgical Society of India for two sessions. He was a foundation fellow of the United Provinces Academy of Sciences (now the National Academy of Sciences), the Indian Academy of Sciences, and of the National Institute of Sciences in India.

On the personal side, Prof. Mathur was a man of strong principles and high ideals. As an administrator, his sense of justice was great, which won for him love from all quarters. He was strict in imposing rules but very liberal in judging faults. He was simple, sincere and a great philanthropist. His purse was always open for the poor student and for the cause of science. He carried his greatness with charming modesty; he was a selfless and conscientious worker.

Prof. D. F. Fraser-Harris

PROF. DAVID FRASER FRASER-HARRIS, whose death occurred on January 3, was born on February 24, 1867, the eldest son of Mr. David Harris, of Bath. He studied medicine at the University of Glasgow, where he obtained the Neill Arnott Prize in physiological physics in 1890 and the British Medical Association Prize on the effects of alcohol in 1892. He qualified in 1893 and for the next five years was senior assistant to the professor of physiology and Muirhead demonstrator in physiology at Glasgow. He then went to St. Andrews as acting professor of physiology until 1908. He also lectured on physiology and hygiene at Manchester and Birmingham, where he obtained the degree of doctor of science and was made a member of a committee to investigate artificial respiration apparatus.

Prof. Fraser-Harris was an original member of the Biochemical Society and president of the Scottish Microscopical Society in 1908–9. In 1911 he was appointed professor at Dalhousie University, Halifax, Nova Scotia, which he represented on the Medical Council of Canada, and he remained there until 1924, when a breakdown in health compelled him to resign his appointment.

Prof. Fraser-Harris was a lucid and prolific writer on the physiology of the nervous system and the history of medicine. In addition to being general editor of the Modern Health Series, to which he contributed "Nerves—Master System of the Body" (1927), he was author of "The Functional Inertia of Living Matter: a Contribution to the Physiological Theory of Life" (1908), "Coloured Thinking" (1928) and "Morpheus or the Future of Sleep" (1928). As member of the editorial board of *Medical Life*, the official organ of the American Society of Medical History, he contributed a number of interesting essays to that journal on eminent undergraduate observers, medical presidents of the Royal Society, Shakespeare's perception of the functional importance of the brain and other medico-literary topics. His interest in other branches of medicine is shown by his publication last year of a little work entitled "Aural Therapy in Relation to Deafness" and an article in the *Medical Press and Circular* of October 28 on "The Duke-Fingard Method as applied to the Respiratory System". He is survived by his widow and a son, a sub-lieutenant in the Navy.

We regret to announce the following deaths:

Sir John A. F. Aspinall, past-president of the Institutions of Mechanical and Civil Engineers, and also of the Institution of Civil Engineers of Ireland, on January 19, aged eighty-five years.

Prof. David Ellis, professor of bacteriology and superintendent of the Schools of Pharmacy and Bakery in the Royal Technical College, Glasgow, on January 16, aged sixty-two years.

Dr. Marshall A. Howe, director of the New York Botanical Gardens, an authority on the seaweeds and liverworts of North America, on December 24, aged sixty-nine years.

News and Views

Genetic Theory and Practice in the U.S.S.R.

A REPORT of the fourth session of the Lenin Academy of Agricultural Sciences, which was held in Moscow in December last, has been received from the Soviet Union Year Book Press Service, 623–4 Grand Buildings, Trafalgar Square, London. Apart from seventy-one special papers, there was a general debate on the present position of research in genetics. This apparently took the form of an attack on modern genetic theory by experts who have been engaged in the study of practical problems unrelated to genetics. The grounds of the attack were ostensibly twofold. First, geneticists like Muller and Vavilov were said to have neglected the Marxian principle of the unity of theory and practice in failing to keep their work in touch with the needs of farmers. Secondly, the primary assumptions of genetics were held to be invalid. Presumably, in the absence of other evidence, the second contention was deduced from the first. The attack was reinforced by pointing to work like that of Michurin and Lysenko which, unhampered by academic prejudice, has yielded results of immense practical value by methods of trial and error.

MICHURIN is described as a "self-made practical plant breeder"; his published work has unfortunately not been translated into any foreign language. He is understood, however, to have made hybrids and discovered sports in various economic plants of a kind never produced elsewhere. Lysenko, on the other hand, is well known as the author of the technique of vernalization, which he invented apparently without knowledge of the previous experiments conducted abroad on the same subject. This worker went further than the other disputants and promised that the physiological behaviour acquired by plants under his treatment could be inherited, winter wheat being turned into spring wheat and *vice versa*. If this were true, the tedious methods of plant breeding now practised by orthodox geneticists in Prof. Vavilov's institutions would of course be superfluous.

THE situation revealed by this discussion is astonishing in more than one respect. It is a commonplace and as old as Aristotle for scientific men unfamiliar with experimental methods to set forth Lamarckian doctrines in explaining evolution. For experimental workers to set out a Lamarckian method for the advancement of practical breeding is, however, something new and particularly remarkable in the Soviet Union, where the moral bias of this ancient myth might well have made it suspect. Still more astonishing is it to find that these arguments are combined with a charge of doctrinal incompetence against Muller and Vavilov, who, while making fundamental contributions to genetic theory, have probably done more than any other living workers in this field to show its practical value to mankind.

Scientific Freedom

THE following resolution was adopted at a meeting held on December 31 by the American Society of Naturalists during the recent Atlantic City meetings of the American Association for the Advancement of Science: "The American Society of Naturalists observes with regret an increasing tendency in certain parts of the world to require of investigators the conformity of their research to officially prescribed doctrines. This society wishes to emphasize that intellectual progress is compatible only with perfect freedom in the conduct of investigation and in the announcement both of results and of conclusions based upon those results. Attention is called also to the fact that the scientific world can place no reliance upon reports of research carried on under conditions which limit its freedom by an enforced agreement with any preconceived views or dogmas."

American Flood Devastation

LESS than a year has elapsed since, on March 28, 1936, we recorded a serious flood visitation suffered on the west of the Atlantic, and now once more the peril of the waters is rife in many eastern States of North America. Due to extremely heavy rainfall, the Mississippi and Ohio Rivers have been steadily and rapidly rising, overflowing their banks and inundating the surrounding country. The whole of the Ohio valley is affected and it is estimated that, up to the time of writing, some 750,000 people have been rendered homeless in thirteen States, with every expectation of a greatly increased total. The deaths so far number more than a hundred and many people are missing. Pittsburgh (Pennsylvania) with a population of 700,000, and Cincinnati (Ohio) with a population of 450,000, are menaced with a repetition of the tragic experience last year when many of the inhabitants in the former town lost their lives. At Cincinnati, the river has risen to the abnormal height of more than 70 feet, the highest level recorded for almost fifty years. Wheeling, a busy industrial centre in West Virginia, is threatened with the complete submergence of the island on which part of the town is built.

PERHAPS the most exciting incident of the calamity has been the compulsory opening at Portsmouth (Ohio) of the main sewer sluices to relieve the heavy pressure of water against the river embankments, which it was feared were on the point of collapse. After dramatic warning by factory sirens and locomotive whistles to enable the residents to evacuate houses and buildings and find refuge on higher ground, water from the river was allowed to flow into the business quarter of the city to a depth in places of 10 ft. At Cincinnati, the situation was further imperilled by the escape of oil from the Standard Oil Company's storage tanks, which caught fire and transformed the river surface into a sheet of flame,

extending for a distance of four miles and doing damage estimated at about £200,000. Fire broke out, too, at Louisville (Kentucky) where martial law had to be proclaimed, as also at Columbus (Ohio). The sufferings of the homeless are increased by inclement weather conditions, with intense cold, snow and sleet. President Roosevelt has issued a proclamation stating that it is imperative to raise a fund of at least £400,000 to relieve the destitution of the victims.

Flooding in Southern England

THE catastrophic experience in the United States is reflected in a minor degree in the southern counties of England, where persistent rains have caused inundations in Kent, Sussex, Berkshire, Wiltshire, Northamptonshire, Bedfordshire and elsewhere. The valley of the Thames in many places is under water and the river is running more than 'bank high', the rate of flow having reached 8,700 million gallons per 24 hour day, as compared with the 9,000 million gallons recorded on January 3 last year, during a period of exceptionally heavy rainfall. The standard daily average for the month of January is 2,407 million gallons. Although the latest indications are that the peak level has been passed, yet, with an outlook presaging more rain in all districts, the prospects of an early subsidence of the flood waters are by no means reassuring, and much discomfort to marooned residents and interference with road traffic is being experienced.

Leopold von Schrötter (1837-1908)

A COMMITTEE of prominent Viennese physicians and laryngologists has recently been formed to commemorate the centenary of the birth of the man, equally illustrious as laryngologist and physician, whose full name and titles were Hofrat Prof. Dr. Leopold Ritter Schrötter von Kristelli. He was born at Graz on February 5, 1837, the son of the eminent chemist who discovered amorphous phosphorus. He studied medicine at Vienna, where he qualified in 1861. From an early stage in his career he took a keen interest not only in diseases of the chest, which he had an unrivalled opportunity of studying under Prof. Skoda, the great authority on this subject, but also in laryngoscopy, the importance of which to the physician he was the first to emphasize. During his subsequent career he occupied the important positions of director of the first laryngological clinic to be established and later the chair of clinical medicine in the University of Vienna. His principal work was a book on diseases of the larynx, trachea, nose and throat, which for a long time was the standard publication on this subject. He also contributed important articles to various systems of medicine on diseases of the heart and pericardium and syphilis of the larynx. Lastly, he deserves recognition as being one of the first to introduce sanatoria for the treatment of pulmonary tuberculosis, and to combat the pessimistic outlook of the medical profession regarding the cure of this disease. His death took place on April 22, 1908.

Severance of Britain and the Continent

IN another column of this issue of NATURE (see p. 200) there appears a brief account of an archæological investigation of the submerged land-surface of the Essex coast by a sub-committee of the Fenland Research Committee. Questions of land elevation and submergence are naturally of much interest to prehistorians, more especially in relation to questions of dating, as well as of the possibilities and means of contact and communication between early cultures and peoples. One of the most important of such inquiries is that of the period at which separation of Britain from the Continent took place. In the same issue of the *Proceedings of the Prehistoric Society* in which the report on the submerged area of the Essex coast appears, Mr. Philip Ullyott, of the Department of Zoology, Cambridge, opens up a new line of evidence for dating this severance in "A Note on the Zoogeographical History of North-western Europe". In this he examines the geographical distribution of certain types of flat-worms (planarians) belonging to the same group and living in fresh-water, but adapted to different temperature ranges. His conclusion, in brief, is that the distribution of these types suggests that Britain must have separated from the Continent after the average summer temperature had exceeded 12° C., but before it had reached more than 16° C.

THANKS to the studies of Scandinavian workers, the curve of mean summer temperature during post-glacial time is known fairly accurately. It is, therefore, possible to say that the breaking of the land surface, across which the flat-worms migrated in fresh-water from the Continent to Britain, must have occurred during the Boreal period, but before its later stage, when the temperature curve rose to its maximum during post-glacial time. This conclusion agrees remarkably closely with the evidence of palæobotanical investigation, which points to an early Boreal phase, c. 6800–5000 B.C. As is pointed out in an editorial note, there is archæological support for this dating in the close connexion of the Baltic and Britain in the Continental period, while certain types become infrequent in Britain in the late Boreal period, and by Atlantic times the forest culture of south-east Britain had become quite distinct from the Ertebölle of Denmark and Schleswig-Holstein.

Snow

IN his Friday evening discourse at the Royal Institution on January 22, Mr. Gerald Seligman discussed "The Nature of Snow". He commenced by showing how the molecular structure of ice accounts for the hexagonal structure of ice crystals. He reproduced Tyndall's experiment of forming 'negative crystals' in ice by passing a beam of light through it. A cinematographic reproduction of the same experiment showed the formation of these 'crystals' under high magnification. Ice evaporation is stimulated by a comparatively high temperature, and the reverse process—reconsolidation—by a low temperature. Mr. Seligman stressed the importance of sublimation in every question affecting snow and snowcraft. The life-histories of different types of

snowflakes under varying atmospheric conditions were then dealt with. Passing now to *firnification*, or the changes of the snowflake after lying on the ground, Mr. Seligman showed the complete cycle from newly-fallen snow to advanced firn snow by photo-micrographs taken by him in the Alps and by scenic views illustrating the different kinds of snow surfaces encountered by the mountaineer or explorer. The process is essentially one of a consolidation of the fine, newly-fallen snow, occasionally containing as much as 89/90 of air, to one of pure ice containing little or no air at all. The final stage of firnification, the genesis of glacier ice, has never been fully recorded, and this is to form the subject of a research now in course of preparation by the lecturer who showed tools for the purpose lying on the table. Dealing briefly with new snow avalanches, Mr. Seligman used some of his microphotographs of firnification to show why snow slopes do not as a rule become dangerous until the temperature has risen after a snowfall—a practical point of value to the ski-runner. Turning next to the effects of wind upon snow, Mr. Seligman showed photographs of a number of wind-formations, including sastrugi, cornices, and snow 'wind-packed' or hardened by a wet wind. Wind-packed snow causes wind-slab avalanches, which consist of hard brittle drifts of snow lying loosely on steep slopes. These, if disturbed, break into blocks and form dangerous avalanches. A knowledge of the weather conditions which cause this type of avalanche has already proved of value to Everest climbers.

Harry Price Library of Magical Literature

To celebrate the transference of the library and records of the University of London Council for Psychical Investigation to the new University building in Bloomsbury, a dinner was held on January 22 at the Hotel Splendide. The occasion was also a mark of the Council's appreciation of the valuable work which Mr. Harry Price has done for psychical research and of his generosity to the University, and an illuminated testimonial to that effect was presented to him. The chairman, Dr. C. E. M. Joad, in complimenting Mr. Price, pointed out that in the early stages of all sciences, the experiments were carried out by private individuals at their own expense, and that it was to co-ordinate such activities and avoid acrimonious correspondence and personal animosities, that the Royal Society itself was founded. Mr. Price, in his reply, gave a short survey of the positive results of his many years of investigation, and concluded that sufficient evidence has been obtained to justify scientific investigation of telekinesis, thermal variations, teleplasmic masses, secondary trance personalities and extra-sensory perception of various kinds. The future of psychical research, he said, lies with the universities, and already there are six universities abroad taking the study seriously. The evening concluded with a demonstration by Mr. and Miss Tree, the foremost vaudeville telepathists in Britain. Their performance is remarkable for the extraordinary rapidity with which their code-system can be worked.

The Society of Smeatonian Civil Engineers

AMONG the least known engineering societies is that of the Smeatonian Society of Civil Engineers, which to-day exists mainly for social intercourse and has a small but select membership. When it was founded in 1771 it had as its aim the furtherance of professional knowledge. Its history has never been written fully, but on January 20, at a meeting of the Newcomen Society held at the Institution of Civil Engineers, Mr. S. B. Donkin gave an interesting account of its early fortunes. From the technical point of view, the most lasting result of the Society was the publication in 1812 of the four volumes of the "Reports of the late John Smeaton". In the preface to this and in two minute books are contained what is known of the Society in its early days. It was the increasing demands being made on canal, harbour and bridge builders which led to the formation of the Society, it being felt that good results would accrue from members of the civil engineering profession meeting together to discuss their various projects. That they did so in a friendly manner can be seen from the minute of a meeting in 1778 which "was spent canallically, hydraulically, mathematically, philosophically, mechanically, naturally and socially". The original society founded in 1771 came to an end in May 1792, but was almost immediately revived when, as the minute records, "The first meeting of this new institution The Society of Civil Engineers was held on the 15th of April 1793 by Mr. Jessop, Mr. Mylne, Mr. Rennie and Mr. Whitworth". Smeaton had been a leading figure of the old Society but he had died in October 1792. Soon after the revival of the Society, it learnt that Sir Joseph Banks had purchased all Smeaton's manuscripts and drawings, and it was with his concurrence the Society undertook the publication of Smeaton's "Reports". At the dinners, later on, five toasts were instituted, one of which was to "The memory of our late worthy brothers—Mr. Smeaton, Mr. Mylne, Mr. Watt and Mr. Rennie", and these toasts are still the order of the day at dinners of the Society. The Society, it may be added, had little, if anything at all, to do with the formation of the Institution of Civil Engineers, which arose from the efforts of half a dozen young engineers with their fortunes still to make.

Recent Acquisitions at the Natural History Museum

THE human remains from the Pleistocene deposits of Kenya Colony, on which much of Dr. L. S. B. Leakey's work is based, have been presented to the Department of Geology by the president and council of the Royal Society, through Dr. Leakey. The Mineral Department has received from the proprietors of the Hup Tuck Kongsi mine in the State of Selangor, Federated Malay States, the gift of an unusually large mass of cassiterite, showing numerous well-developed crystals. Cassiterite, which is more popularly known as tinstone, is almost the only source of tin and is therefore a valuable ore. Very occasionally it has been found in large enough crystals for cutting as gem-stones. The crystals in the present mass are at the best translucent at the surface. In colour they are mainly

reddish brown, but some are black. Dr. Germaine A. Joplin, of the University of Sydney, has given a series of igneous rocks described by her, and rocks described in the Records of the Geological Survey of New South Wales are a donation from the Curator of the Mining and Geological Museum, Sydney. Dr. K. S. Sandford has presented the series of rocks which he collected when with Major Bagnold's expedition in 1932 and has since described. An opaque crystal of scheelite from Perak, larger than any hitherto in the Museum, has been given by Mr. John Weekley. Of considerable historical interest is the diary kept by Robert Allan (1806–63) during a visit to the Mediterranean in 1830, which has been given by Miss B. M. Clay, one of his descendants. Robert Allan was the son of Thomas Allan (1777–1833), the Edinburgh banker, whose mineral collection was bought after his death by R. H. Greg and acquired by the British Museum in 1860. Many of the minerals and rocks collected during this expedition are in the Mineral Department.

THE Department of Botany has received 1,650 plants collected by Messrs. G. Sherriff and F. Ludlow in Bhutan and Tibet. The route followed was from the Assam plains near Gauhati, through eastern Bhutan. Tibet was entered up the Nyan Jang Chu, a river rising north of the main Himalayan range which cuts its way through the range and flows south to join the Manas River. The plateau region was crossed and one of the headwaters of the Subansiri River was followed down. There six months were spent with Tsari as a centre, an area which proved very rich in alpine flora, some of the grassy hill-sides, above the tree-line, being literally covered with Primulas. After the flowering season was over, seeds were collected. It is probable that several interesting horticultural plants will be introduced to British gardens, for a number of new species of *Primula* and a new *Mecanopsis* were found. The specimens are exceedingly well preserved and the collection is a most valuable addition to the series of Himalayan plants in the Department. Among purchases are 600 flowering plants from the west-central district, Sikang, of China, the first consignment of a set of Dr. Harry Smith's collections on his recent expedition; the herbarium of A. L. Hübl, containing 4,600 specimens chiefly from Austria, and the moss herbarium of the well-known Dutch bryologist Fr. Verdoorn, comprising about 3,200 specimens.

Alcohol and Motor Accidents

AT a meeting of the Society for the Study of Inebriety on January 12 reported in the *British Medical Journal* of January 23, Dr. H. M. Vernon stated that though the maximum of road traffic accidents during the last two years was a little less than in 1934, the fatalities still averaged 18 a day and the injuries more than 600. Half the deaths were among pedestrians and a fifth among pedal cyclists, while drivers of motor vehicles and their passengers had only a third to a fourth as many accidents as pedestrians. Although the data of the Ministry of Transport indicate that only 1 in 80 of the road fatalities are due to persons obviously under the influence of drink, the evidence from America suggests that alcohol plays a much larger part in motor accidents. Alcohol even in moderate quantities frequently affects driving capacity, and in particular causes drivers unconsciously to increase their speed, which is the most important factor in the causation of fatal accidents. Examination of the blood or urine by Widmark's method shows the following correspondence between the alcohol content and the clinical symptoms. In persons with 1 part of alcohol per 1000 in the blood, 40–60 per cent were found to be "under the influence"; of those with 1·7 parts, 80–88 per cent were so affected, and of those with 2 parts all were affected. Dr. Vernon has come to the conclusion that abstinence from alcohol should be practised for several hours before driving as well as during its course, as the rate of disappearance of alcohol from the blood is very slow.

Communal Aerials for Radio Reception

IN large towns and cities, the provision of a good aerial generally presents many difficulties, especially in houses divided up into self-contained flats. In the latter case, it would be necessary to erect on one roof a number of separate aerials which would satisfy the varying requirements of the listeners. In some places also there is an almost insuperable difficulty owing to interference from electric motors and other electric devices. Some years ago the Philips Research Laboratories at Eindhoven, Holland, evolved a communal aerial system which they call the 'Antennaphil' which surmounts most of the difficulties met with in practice. A description of it is given in the *Journal* of the Philips Research Laboratories of August last. In this system an aerial of suitable dimensions is erected at a spot where interference is limited, for example, at a height of twenty feet above the roof. Through a specially screened conductor made as short as possible, the aerial is connected to an aerial signal amplifier, from which the incoming signals are transmitted to a number of receiving sets through a lead-covered cable which acts as a screened distributing circuit. Up to fifty sets can be connected to an aerial fitted with this form of amplifier. If the distance of the spot from which reception, practically free from interference, can be received is a few hundred yards, then the number of sets is less. But even up to a distance of 1,000 yards, several sets can be supplied. An aerial of this type has been in use at the laboratory for several years at a distance of 200 yards, and has ensured reception free from all interference. It is proved that a concentric cable of suitable dimensions is the best to use for high-frequency distribution.

"For Intellectual Liberty"

THE Society "For Intellectual Liberty", which was founded early in 1936 as a rallying-point for intellectual workers concerned with the active defence of peace, liberty and culture in the present conditions of the world, has recently issued its first bulletin.

The Society was formed as a result of an appeal from the French Comité de Vigilance des Intellectuels Antifascistes, which in January called a conference where it was decided to form an International Federation of Intellectual Workers. The bulletin in question describes the growth and activities of the British group from its original membership of fifty. The group has worked in close touch with the National Council for Civil Liberties, from which it differs chiefly in its wider concern with domestic and foreign affairs, and with various committees for the assistance of victims of Fascism and latterly with organizations to provide help for the Spanish people. It is not a party political organization and its present supporters are drawn from all shades of political opinion. It is broadly democratic and international in outlook, and by arranging for discussions among its members seeks to find the greatest measure of agreement on such questions as the need for a Popular Front or of the best way of forming it; on the question of armaments, the League of Nations and collective security, and on the practicability of removing, by economic or political action, the causes of war. The Honorary Secretary is Margaret Gardiner, 23, Haymarket, London, S.W.1.

Birth- and Death-Rates for 1936 in England

ACCORDING to a return published by the Registrar-General, the birth-rate in England and Wales during the year 1936 is provisionally estimated at 14·8 live births per thousand of the population, and the crude death-rate at 12·1 deaths per thousand of the population. The number of deaths of children under one year, per 1,000 live births, was 59. The birth-rate for 1936 is 0·1 above that for 1935, and 0·4 above that of 1933, the lowest on record. The crude death-rate is 0·4 above that of 1935 and 0·7 above that of 1930, the lowest on record. The infant mortality is 2 above that of 1935, which was the lowest on record, and is the same as that of 1934, the previous lowest on record. In 122 county boroughs and great towns of England and Wales, including London, the birth-rate during 1936 is provisionally estimated at 14·9 live births per thousand of the population, the crude death-rate at 12·3 deaths per thousand, and the deaths of children under one year at 63 per 1,000 registered live births. The corresponding figures for the 143 smaller towns with estimated resident populations of from 25,000 to 50,000 at the 1931 census are estimated as follows: birth-rate, 15·3, crude death-rate 11·7 and infant mortality 55. In the Administrative County of London the corresponding figures are estimated at: birth-rate, 13·7, crude death-rate, 12·5, infant mortality, 66. These figures are provisional, and may be subject to readjustment before the publication of the Registrar-General's Statistical Review in July.

Sir George Beilby Memorial Awards

THE administrators of the Beilby Memorial Fund, consisting of the presidents, treasurers and secretaries of the Institute of Chemistry, the Society of Chemical Industry and the Institute of Metals respectively, have announced awards of a hundred guineas each to Dr. B. S. Evans and Dr. W. H. J. Vernon. Since 1919, Dr. Evans has been attached to the Research Department of Woolwich Arsenal, where he now holds the position of a scientific officer. He has devised numerous analytical methods for the separation and determination of metals, and contributed the chapters dealing with the methods of analysis applicable to lead, bismuth, arsenic, antimony, tin, iron, chromium and metallic constituents of steel in Mitchell's "Recent Advances in Analytical Chemistry". Dr. Vernon was appointed investigator to the newly-formed Atmospheric Corrosion Committee of the British Non-ferrous Metals Research Association in 1921. His experimental work was carried out at the Royal School of Mines, South Kensington, under Sir Harold Carpenter until 1927, when the investigation was taken over by the Department of Scientific and Industrial Research and continued at the Chemical Research Laboratory, Teddington, under Sir Gilbert Morgan. In the course of this work, which included early quantitative determinations of invisible oxide films on metals, a number of generalizations on atmospheric corrosion phenomena (ferrous and non-ferrous) has been established. Dr. Vernon's publications have included "A Bibliography of Metallic Corrosion" (Arnold), the first and second reports to the Atmospheric Corrosion Research Committee (each of which formed the subject of a general discussion by the Faraday Society) and numerous papers.

Awards of the Institution of Electrical Engineers

THE Council of the Institution of Electrical Engineers has elected Dr. Alexander Russell, principal of Faraday House Electrical Engineering College, to be an honorary member of the Institution. The Council has made the fifteenth award of the Faraday Medal to Prof. André Blondel, of Paris. The Faraday Medal is awarded by the Council of the Institution not more frequently than once a year, either for notable scientific or industrial achievement in electrical engineering or for conspicuous service rendered to the advancement of electrical science, without restriction as regards nationality, country of residence, or membership of the Institution.

International Congress on the History of Science

ON the occasion of the one hundred and fiftieth anniversary of the birth of Jan Evangelista Purkyně (or Purkinje), a distinguished Czech biologist, the fourth International Congress on the History of Science will be held in Prague on September 22-27. The Congress, under the presidency of Prof. Quido Vetter, will discuss papers dealing with (1) the development of the sciences during the eighteenth and first half of the nineteenth centuries; (2) the history of science in education; and (3) historical themes not included above. The contributions will not be restricted to the natural sciences only, medicine and the technical applications of science (for example, in agriculture) being also included.

Soviet Scientific Films

A MICRO-CINEMATOGRAPHIC study of the human capillaries is to be made by the medical cinematographic department of the Soviet Commissariat of Health. According to Mr. Volkof, the head of the department, the chief advantages of the scientific medical film in medicine lies in the possibility it opens up of modifying the time range of experiments to meet requirements. Action can be accelerated or slowed down at will. Moreover, the photomicrograph flashed on the screen frequently discloses many details unseen to the eye even with the aid of the microscope.

The Influenza Epidemic

THE Minister of Health has had special inquiries made through the regional medical officers of the Ministry into the local prevalence of the influenza epidemic. It appears that generally there is at present an extension from south to north, but that the distribution is patchy. Prevailing medical opinion is that the present outbreak, though widespread and highly infectious, is for the most part mild, most of the deaths being among the elderly. In the week ending January 9, there were 768 deaths ascribed to influenza in 122 great towns, as compared with 325 for the previous week, and the number of notifications of primary and influenzal pneumonia increased from 1,513 to 2,321.

The Night Sky in February

BETWEEN February 1 and February 28, the length of the night in the latitude of London decreases from $14^h\ 54^m$ to $13^h\ 13^m$. New moon occurs on February $11^d\ 7{\cdot}6^h$ and full moon on February $25^d\ 7{\cdot}7^h$. The planet Venus in the evening sky is a brilliant object; and in conjunction with the crescent moon on February $14^d\ 23^h$ will make a striking spectacle. On February 15 at 23^h, the planet will pass within 3′ of the star δ Piscium (magnitude 4·6). Venus is at greatest elongation (47° E.) on February 5. Mercury is a morning star at greatest western elongation (26°) on February 7, when it rises about $1^h\ 12^m$ before the sun. On February 9 at 7^h, Mercury is in conjunction with the moon, the planet being 2° south of the latter. In mid-February, Saturn sets about two hours after the sun. On February 20, the plane of the rings passes through the earth, and the appearance of the ring system in large telescopes will be of special interest. In 1920 and 1921 when the system could be viewed in similar circumstances as will occur on February 20, it was found that the rings did not completely disappear—a fact which has a bearing on their thickness and structure. On February 13 at 15^h, Saturn will be in conjunction with the moon, the planet being 8° S. Jupiter rises near daybreak in the south-east; its magnitude is − 1·5. The most favourable times for observing the light changes of Algol (R.A. $3^h\ 04^m$, Dec. 40° 43′ N.) are as follows: February $2^d\ 2{\cdot}4^h$, $4^d\ 23{\cdot}2^h$, $7^d\ 20{\cdot}0^h$, $22^d\ 4{\cdot}1^h$, $25^d\ 0{\cdot}9^h$ and $27^d\ 21{\cdot}8^h$. The radiant for the α Leonid meteors on February 22–28 is at R.A. $10{\cdot}4^h$, Dec. 14° N.

Announcements

THE French Government has awarded the rank of Chevalier of the Legion of Honour to Prof. J. B. S. Haldane, professor of genetics, University College, London, for his scientific services to France.

PROF. ARTHUR HOLMES, professor of geology in the Durham Division of the University of Durham, has been elected a foreign correspondent of the Geological Society of America.

THE John Anisfield Award has been given to Drs. Julian Huxley and A. C. Haddon for their book "We Europeans: A Survey of 'Racial' Problems", with a chapter on "Europe Overseas" by Prof. A. M. Carr-Saunders, which was reviewed in NATURE of November 9, 1935, p. 736. The judges of the award are Prof. Henry Pratt Fairchild of the University of New York, Prof. Donald Young of the Social Science Research Council, and H. S. Canby of the *Saturday Review*. The prize is given for "a sound and significant book published in the previous twelve months on the subject of racial relations in the contemporary world".

AT the annual meeting of the New York Academy of Sciences held on December 21, the following honorary members were elected: Prof. K. S. Lashley, of Harvard University; Prof. Henri Breuil, professor of prehistory in the Collège de France; Dr. Julian S. Huxley, secretary of the Zoological Society of London; Dr. Aleš Hrdlička, curator of physical anthropology in the U.S. National Museum; Dr. A. C. Haddon, formerly reader in ethnology in the University of Cambridge; Sir Arthur Hill, director of the Royal Botanic Gardens, Kew; Prof. Maurice Caullery, professor of zoology (evolution) at the Sorbonne, and Prof. Octave Duboscq, professor of marine biology at the Sorbonne.

LORD NUFFIELD has given a silver trophy which will be awarded to the town or village collecting the most money, per head of population, for the annual Empire Day appeal for the British Empire Cancer Campaign. In 1931 Lord Nuffield gave £25,000 to the British Empire Cancer Campaign to be invested to provide a research fellowship at the Mount Vernon Hospital.

AT the annual meeting of the Royal Meteorological Society, held on January 20, the following officers were elected: *President*, Dr. F. J. W. Whipple; *Treasurer*, W. M. Witchell; *Secretaries*, H. W. L. Absalom, W. Dunbar and E. L. Hawke; *Foreign Secretary*, J. F. Shipley; *New Members of Council*, Miss Elen E. Austin and R. S. Read.

A PRIZE of £20 with a diploma is awarded annually by the Royal Asiatic Society for an essay on a selected subject. The object of the competition is to encourage interest in the history and civilization of the East among non-Asiatics. Alternative subjects for 1937 are: (*a*) "Tamerlane" and (*b*) "The Relations of the Greeks with the East". Essays must be in the hands of the secretary by October 1. Further information can be obtained from the Secretary, Royal Asiatic Society, 74 Grosvenor Street, London, W.1.

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. 199.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Museums and their Type Specimens

IN NATURE of January 9 (p. 62), reference is made to a paper published by Dr. R. Broom in the *Annals of the Transvaal Museum* (18, 397–413; 1936), in which he complains that four type-specimens in the British Museum have been maltreated while being investigated by Dr. Boonstra; one, a type described by Owen, and the others by himself. Speaking generally of type-specimens, "in some cases," he says, "even the matrix ought not to be removed for sentimental reasons". He would scarcely permit a type "to be broken up in the interest of the morphologist. . . . But any museum which allows type-specimens to be cut in slices or to have parts ground away always seems to me to be guilty of a gross breach of trust". As for the British Museum, "apparently any visitor can cut up types in any way he fancies".

It is unlikely that many readers of NATURE will suppose the Trustees to be so careless of the collections as the last sentence suggests; nor will they be led astray by Dr. Broom's generalizations on the sectioning of type-specimens. But Dr. Broom should remember that the study of many groups of fossils, for example, Palæozoic corals, would be at a standstill, instead of (as indeed it is) going rapidly forward, if type-specimens were not sectioned as a matter of course. It is clear that it is for the responsible officers alone to decide to what extent it is desirable to develop or otherwise treat a type-specimen. Perhaps more surprising is Dr. Broom's attitude to morphology as shown by the remark quoted above. So long as the Natural History Museum is an institution of progressive research, as in fact it is, so long the type-specimen of a fossil species placed there has no value other than a morphological value. Palæontology is based on morphology, and to refrain from removing matrix from a type "for sentimental reasons" is to place a type fossil on a par with a mere personal relic.

Dr. Boonstra came to England in 1933 to study under Prof. D. M. S. Watson. He was then palæontologist to the South African Museum, and even at that time was noted for his experience and skill in developing Karoo reptiles. He could not, therefore, be described as "any visitor". In view of his known skill, and on the understanding that Prof. Watson was supervising his work, Dr. Boonstra was allowed to develop certain specimens, among them being those about which Dr. Broom complains. In Prof. Watson's opinion, Dr. Boonstra's work upon the specimens, far from having damaged them, has enhanced their value.

It may also be added that Dr. Broom has not seen the specimens since they were developed by Dr. Boonstra.

Prof. Watson allows me to quote his comments upon each of the four specimens concerned:

"(1) Owen's type of *Theriognathus microps*. Dr. Broom's claim is in effect that no old type should ever be re-prepared. This is an impossible position, held by no museum of importance in the world. The specimen (No. 47065) in its original state was undeterminable specifically, generically and *ordinally*! It was in fact entirely valueless. We do know now to what group it belongs. Its outer appearance has been very little altered by preparation.

"(2) The type of *Burnetia mirabilis* (R. 5697). This was described and figured by Broom when still covered with a coat of matrix. I began to prepare it, and found that the matrix coat was very irregular in thickness, so that its outer surface bore little relationship to that of the skull, and that the contact between bone and matrix was such that there would be no difficulty in making an accurate preparation. Sufficient flecks of matrix remain attached to the skull to show that Dr. Boonstra's preparation was well done, and that the present form of the skull is genuine.

"(3) The type of *Cerdodon tenuidens* (49420). The specimen is indeterminable. The exposed surface has not been touched at all by preparation. The attempts to cut a median section failed because so little of the skull was visible, and really amounts to no more than the removal of useless matrix. The specimen is completely incapable of preparation, since there is practically nothing but a weathered surface.

"(4) *Ictidosuchoides longiceps* (R. 5744). The information which can be gained from this specimen has been very greatly increased by Dr. Boonstra's preparation. Dr. Broom objects that Dr. Boonstra, by grinding away the edge of the maxilla, has destroyed two small canine teeth and removed all evidence of the shape of the maxillary margin. The technique of grinding faces on fossil skulls which are difficult to prepare was, I believe, first used extensively by Dr. Broom himself on Texan and S. African materials in the American Museum, and is sometimes of use. Dr. Boonstra's use of it on this skull was restrained and reasonable. He ground down into the lingual surface of the maxilla, so that its outer surface remains untouched, the margin being preserved. There is thus in my opinion no justification for Dr. Broom's strictures."

W. D. LANG.
(Keeper of Geology.)

British Museum (Natural History),
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Jan. 14.

Electrical Stimulation of the Human Cochlea

IT has been shown by Jellinek and Scheiber[1], and since confirmed[2,3,4], that stimulation of the human cochlea by audio-frequency alternating currents results in a sensation of tone corresponding in pitch to the frequency of the stimulus. The possibility that the mechanism of excitation is by direct stimulation of the cochlear nerve fibrils has an important bearing upon existing views on audition, in so far as it would provide clear evidence in support of the 'telephone' theory. It has been suggested as an alternative possibility that the electrical currents excite the nerve elements indirectly by setting in motion, in a manner not understood, those cochlear elements which are normally set in motion by physiologically applied sound waves. Such a mechanism of excitation would imply localization of the response according to frequency by resonance, and so would make possible an explanation of the observed phenomena upon the basis of the Helmholtz resonance hypothesis. This 'movement' theory of excitation is strongly supported by experimental evidence which is now described. As stated by Hartridge[5], sudden reversal in the phase of a continuous musical tone results in the human subject in a sensation described as a 'phase change beat'. This, in accordance with the resonance hypothesis, has been correlated with a transient arrest of the basilar fibres due to the opposition of the applied force following the phase reversal to the after swings due to resonance. Further, objective evidence of the occurrence of such an arrest has been provided by a recent study of the auditory tract potentials in the cat[6].

In the light of these findings, it has been considered justifiable to attribute the 'phase change beat' to the intervention of resonant moving parts between the nervous elements and the applied stimulus. The experimental demonstration of the occurrence of a 'phase change beat' in response to an electrical stimulus undergoing periodic phase reversal would therefore clearly be subject to the same explanation and so support the 'movement' theory of excitation. Stimulation of the human ear upon these lines has accordingly been carried out. The electrical output of the phase-reversing photo-electric siren already described[6] was used at a frequency of 1,024 ~ with leads to the external auditory meatus (filled with saline) and to a metal plate on the forearm.

Under these conditions the phase change beat was found to be clearly observable. Further, the beat was heard at an intensity some 8 db. above that of the threshold for perception of the tone itself. This difference was found to approximate closely to that observed when the phase-reversing stimulus was applied to the ear mechanically, namely, by means of a moving-coil loud-speaker. This correspondence is considered to provide further evidence that the mechanism of excitation involved in the normal mode of audition is similarly involved by electrical stimulation. In addition, observations have been made upon the response of the human ear to interruptions of four and ten cycles duration in continuous tones of 1,024 ~. Here also the stimulus was generated by a suitable modification of the photo-electric siren and was applied to the ear electrically and also by means of the moving-coil loud-speaker.

With an interruption of four cycles duration, the beat due to the interruption was observed at an intensity some 18 db. above that of the threshold for the tone itself. With an interruption of ten cycles duration, the difference between the beat and tone thresholds was smaller (10 db.), in accordance, presumably, with a change in ratio of the factors of intensity and duration of interruption which govern perception of the flicker of sound.

In all cases, the differences in threshold for tone and beat observed with the electrical mode of stimulation were found to approximate closely to the corresponding differences found by the mechanical mode represented by the loud-speaker method of stimulation.

This finding must again be considered to provide confirmation of the movement theory of excitation of the human cochlea by audio-frequency electrical stimulation.

C. S. HALLPIKE.
H. HARTRIDGE.

Ferens Institute of Otology,
Middlesex Hospital, W.1,
and Dept. of Physiology,
St. Bartholomew's Medical College,
E.C.1.
Jan. 14.

[1] Jellinek, S., and Scheiber, T., *Wien. Klin. Woch.*, **43**, 417 (1930).
[2] Perwitzschky, R., *Z. Hals, Nasen, und Ohrenheilk.*, **26**, 477 (1930).
[3] Fromm, B., Nylén, O., and Zottermann, Y., *J. Physiol.*, **80**, 3*P* (1933).
[4] Gersuni, G. V., Volokhov, A. A., *J. Physiol. U.S.S.R.*, **17**, 1259 (1934).
[5] Hartridge, H., *Brit. J. Psychol.*, **12**, 142 (1921).
[6] Hallpike, C. S., Hartridge, H., and Rawdon-Smith, A. F., *Proc. Roy. Soc.* (in the press).

Sir Grafton Elliot Smith and Work on Early Man in China

IN looking back over the history of the research on early man in China, it is of interest to realize how precarious was the adventure we entered upon. At the present time, we have five more or less complete skulls, four large skull-fragments, twelve mandibles, and nearly one hundred isolated teeth—indeed an imposing 'sum' of specimens of *Sinanthropus*. However, the impressive point in this history is the fact that the vital generic characteristics of the distinct hominid were deduced from a diagnosis based, not upon this large number of specimens, but upon *one single molar tooth*. This specimen, which heralded a period of great scientific activity, was placed at our disposal in 1927 by the late Dr. Davidson Black.

After this birth of *Sinanthropus*, on account of the dearth of material and the difficulty of drawing conclusions from one isolated tooth, Dr. Black's claims were not everywhere accepted. It was Sir Grafton Elliot Smith who, as an authority in the field of early man, first accepted *Sinanthropus* as a distinct genus of the hominid; and it was Sir Grafton Elliot Smith who gave the needed support and impetus to Dr. Black, which encouraged him to carry on his scientific explorations in China.

The discovery of a skull in 1929 proved that *Sinanthropus* was not a product of Dr. Black's imagination, but that on the contrary he had been quite justified in his classification of a new genus in human palæontology. In November 1930, the Cenozoic Research Laboratory of the National Geological Survey of China invited Sir Grafton to take the long journey to the Far East in order to examine the new specimens and to visit the very site from which they had been taken. Thus it was Sir Grafton who, among all the anthropologists from outside the laboratory, was the first to handle the skull and to discuss it with Dr. Black.

After a painstaking examination of the specimens and a lengthy inspection of the site at Choukoutien, Sir Grafton announced his complete agreement with the geological and palæontological bases upon which the claims for the antiquity of *Sinanthropus* were based. Upon his return to England, Sir Grafton delivered a series of lectures and issued several important publications fully supporting our conclusions concerning the antiquity of *Sinanthropus*. Furthermore, he compared Peking man exclusively with early man from other localities, and stated his belief that the Lower Pleistocene man of China was contemporary with *Eoanthropus* and *Pithecanthropus*.

While it is a source of much gratification to realize that research on early man in China is being actively prosecuted, our joy in these achievements is lessened when we realize that the energetic promoter, the powerful protector, the kindly friend, of all these scientific investigations, Sir Grafton Smith, is gone. One hears frequent mention of the work of the members of the Cenozoic Laboratory—their research, their accomplishments—but it is doubtful whether their undeniably sincere efforts and scholarly achievements would have been so widely known and so quickly accepted but for the backing of such an authority as Sir Grafton. His approval naturally carried the greatest weight with European scientific workers.

After the sudden death of Dr. Davidson Black in May 1934, Sir Grafton grieved, not only for the loss of a friend, but also for the consequent setback to the search for early man in China. We in China suffered even more, because ours was the difficult problem of finding another anthropologist willing and capable of carrying on Dr. Black's half-finished task. It was Sir Grafton who, at the request of the director of the Geological Survey of China, and of the Rockefeller Foundation, recommended Prof. F. Weidenreich to succeed Dr. Black. We deeply appreciate the honour of having so wise and experienced an anthropologist as Prof. Weidenreich to carry on this vital research, but the thought is always foremost with us that it was Sir Grafton who introduced him to us.

In addition to material in his books, Sir Grafton wrote frequent articles concerning the search for man's ancestors in China, which were published in weekly or daily papers. Every fresh discovery made in China would be followed by a review of Sir Grafton's. His enthusiasm in his desire to help us surmounted even the unfortunate state of his health, which prevented him from writing much towards the last.

Very recently, having learned through a letter from me that we had requested the Rockefeller Foundation for a three-year grant, Sir Grafton wrote immediately, stating the importance of the continuation of our research work on early man in China. His appeal, written from the Queen Mary Hospital at Sidcup, appeared in *The Times* about a month before his death, and was undoubtedly influential in securing us continued financial support.

The death of Sir Grafton is indeed a signal loss to the entire scientific world. To us, in China, where the modern sciences are but newly and insufficiently developed, and where our need is great for the interest of authorities in other parts of the world, this new lack will be felt with especial keenness. We have lost, not only an ardent advocator, but also a sympathetic and well-loved friend.

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Jan. 11.

A Condensing Monochromator for X-Rays

IT has long been recognized that some of the halos observed on X-ray photographs of liquids and amorphous substances may be spurious and due to the white radiation peak. Some of the observed reflections obtained from concentrated solutions of tobacco mosaic virus[1] were under suspicion for this

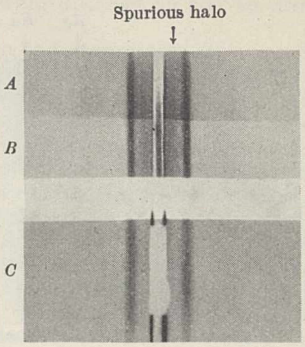

Fig. 1.

TOBACCO MOSAIC VIRUS. ELIMINATION OF SPURIOUS HALO BY USE OF MONOCHROMATIC RADIATION. *A*, UNFILTERED RADIATION, COPPER TARGET. *B*, FILTERED THROUGH 0·0005 IN. NICKEL FOIL. *C*, MONOCHROMATIC RADIATION. SPECIMEN TO FILM DISTANCE, 40 CM.

reason, and the use of a nickel filter did not serve to resolve our doubts. Consequently, it was necessary to attempt to use monochromatic radiation. This was achieved as described below. As shown in Fig. 1, the use of monochromatic radiation decisively establishes the spurious nature of the innermost reflection.

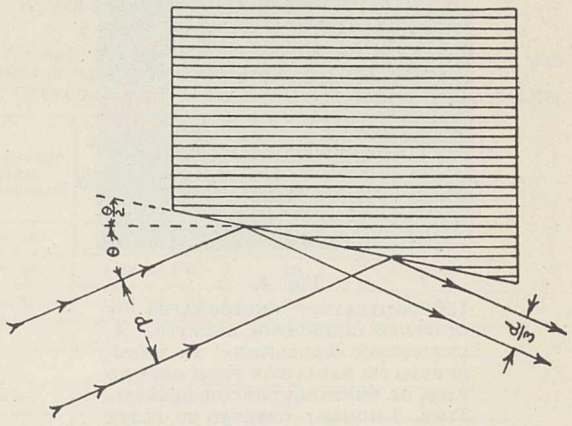

Fig. 2.

CONDENSING EFFECT OF SURFACE GROUND AT AN ANGLE θ/2 WITH BRAGG PLANES.

As the exposure times necessary with the available X-ray sources, using a 0·0005 in. nickel filter, were of the order of 40 hours, it was obviously essential to develop a monochromator which would not increase the exposure time to prohibitive length. Stephen and Barnes[2] had suggested the use of single copper crystals cut at an angle of 40° with the 311 plane.

Such an arrangement, they suggested, would give a concentrated beam of polarized copper $K\alpha$ X-rays. This arrangement, to my knowledge, has not been tried. For the work in question, it was desirable to have a very intense source of comparatively unpolarized radiation. Various crystals were tested as monochromators and both cleavage surfaces and crystals ground as suggested by Stephen

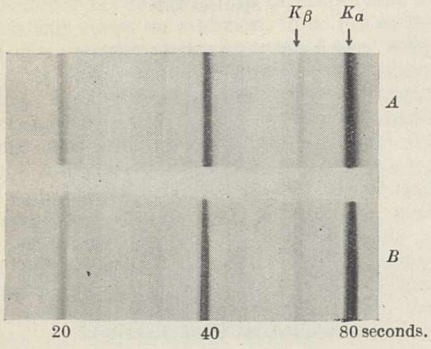

Fig. 3.

EFFECT OF GRINDING FACE OF PENTAERYTHRITOL CRYSTAL AT AN ANGLE OF 5° WITH CLEAVAGE SURFACE. *A*, GROUND SURFACE; *B*, CLEAVAGE SURFACE.

and Barnes were used. For all the crystals tested, the face was ground at an angle $\theta/2$ with the reflecting planes. For small Bragg angles θ, this should give a concentration of 3 : 1 (Fig. 2). It was thought desirable for two reasons to use a moderate concentration in these preliminary experiments, contrary to the suggestion of Stephen and Barnes, first to reduce the absorption of the reflected beam, and secondly because there was no need for a beam finer than the slit used.

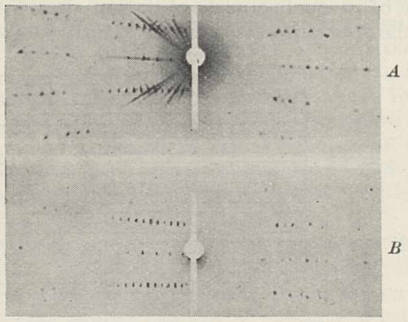

Fig. 4.

15° OSCILLATION PHOTOGRAPHS OF DI-HYDRO LUMISTEROL ACETATE. *A*, UNFILTERED RADIATION; *B*, MONOCHROMATIC RADIATION FROM GROUND FACE OF PENTAERYTHRITOL CRYSTAL. TIME, 3 HOURS; CRYSTAL TO PLATE DISTANCE, 3 CM.

In view of the success of these preliminary experiments, further work is in progress to determine the optimum angle of grinding for pentaerythritol, the crystal finally chosen. This can easily be obtained from aqueous solution in large crystals; it has a perfect *c* face cleavage, and the second order reflection is very intense. The Bragg angle is 10° for copper radiation, so the degree of polarization introduced into the reflected beam is not serious. Fig. 3 shows the concentrating effect of grinding the crystal so that the face makes an angle ($\theta/2$) of 5° with the reflecting planes. These reflections were obtained from a single pentaerythritol crystal, one side of which was a cleavage face and the other side ground as stated above. No slit was used and the crystal to film distance was 120 cm. The concentrating effect of the ground surface is very marked.

The same crystal was then set up as a monochromator using the ground surface, and test exposures made on an analysing crystal, di-hydro lumisterol acetate (Fig. 4, *A* and *B*). In *A* the direct unfiltered beam from a Philips Metallix copper tube was used, in *B* the monochromatic radiation. The same slit system was used, but with the monochromator, the front slit was removed as the monochromatizing crystal itself acts as a slit of very small width. If one takes into consideration the lack of background and the smaller size of the reflections obtained with the monochromatic radiation (with the possibility therefore of using a larger slit), it can be safely said that for equivalent intensity and size of reflection the use of a monochromator as described involves no appreciable increase of exposure time. Considering that these experiments were done very roughly and that optimum conditions were certainly not realized, it is not too optimistic to believe that work with monochromatic radiation can be done with the same ease as, or greater ease than, with heterogeneous radiation.

I. FANKUCHEN.

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Cambridge.
Dec. 30.

[1] Bawden, Pirie, Bernal and Fankuchen, NATURE, **138**, 1051 (Dec. 19, 1936).

[2] Stephen and Barnes, NATURE, **136**, 793 (Nov. 16, 1935); **137**, 532 (March 28, 1936).

Layer-Line and Debye Photographs by means of the Characteristic X-Rays of the Crystal Itself

THE anomalous X-ray reflections from rotating crystals reported by Clark and Duane[1] and first ascribed to characteristic radiation of the crystal itself have since been regarded as due to other phenomena. The *Quellen-Strahlung* of W. Kossel[2] emitted by single-crystal anticathodes and found by G. Borrmann[3] on exciting the crystal with X-rays is not able, however, to account for the layer-line and Debye photographs produced by us[4] using either an X-ray source giving only 'white' radiation or a tube with copper or iron anticathode.

The photograph of a rotating crystal reproduced in Fig. 1 shows interferences among the ordinary reflections due to the copper K_α-radiation, which must be ascribed to the rubidium *K*-radiation of the crystal itself. A series of photographs has also been taken using rotating single crystals of cæsium nitrate and strontium sulphate, powdered rubidium salts and sodium bromide and copper, iron and zinc wires. In the Debye photographs of copper and iron wires using an aluminium anticathode, not only the well-known reflections due to the face-centred (Cu) or body-centred (Fe) cubic lattice were observed, but also reflections corresponding to the simple cubic lattice. Using an ordinary X-ray tube with copper anticathode these 'forbidden' reflections, though faint, could still be observed in the Debye photographs of a copper wire.

The last fact makes it rather probable that the new effect is partly due to the direct interference

of the characteristic radiation emitted by the excited atoms, this radiation thus showing a certain degree of coherence. It is clear, however, that a secondary interference of the primary fluorescence radiation must play a part, since a crystal of ammonium

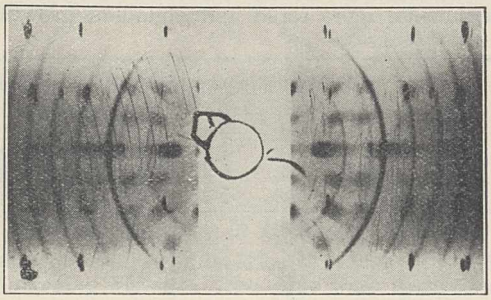

Fig. 1.

nitrate embedded in bromoform and rotating in a beam of 'white' X-rays gave a layer-line photograph of the crystal in question corresponding to the wave-length of bromine *K*-radiation. As to the question of the coherence of the fluorescence radiation, the modern view on the exciting act makes a certain degree of coherence rather plausible.

We shall deal in a more detailed way also with the theoretical side of the effect in a forthcoming communication.

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Institute of Physical Chemistry, O. HASSEL.
University of Oslo.
Dec. 12.

[1] Clark, G. L., and Duane, W., *Proc. Nat. Acad. Sci.*, **9**, 422 (1923).
[2] Kossel, W., Loeck, V., and Voges, H., *Z. Physik*, **94**, 139 (1935)
[3] Borrmann, G., *Naturwissens.*, **23**, 591 (1935).
[4] *Norsk geologisk Tidsskrift*, 16 (1936).

The Existence-Range of the β Hume-Rothery Phases

FROM the data given in Dr. Hansen's recently published elaborate work[1], "Equilibrium Diagrams of Two-Component Alloys", and various other original diagrams, I have tried to find some regularities in the existence-ranges of the β Hume-Rothery phases. The term 'existence-range' indicates that range (expressed by the valency electron concentration) which lies between the maximum and the minimum solid solubilities of the second component in β phases. The accompanying table was obtained. (In this table, the maximum solid solubility in α solid solution and the minimum solid solubility in γ phase are also given.)

The following conclusions can be drawn from this table.

(1) When the atomic size factor is favourable for the formation of electron compounds[2] (Hume-Rothery phases)—according to Hume-Rothery, the size factor is favourable, as long as the difference of the atomic diameters of two components is kept within 15 per cent—the existence-range of the β Hume-Rothery phases are, approximately, 1·37~1·57 for zinc alloys, 1·42~1·58 for cadmium alloys, and 1·38~1·62 for aluminium alloys, respectively. It is a very interesting fact that the existence-ranges are approximately constant, where the second component is the same. For example, in copper-zinc, silver-zinc and gold-zinc systems, the ranges show approximately constant values, namely, 1·37~1·57.

(2) When other factors[2] (such as size factor, negative valency effect, etc.) are favourable, the maximum solid solubility of the second component in α solid solution is a little greater than the minimum solid solubility of the same component in β phase, as can be seen in the systems copper-zinc, silver-cadmium, copper-aluminium, and silver-aluminium. Hence the existence-ranges of α- and β-phases overlap by a few atomic per cent (in most cases 1 per cent). For example, in the copper-zinc system, the maximum solid solubility of zinc in α solid solution and the minimum solid solubility of zinc in β phase are 38 and 37 per cent, respectively.

A similar relation is likely to be found in the existence-range boundaries of β and γ phases, although with less accuracy.

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Institute of Metallography,
College of Science,
Kyoto Imperial University,
Japan. Nov. 7.

[1] Hansen, M., "Der Aufbau der Zweistofflegierungen" (1936); published in Japanese by the Zairyoh-kenkyuhkai (1936).
[2] Hume-Rothery, W., "The Structure of Metals and Alloys" (1936).

System	Difference of atomic diameter (per cent)	Maximum solid solubility in α-phase (atomic per cent)	Maximum solid solubility in α-phase (valency electron concentration)	Existence-range of β-phase (atomic per cent)	Existence-range of β-phase (valency electron concentration)	Minimum solid solubility in γ-phase (atomic per cent)	Minimum solid solubility in γ-phase (valency electron concentration)
Cu–Zn	+ 7·7	38	1·38	37 ~ 56	1·37 ~ 1·56	57	1·57
Ag–Zn	− 4·7	38	1·38	38 ~ 57	1·38 ~ 1·57	60	1·60
Au–Zn	− 4·5	31	1·31	36 ~ 57	1·36 ~ 1·57	64	1·64
Cu–Cd	Size factor is not favourable.						
Ag–Cd	+ 5·5	43	1·43	42 ~ 57	1·42 ~ 1·57	57	1·57
Au–Cd	+ 5·7	36	1·36	43 ~ 58	1·43 ~ 1·58	61	1·61
Cu–Al	+ 10·9	20	1·40	19 ~ 31·5	1·38 ~ 1·63	31·5	1·63
Ag–Al	− 1·8	20·6	1·41	19·7 ~ 31	1·39 ~ 1·62	—	—
Au–Al	Existence of β Hume-Rothery phase is doubtful.						

Remarks on the table.

1. As the numerical values of the atomic diameters, those[2] given by Hume-Rothery are used.
2. All the numerical values of the atomic percentage indicated are those of the second component in each system.
3. "Valency electron concentration" means the ratio "valency electrons : atoms".
4. The negative sign of the difference of the atomic diameters means that the atomic size of the second component is less than that of the first component, and the positive sign means that the former is greater.

Assimilation of Different Organic Substances by Saprophytic Flagellatæ

THE ordinary sewage flagellate, *Polytoma uvella*, which contains no chlorophyll, is, as I showed in 1920[1], an acetate organism. It builds up its body and the starch abundantly deposited in it from fatty acids, while it cannot utilize sugars. Since *Polytoma* lives in decaying protein solutions, I concluded that amino acids must be hydrated under desamination to supply to the *Polytoma* its specific food. In the meantime, it was shown that fatty acids, and especially acidic acid, are very important for the nutrition of micro-organisms. I have investigated a number of organisms with life conditions more or less similar to those of *Polytoma*—pigment-free forms from groups nearly related to those assimilating carbon dioxide[2]. I found that in all cases acetate is the food-substance preferred. These micro-organisms belong to three series of flagellatæ, rather removed from each other systematically, namely, Phytomonades, Cryptomonades and Euglenomonades (see table). The first two deposit starch, the last one the similar polysaccharide 'paramylum'.

	PHYTOMONADES						CRYPTOMONADES			EUGLENOMONADES		
	Polytoma uvella	*Polytoma ocellatum* (1)	*Polytoma ocellatum* (2)	*Polytomella cæca*	*Chlorogonium euchlorum*	*Hyalogonium Klebsii*	*Chilomonas oblonga* (1)	*Chilomonas oblonga* (2)	*Chilomonas paramecium*	*Euglena gracilis*	*Astasia quartan*	*Astasia (Chattonii) longa*
Acidic acid	+	+	+	+	+	+	+	+	+	+	+	+
Propionic acid	−	−	+	+	−	−	+	−	−	+	+	+
n-Butyric acid	+	+	−	+	−	−	+	−	−	+	+	+
n-Valerianic acid	−	+	−	+	−	−	+	−	−	+	−	−
n-Capronic acid	−	−	−	−	−	−	−	−	−	+	−	−
i-Butyric acid	−	+	+	+	−	−	+	−	−	−	−	+
Ethyl acetate	+	+	+	+	+	+	+	+	+	+	+	+
Ethylal	−	−	−	+	−	−	−	+	+	+	−	+
Malic acid	−	+	−	−	−	−	−	−	−	+	−	+
Lactic acid	+	+	−	+	−	−	−	−	+	−	−	−
Pyruvic acid	−	−	−	−	−	−	+	−	−	−	−	−
Succinic acid	+	+	−	+	+	+	+	+	−	+	+	+
Glycerine aldehyde	−	−	−	−	−	−	−	+	−	−	−	+
Dioxyacetone	−	+	+	+	−	−	+	−	+	−	−	−

Up to date, I have results for twelve forms, to which *Peptone de viande Vaillant* in the presence of about twenty different organic substances was offered in solution. With peptone alone as well as with formic, oxalic and lævulinic acid, with glycol, glycolic acid, glycerine, pentoses and hexoses in case of small inoculation only a very small or no development at all was observed. With the other substances, the micro-organisms behaved in very different ways. Only acetate was favourable in all cases, and so too ethyl acetate. The homologues of acetic acid are not so generally accepted: the longer the carbon-chain the more rarely the fatty acids are assimilated.

Special importance is attached, therefore, to newer results with succinic acid. The trioses are, contrary to the hexoses, assimilated by some species, and also such substances as ethylal, malic, lactic and pyruvic acids, but not so often as succinic acid. In a similar way to that in which acetic acid is formed from glycine, succinic acid is formed from asparaginic acid in the putrification of proteins by reduction and splitting off of ammonia. Also, the dehydration of acetic acid with condensation of two molecules may be considered as a source for succinic acid. This appears to me important to the conditions of life in the natural environment of the pigment-free flagellatæ. Here, succinic acid may be formed in putrifying mud, rise into the oxygen-containing water layer and there be used by the flagellates. Probably this acid plays, in general, a more important role in nutrition than at present known.

Especially strong was the growth of a *Chilomonas* species with succinic acid salts, here even as great as with acetate. In the course of many nutrition experiments, more rapid and abundant growth has not been observed. Succinic acid may consequently be regarded as the specific nutrient for this organism, from which it builds up its body and forms a considerable quantity of starch in pure cultures.

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Dec. 16.

[1] *Ber. deutsche botan. Ges.*, **38**, (8) (1920); *Beitr. allgem. Botanik*, **2**, 88 (1921).
[2] *Naturwiss.*, **23**, 110 (1935).

Adrenal Degeneration in a Pure Strain of Mice subject to Mammary Cancer

WE have observed as a regular occurrence spontaneous degenerative changes in the adrenals of both males and females of a genetically pure strain of mice. The strain is the *R* III strain obtained by Mme. Dobrovolskaia-Zawadskaia of the Institut du Radium in Paris as the result of brother and sister mating and maintained in our laboratory in this way for the last three years. The degenerative changes in the adrenals are progressive, and when fully developed at the age of about one year are massive and involve both cortex and medulla. The degenerative changes are of a specific kind and have never been seen by us to occur spontaneously in the adrenals of mice of mixed strains up to one year of age, of which we have examined more than a thousand.

The following considerations add to the interest which these findings may have from the point of view of genetics: (1) The genetically pure strain *R* III in which these degenerative changes occur has a high incidence of spontaneous mammary cancer in the females. (2) In the males of this strain, which never develop mammary cancer spontaneously, a high incidence of mammary cancer can be induced by the continued administration of œstrin. (3) The degenerative changes in the adrenals, which set in spontaneously in the mice of the *R* III strain, are

identical with the degenerative changes in the adrenals which we have recorded[1] as developing regularly in male and female mice of mixed strains after the continued application of œstrin.

A detailed account of these observations will be published soon.

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[1] *The Lancet*, i, 247 (1936).

Wing Abnormality in *Locustana pardalina*

I ENCLOSE photographs (Fig. 1) of two locusts with the following history: The eggs were hatched and the young reared inside, in glass, so that the only sunlight that could reach them was screened through two layers of glass; other conditions were identical with such as produced perfectly normal flyers. They remind one strongly of similarly localized (and similarly produced ?) abnormalities in *Drosophila*, and we may legitimately assume that the abnormality will be hereditary.

Most of the young were used for experimental purposes, but eleven remained over by the time that they were ready to undergo the final moult. Of these, three died immediately after the moult, the wings remaining small and crinkled. Four survived the moult but with wings as in the photographs, and four were apparently perfectly normal.

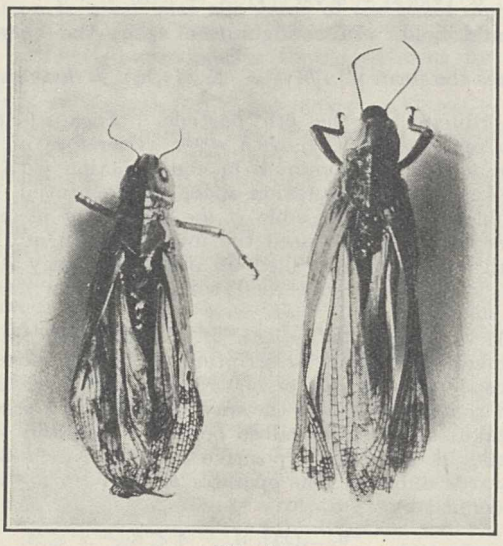

Fig. 1.

LOCUST WITH ABNORMAL WINGS. THE LEGS OF BOTH SPECIMENS WERE BROKEN OFF AFTER DEATH.

About a fortnight after the moult, the eight locusts were sprayed with a suspension of a *Micrococcus* sp. in the form of a fine mist: all four abnormal locusts died (the first two, the last nineteen days after infection); the four normal ones are still alive. The course of infection is the same in all—the fæcal pellets, 24 hours after infection, were in the mornings red, jelly-like and swarming with *Micrococcus*; after feeding, the pellets become more or less normal with only a light infection. The live ones are still (nearly a month after infection) passing such pellets. In those that died, the rectal matter suddenly became a very acid, brown, slimy liquid with a massive *Micrococcus* infection.

The abnormal wing character is thus associated with a loss of constitutional vigour, the latter being revealed by non-survival of the last moult and by decreased resistance to bacterial attack. This is, of course, no new phenomenon; idiocy in man is almost constantly associated with small bodily size, a short expectation of life and an increased susceptibility to disease.

Cases such as these add force to the objections that have been raised against the mechanistic preformationalism of modern genetics; they indicate in no uncertain way that the injuries concerned are of a constitutional character—injuries of the organism as a whole—which may be expressed as definitely localized abnormalities, perhaps particularly in the latest ontogenetic developments; they seem to indicate that genetics deals not with primary and independent but with secondary phenomena, dependent on, or modifying, 'holistic' changes.

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Dec. 8.

McCormick and the Reaping Machine

IN NATURE of December 26, p. 1088, a note appears referring to twelve notable American inventions. Among these is included a practical reaping machine by Cyrus McCormick. Cyrus McCormick was not the inventor of the first practical reaping machine. No doubt the American firms concerned with the manufacture of reaping machines have loudly and persistently claimed McCormick as the inventor of the reaping machine, and some British writers, who should have known better, have accepted this claim, but it has been repeatedly disproved that McCormick has any claim to be considered the maker of the first practical reaping machine.

Early in the nineteenth century there were many attempts to make reaping machines, and some of these attempts attracted considerable attention. The first really practical machine which was able to cut a harvest and continue to do so year after year was made by the Rev. Patrick Bell, in 1828, when he was a divinity student at the University of St. Andrews. A full account of this machine was published in 1828 in the *Quarterly Journal of Agriculture*. The original machine, which Bell made with his own hands with the assistance of the local blacksmith, is now in the Science Museum at South Kensington. This machine was used on the farm of Bell's father and afterwards on the farm of his brother for many years.

The earliest year in which it is claimed that McCormick produced a reaper is 1831, but no proof can be produced to show that he made any machines until several years later. By that time several of Bell's machines had found their way to America.

It is claimed on behalf of McCormick that Bell never patented anything whereas McCormick took out his first patents in 1834, and further patents in 1845 and 1847. Bell's reasons for not patenting anything have been given to us by himself and were of the highest and most honourable kind. He considered it to be his duty to present his invention freely to the agricultural public and not to add to its cost by any royalties or profits accruing to himself. He tells us

that "The late Lord Panmure, knowing the low state of my finances, offered to be at the expenses of the patent if I would accept one. For the reasons above stated, I declined his lordship's offer". In later life, Bell admitted that it was probably a mistake that he did not patent his invention. As he gave it freely to the public, many imitations were turned out. He himself says, "Had I patented the machine at the time, all this bungling in machine-making would have been avoided; and the issue perhaps proves that, for the public benefit even, this was the prudent course to have been adopted".

Bell's machine embodied all the main features of the modern reaping machine though in a somewhat crude form. All these features were also included in the earliest known machines which could be ascribed to McCormick, but before McCormick's machines were made several of Bell's machines were already in America. McCormick's patents were disputed in his own country and prolonged law suits took place with regard to them.

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Gesture Language

A PARAGRAPH in the Research Items in NATURE of December 5, entitled "Origins of Speech and the Orang-Utan", refers to Dr. Cornelius J. Connolly's important studies of the brains of various primates. The note stated that it is believed by neurologists that the associative process, with the power of making articulate sounds, constitute the essential elements in human speech, and that the association between sound and objects makes symbolism possible.

May I point out that human power of symbolism is not primarily dependent on association between *sound* and objects, but rather on the ability (which apparently is peculiar to man) of analysing events—whether sensed or imagined—and expressing the separated elements by a series of separate bodily gestures.

The association between sound and objects (except in the comparatively rare onomatopœic symbolism of objects or events which are naturally associated with a characteristic and imitatable sound) came later; it probably arose—as I have previously pointed out—from the natural sympathy of movement between man's hands and his mouth which Charles Darwin described in "The Expression of the Emotions".

It is not generally known that the natural pantomime of uneducated deaf mutes, by which the born deaf of all nations can communicate with one another, is not built up of separate signs equivalent to words. It does not analyse events into separate parts equivalent to parts of speech; it cannot define. It would appear that man's advance was primarily due to his development of this power of symbolism —which made new syntheses possible.

The original pantomimic expression of primitive man was doubtless accompanied by an emotional gabble—due to the Darwinian association of hand and mouth, and to the corresponding association of facial gesture and muscular movements of the larynx and pharynx which was assumed by E. B. Tylor[1] and which I have personally observed.

This 'gabble' can scarcely have been understandable by ear, for if the hand gestures were not standardized, the associated sounds could have no constant meaning. It was only when man had learnt to use a particular gesture to symbolize a definite object, action, quality, etc., that true speech began.

The chimpanzee fails in two respects: he cannot apparently symbolize, and his tongue does not move in sympathy with his hands. Thus, Madame Kohts[2] points out that whereas the young child feels with his hands and his tongue, the young chimpanzee feels with his hands and his lips.

In attempting to locate the areas of the brain responsible for the development of speech, the physical anthropologist should, I suggest, study especially those areas which control bodily gesture on one hand, and those which give the power of analysis on the other.

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[1] E. B. Tylor, "Primitive Culture", vol. 1, chap. v.
[2] "Infant Ape and Human Child", Darwinianum, Moscow, 1935.

Neutrino Theory of Light

PROF. V. FOCK[1] has pointed out an apparent inconsistency in the neutrino theory of light. He shows that the operator of Jordan

$$\sqrt{|\nu|}\,b(\nu) = \sum_{\alpha=-\infty}^{\alpha=+\infty} \gamma^{+}(\alpha)\gamma(\alpha+\nu) \qquad (1)$$

commutes with his adjoint operator $b^{+}(\nu) = b(-\nu)$, while according to Jordan the relation

$$b^{+}(\nu)b(\nu) - b(\nu)b^{+}(\nu) = -1 \text{ for } \nu > 0 \qquad (2)$$

should hold. In configuration space the operator takes the form $\sqrt{|\nu|}\,b(\nu) = \sum_{k=1}^{k=n} b(\nu,x_k)$. k denotes the co-ordinate of the kth particle. Fock identifies the operators $b(\nu,x^k)$ with $e^{i\nu x^k}$. Therefore all the $b(\nu)$ and $b^{+}(\nu)$ commute in contradiction with (2). However, a configuration space representation of a problem is only possible *if the number of neutrinos n is finite*. As we need the interpretation of Dirac with respect to the filled up negative energy states ($\alpha < 0$), we are concerned with an *infinite number of particles*.

If we assume *the number of possible states finite*, a configuration space description of $b(\nu)$ is possible, because the number of neutrinos is *a fortiori* finite. Let therefore $u_\alpha(x)$ be the wave function of a state α. α takes all integral values between $-A$ and $+A$, where A is a finite positive integer, which tends towards infinity. The operator $b(\nu,x_k) = b^{+}(-\nu,x_k)$ is defined by

$$b(\nu,x_k)u_\alpha(x_k) = \begin{cases} u_{\alpha-\nu}(x_k), \text{ if } -A \leqslant \alpha-\nu \leqslant A \\ 0 \text{ , for all other values of } \alpha-\nu \end{cases} \qquad (3)$$

Let

$$\psi(\alpha_1, \ldots \alpha_k \ldots) = \sum_P \delta(P)u_{\alpha_1}(x_1)u_{\alpha_2}(x_2)\ldots u_{\alpha_k}(x_k)\ldots u_{\alpha_n}(x_n),$$

with $\delta(P) = \pm 1$ an antisymmetric wave function. The sum is to be extended over all permutations P. An easy calculation leads to the identity

$$\nu\{b^{+}(\nu)b(\nu) - b(\nu)b^{+}(\nu)\}\psi = \psi\left\{\sum_{\alpha=A-(\nu-1)}^{\alpha=A} N_\alpha - \sum_{\alpha=-A}^{\alpha=(\nu-1)-A} N_\alpha\right\} \text{ for } \nu > 0 \qquad (4)$$

$N_\alpha = 1$ or 0 according to whether the particular α occurs or does not occur in $\psi(\alpha_1 \ldots \alpha_n)$. If the number

of states tends to infinity and the total energy of the system remains finite, the Dirac interpretation demands that all states whose energy is smaller than a finite negative energy $-B$ are occupied ($N_\alpha = 1$ for $\alpha < -B$), while all states of positive energy above a certain positive energy B are empty ($N_\alpha = 0$ for $\alpha > B$). If ν is a finite positive integer, and if A tends to ∞, the first sum in the right hand term disappears and the second one equals ν, which is the desired result (2).

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[1] Fock, V., NATURE, **138**, 1011 (1936); *C.R. Acad. Sci.*, **4**, 229 (1936).

Nigeria and the Sahara

SOME passing remarks in the article entitled "Soil Drift in South Australia" in NATURE of December 19 (p. 1039) may give the casual reader the erroneous impression that the northern part of British Nigeria is threatened by the "encroaching desert". A glance at any adequate map of Africa will show that the northern frontier of Nigeria runs through the western Sudan and that the Sahara lies well to the north in French West Africa. The geological evidence is clear, as I pointed out twenty-five years ago[1], that the desert pulsates, that its margins expand and contract, and that the most recent movement has been one of contraction with the consequent spread of more humid conditions over the country between Lake Chad and the River Niger. There is no evidence that existing climatic conditions are deteriorating.

There may be room for some adjustment of stocking policy, but comparison with the Dominions is to be deplored. It should be remembered that in Nigeria the Africans themselves are the stock farmers, following ancient methods in unfenced communal pastures. They are happy and contented, and problems arise only when the industry is unduly stimulated by ambitious administrators or ardent tax collectors.

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Dec. 21.

[1] "The Geology and Geography of Northern Nigeria" (Macmillan, 1911).

Points from Foregoing Letters

REFERRING to criticisms by Dr. Broom, the Keeper of Geology in the British Museum (Natural History) defends the removal of matrix and the sectioning of type-specimens in museums, in the interests of morphological research. He quotes Prof. D. M. S. Watson to show that the value of the fossil reptiles referred to by Dr. Broom were in no way impaired, but rather enhanced, after their treatment by Dr. Boonstra.

New experiments on sound 'beats' produced in the inner ear (by means of electrical stimuli, undergoing periodic phase reversal) are considered by C. S. Hallpike and Prof. H. Hartridge to supply additional evidence in support of the Helmholtz hypothesis, which postulates indirect excitation of the nerve elements by a resonance mechanism.

Preliminary results obtained by means of a new technique in utilizing monochromatic X-rays in crystal analysis are described by Dr. I. Fankuchen, and photographs are submitted indicating the spurious nature of the innermost halo observed in ordinary spectrograms of tobacco virus. Crystals of pentaerythritol ground at a suitable angle were found convenient for the purpose of increasing the concentration of the monochromatic X-rays.

An X-ray photograph of a rotating crystal, showing interference phenomena, is submitted by Chr. Finbak and Prof. O. Hassel. The authors consider that the effect is partly due to direct interference of the characteristic radiation emitted by the excited atom, and that a secondary interference of the primary fluorescence radiation also plays a part in the phenomenon.

A table showing the concentration ranges in which 'electron compounds' ('Hume-Rothery' phases) are formed in binary alloys of various metals (zinc, copper, silver, gold, cadmium, aluminium) is supplied by M. Hara. The existence ranges and also the solubility in the α and γ solid phases are considered by the author in relation to the difference in the atomic diameters of the components.

Various non-pigmented one-celled organisms (flagellates) have been grown by Prof. E. G. Pringsheim in peptone medium to which various organic substances (fatty acids, esters, etc.) were added. All organisms investigated thrived on acetic acid and on ethyl acetate but differed in their ability to assimilate other compounds. Succinic acid was also used by a large proportion of the organisms, and malic, lactic and pyruvic acids to a lesser extent.

A pure strain of mice in which degenerative changes in the adrenal glands develop spontaneously before the animals are one year old have been found by Dr. W. Cramer and E. S. Horning to be likewise very susceptible to cancer. The females have a higher rate of spontaneous mammary cancer, and in the males mammary cancer can be induced by administration of the sex hormone, œstrin.

Photographs of two locusts with abnormal wings, reared under glass in conditions which usually produce normal flyers, are submitted by Prof. T. F. Dreyer. The abnormal individuals also show lower resistance to micrococcus infection, indicating that wing abnormality is associated with changes in the organism as a whole. This, the author claims, supports the 'holistic' view of genetics.

Referring to the early history of the reaping machine, Prof. James Hendrick states that the Rev. Patrick Bell of St. Andrews built a practical reaping machine in 1828, several years before McCormick took out his patents in the United States.

Sir Richard Paget writes that the symbolism of human speech is not primarily dependent on association between sound and objects, but arose after man had succeeded in analysing events and expressing the various components by separate bodily gestures.

Referring to recent criticism by Prof. V. Fock of the neutrino theory of light, Prof. E. G. C. Stueckelberg states that, while a configuration space representation of operators is impossible, if the number of particles concerned is infinite, there exists a configuration space method for a finite number of particles, which leads in the limit to Prof. Jordan's result.

Research Items

Submerged Archæological Sites on the Essex Coast

A SUB-COMMITTEE of the Fenland Research Committee, of which Mr. S. H. Warren has acted as chairman, has been engaged on the investigation of the submerged land-surface of the Essex coast and has presented a report (*Proc. Prehistoric Soc.*, 2, 1) dealing with the character of the land-surface, the archæological sites, pollen analysis, pottery, and flint implements, and discussing the relation of this area to the East Anglian fenland, where broadly the same sequence of events—a period of land elevation followed by one of subsidence—has been established. The main archæological sites, three in number, are situated at Lion Point, Clacton (now Jaywick Sands), Mill Bay, Dovercourt, and Stone Point, Walton-on-Naze. They consist of surface settlements, or camp sites, pit dwellings, cooking holes and hearth sites. The old land surface can be seen at various levels below high-tide, and extends below the lowest level of spring-tides. It belongs, therefore, to a period of relative land elevation. The earliest trace of human habitation belongs to the Mesolithic III culture. Windmill Hill pottery, leaf arrow-heads and flint and stone celts, belong to a Neolithic *A* people, who settled on this surface and were responsible for cooking-holes, pit-dwellings and hearths. They were followed by a Neolithic *B* people ; but judging from the relative scarcity of their pottery, they were in small numbers. The latest dateable material from the old land surface consists of a few beaker *B* sherds ; but no *A* beakers and no Bronze Age cord-impressed ware has been recorded. The human occupation of the land-surface seems to have come to an end with the onset of salt-marsh conditions. Over a peat bed, rich in pollen of Chenopodiaceæ, a layer of *Scrobicularia* clay indicates submergence. At Lion Point, Clacton, quantities of grooved ware, showing affinities with two types of Dutch megalithic ware, were found, and are now recognized for the first time to occur over extensive areas in south-eastern Britain.

Effect of Tissue Extracts on Tumour Growth

DR. J. B. MURPHY, of the Rockefeller Institute for Medical Research, summarizes his results on the inhibition of malignant growths by extracts from normal tissue in a paper in the "Reports of the Second International Congress of the Campaign against Cancer" (Brussels, 1936). Extracts of placenta, embryo skin and prelactating mammary gland inhibit the growth of transplanted mouse cancer when the graft is treated with the extract. The prelactating mammary gland, which appears to be the best source of the inhibiting agent, also contains a stimulating factor which is ether-soluble, while the inhibiting agent is water-soluble. In another paper in the same volume, Prof. T. Maisin and Dr. Y. Pourbaix describe the effects of feeding different animal organs on the growth of tumours induced in mice with benzpyrene. These organs contained both activating and inhibiting factors in different proportions. Whole liver had an activating action while whole brain was inhibitory. These factors, however, are probably different from those of Dr. Murphy, as the inhibiting factor was ether-soluble and the stimulating factor was water-soluble. The work described in the two papers indicates how complex is the control of tissue growth in both normal and malignant tissues in the living animal.

An Interesting Larval Bivalve

THE embryonic and larval stages of a Japanese species of *Sphærium* have been described by Dr. Katsuhiro Okada ("Some Notes on *Sphærium japonicum biwaense* Mori, a Freshwater Bivalve. (4) Gastrula and Fetal Larva". *Sci. Rep. Tôhoku Imp. Univ.*, Fourth Series (Biology), Sendai, Japan, 11, No. 1 ; 1936). There is no free-swimming stage, the whole of the embryonic and larval period being passed in the marsupial sac of the mother. The new term 'fetal larva' is given to the larval stage after the complete closure of the blastopore up to the formation of the rudimentary shell. This is quite different from a 'veliger', for the larva continues to develop until the small but adult form is reached without any sign of metamorphosis. This 'fetal larva' is, however, regarded by the author as a vestigial veliger. Most lamellibranchs develop as free-swimming veligers and pass through the larval stage with a simple velum and bivalve shell ; but there are several instances of the veliger stage being suppressed, especially in freshwater forms with viviparous habit. Compared with other lamellibranchs, the present species indicates signs of secondary direct development in which the metamorphosis is indistinct, merely the earlier development of the foot and the vestigial signs of the head region having been shown.

New Varieties of Potato

AN important application of Vavilov's geographical method in the study of economic crops has recently been made by Russian plant breeders with regard to the potato. The results of their work have been published mainly in Russian, and the bulletin issued by the Imperial Bureau of Plant Genetics (School of Agriculture, Cambridge, price 3*s.* 6*d.*), on "The South American Potatoes and their Breeding Value" can be considered as the first comprehensive account in English of one of the most remarkable discoveries in plant breeding. It describes the material collected on expeditions made to South and Central America, the original home of the potato, where more than twelve cultivated, and thirty wild species were found in place of the single cultivated species previously known. The properties exhibited by these forms have already provided a great stimulus to potato-breeding and, among other developments, should result in the crop being grown over a much wider geographical range than has been possible up to the present, for at least one species has been found which forms tubers under sub-tropical conditions, while others occur that can withstand frost. Disease resistance, short dormancy and high protein content are further valuable properties exhibited by these newly discovered forms, that will provide the breeder with new and valuable possibilities.

Sand Devils

THERE is not much detailed information in books on climatology or meteorology about the small pillar-like whirlwinds known as sand devils. It is common knowledge that they develop in deserts when the sun is strongly heating the ground, that is to say, especially in the summer, and then most often during the hottest hours of the day. Observers at the chain of meteorological stations of the Air Ministry that extends from Egypt to Iraq and the Sudan have had them under observation, however, since 1927, and a note entitled "Sand Devils", by W. D. Flower (Professional Note No. 71 of the Meteorological Office, Air Ministry), tells us what they saw and ends with a theory of their structure and formation that takes into account the instability of the lower atmosphere under intense solar radiation. The observed facts are briefly as follows: No marked preference for either clockwise or counter clockwise rotation was found. The way that they favoured the hottest part of the day was very marked, although observers are not prone to be abroad at that time and tend to miss many of those that develop then. Some observations of the linear speed of rotation at the outer edge were made and showed a range from 10 to 40 miles per hour. In size they varied from less than 5 feet to more than 2,000 feet in height, and from less than 5 feet to more than 200 feet in diameter. One might instance a diameter of 30 feet and a height of 200 feet as being the size of a typical sand devil, and less than one minute as its duration, although several lasted for ten or fifteen minutes. A super-adiabatic lapse-rate in the lower atmosphere appears to be usually, if not invariably, present. The sand devil of necessity travels with the general wind in its neighbourhood and demonstrates the normal increase of wind with height by leaning forwards in the direction towards which the wind is blowing.

Centimetre Radio Waves

A NOTE in the *Physical Review* of December 1 (**50**, 1091) by Messrs. C. E. Cleeton and N. H. Williams, of the University of Michigan, describes an investigation undertaken to determine the practical short-wave limit for electrical oscillations produced by valves. Three valves of the split-anode magnetron type were designed to operate at wave-lengths less than 2 cm. The smallest of these was provided with an anode of 0·038 cm. diameter, while the outside diameter of the glass envelope was 0·45 cm. At an anode voltage of 1,200 and with a magnetic field strength of 24,000 oersteds, oscillations were obtained at a wave-length of 0·64 cm., as measured with an echellette grating spectrometer previously described by the authors (*Phys. Rev.*, **45**, 234–237; 1934). The resulting radiation was detected with a crystal detector placed at the focus of a receiving mirror at a distance of 15 metres from the valve. The other two valves produced oscillations of wave-lengths 1·2 cm. and 1·9 cm. at lower intensities of magnetic field. It is concluded that continuous electric waves may be produced at wave-lengths less than 1 cm., the waves being of sufficient intensity for many research purposes. According to a note recently received from Science Service, these minute radio waves are being used for the study of the molecular structure of gases, including water vapour. While such substances as black paper, ebonite and wood are transparent to the waves, it appears that their absorption by the water vapour in the atmosphere is such as to render their application to radio communication somewhat difficult.

Lightning and Overhead Transmission Lines

AT a meeting of the Institution of Electrical Engineers on January 7, a paper on "Lightning" was read by Mr. B. L. Goodlet. The first part of this paper dealt with lightning as a physical phenomenon and reviewed present knowledge and hypotheses on the formation of thunderclouds and the mechanism of the lightning flash. It was pointed out that a complete flash usually consists of a sequence of double strokes separated by time intervals of the order of one hundredth of a second. These double strokes comprise a preliminary or 'leader' from cloud to ground followed by a powerful 'return' stroke from ground to cloud. The distribution of flashes to earth under a storm centre is influenced by the distribution of space charge above the ground and by discontinuities of conductivity in the ground itself. The second part of the paper dealt with the theory of the effects of lightning strokes on overhead transmission lines. It is concluded that direct strokes to overhead conductors are certain to cause flash-over; but interruption of the supply may be minimized either by fitting devices, such as special choke coils or protective gaps, or by the installation of overhead earth wires, which will prevent any strokes falling on the line conductors. Emphasis was laid in the paper on the fact that in order to protect an insulated line from flash-over, when either a tower or the earth wire is struck it is necessary to ensure that the effective resistance of the earth connexion of the tower is reduced to a low value. For example, it is deduced that no flash-over will occur on a line insulated with chains of nine standard cap-and-pin units, if the tower footing resistances are less than 10 ohms. It may not, however, always be possible to secure a sufficiently low value of this resistance to avoid flash-over.

Observation of Orionids, Leonids and Geminids in 1936

KÔZIRÔ KOMAKI, of Kanaya, Aritagun, Wakayama-ken, Japan, has sent the results of his observations of these three showers. The Orionids were very numerous, and he states that he has not observed such a rich display for ten years. On the night of October 21 the rate was more than 33 an hour—a very high rate for this shower. The eastward shift in the radiant from night to night was very obvious. Thus on October $20{\cdot}72^{d}$ U.T. the position of the radiant was $93{\cdot}5°+13°$, and on October $27{\cdot}77^{d}$ it was $99{\cdot}5°+6{\cdot}5°$. A number of other observers in different parts of Japan obtained results similar to those of Mr. Komaki. Mr. K. Yasii at Takehara attempted to photograph meteors during the period of the Orionids, and succeeded in obtaining 10, of which 4 were Orionids. On November 12–16 watch was kept for the Leonids, but the apparition was very poor, only 5 being observed hourly on November 17, when the maximum was attained. Several Andromedids were observed on November 21 by Mr. Sanekata, but nothing is said about the radiant. The Geminids were seen on December 10–16, the maximum being attained on December 13–14, when the frequency was about 40 hourly. This is similar to the rate in previous years. The radiant showed the eastward movement usually observed with this shower. On December $12{\cdot}76^{d}$ U.T. it was at $113°+32{\cdot}5°$ and on December $15{\cdot}65^{d}$ at $115°+32{\cdot}5°$.

American Association for the Advancement of Science

ATLANTIC CITY MEETING

THE ninety-ninth meeting of the Association was held in Atlantic City, N.J., on December 28–January 2, where one meeting had been held previously, namely, in 1932. This was to many of the members a strange setting for a great scientific assembly with the wide board-walk winding along close by the breakers of the Atlantic, and lined on the other side by shops in endless variety over which tower the great hotels, the comforts and service of which have made Atlantic City famous. One found no great university buildings, no richly stored museums, no famous research laboratories such as usually shelter the sessions and stimulate the activities of Association meetings. But all pronounced the meeting a success; the weather was mild, the sea beautiful, the attendance good, and the facilities adequate to serve well all needs of the occasion.

The splendid Municipal Auditorium, with numerous audience rooms of varied capacity, and the well-planned meeting-places in the big hotels brought closer together than ever before the sessions of the fifteen sections and some forty associated societies and conferences included in the programme. Time spent in reaching distant meetings was saved, conferences were easily arranged, and personal contacts more frequent. Important as are the formal papers, one must rate of even higher value the discussions between and after meetings when new ideas are subjected to the keenest criticism. All conditions at Atlantic City contributed to further interchange of views and to strengthen the unity of the Association.

The opening general session on December 28 was devoted primarily to the address of the retiring president, Dr. Karl T. Compton, on "The Electron: Its Intellectual and Social Significance". Dr. Compton used the discovery of the electron, which apparently had no practical use when first found and measured, as the example of how pure research turns into valuable practical application. He enumerated industries made possible by electronic devices which have a total business of hundreds of millions of dollars each year, and added that the application of the discovery of the electron has brought intangible values in improved health, safety and convenience. Taking a swift audit of the electron's money contribution to civilization, Dr. Compton pointed out that it is responsible for a growing industry in electronic devices which now amounts to a total business of 50,000,000 dollars a year in America alone.

The Sigma Xi address on December 29 was given by Dr. Henry G. Knight, chief of the U.S. Bureau of Chemistry and Soils, on "Selenium and Its Relation to Soil, Plants, Animals, and Public Health". The Phi Beta Kappa address on December 30 was delivered by President James R. Angell, of Yale University; his subject was "The Scholar and the Specialist".

Special afternoon general lectures were given on December 28 by Dr. E. O. Hulbert, of the Naval Research Laboratory, on "The Optics of the Surface of the Sea", on December 29 by Mr. David Dietz, science editor of the Scripps-Howard newspapers, on "Science and the American Press", and on December 30 by Dr. P. W. Zimmerman, of the Boyce Thompson Institute for Plant Research, on "Response of Plants to Hormone-like Growth Substances". The last mentioned item was a formal presentation before the Association of the subject awarded the Association Prize at St. Louis last year.

The Section on Medical Sciences devoted four days to a continuing symposium on cancer, covering in series of invited papers by leaders in cancer research the position of various aspects of present-day investigation. The morning of December 29 was devoted to various types of radiation and their effects, and the afternoon to heredity and constitutional factors; the following morning and afternoon to induction, stimulation and inhibition of tumorous growths; and the morning of December 31 to the metabolism of cancerous tissue. On the afternoon of December 30, Dr. C. C. Little, director of the Jackson Memorial Laboratory, gave the afternoon general lecture on the subject "The Social Significance of Cancer". A general lecture was given on January 1 by Dr. Walter Schiller, of the University of Vienna, on "Changes and Modifications in the Conception of Carcinoma". All told, this series constituted the most complete presentation of the cancer problem and the results of research in this field yet organized in the United States. The sessions were largely attended and the discussions prolonged.

Some new features were introduced into the programme at Atlantic City. Friday, January 1, was designated Association Day and devoted to general purposes. The morning was utilized for meetings of sectional committees, scientific boards and the Secretaries' Conference of the Association. In the afternoon was held a demonstration symposium on "The Moving Picture in the Service of Science". In one large auditorium Dr. William Beebe showed his reels on "Bathosphere Embryonic Eels", made under the auspices of the New York Zoological Society. Following this, Mr. Perry Burgess, president of the Leonard Wood Memorial, presented a sound movie of dramatic interest, "Miracles in the South Sea", portraying life in the leper colony in Culion, P.I. At the same time in a separate auditorium Prof. E. M. K. Geiling, of the University of Chicago, and Mr. L. L. Robbins illustrated "Whaling for Science" in a film showing habits of the cetacean and search for the hypophysis. "High Speed Motion Pictures of the Flight of Birds and of Bullets", a series of great interest, was shown by Dr. H. E. Edgerton, of the Massachusetts Institute of Technology. A colour film entitled "A Health Educator with a Cine-Kodak in the Orient" was exhibited and described by Dr. C. E. Turner, of the Massachusetts Institute of Technology; he presented vividly the mode of life, problems of population and sanitation in those regions.

The closing event in Atlantic City was a special showing on Friday evening (January 1) of "The Human Adventure", an eight-reel talking picture sketching man's rise from savagery to civilization. The late Dr. James Henry Breasted, director of the Oriental Institute at the University of Chicago, had

supervised personally the production of this film and the sound record was partly in his own voice.

On January 2 the Association moved to Philadelphia on invitation of the American Philosophical Society, and in its famous hall heard a programme on viruses and virus diseases. The first paper, by Dr. W. M. Stanley, included a survey of the work granted the Association Prize. After the luncheon, visiting members were taken to the Franklin Institute and the Academy of Natural Sciences, where scientific programmes had been arranged.

The newly elected president of the Association, Dr. George D. Birkhoff, recently made Dean of the Graduate School of Arts and Sciences at Harvard, where he has been professor of mathematics since 1919, presented before the mathematicians an important paper entitled "A Conceptual Theory of Atomic Structure". This paper, which gives physicists a clearer comprehension of the composition of matter, presents anew to modern thought fundamental ideas first advanced by the illustrious James Clerk Maxwell. It is interesting to recall that in 1926 Dr. Birkhoff was awarded the Association Prize of the Philadelphia meeting for his paper demonstrating that Schrödinger's fundamental wave equation, then recently published, could be reached on the basis of a conceptual theory of matter and electricity.

The Association prize for an outstanding contribution to science in the Atlantic City programme was given to Dr. W. M. Stanley, of the Rockefeller Institute for Medical Research, for his paper entitled "Crystalline Tobacco-Mosaic Virus Protein". After reporting his experiments and analysing their significance with thoroughness, he concluded his paper as follows :

"In view of the properties which this protein possesses, the borderline between the living and the non-living tends to become non-existent, for, although it possesses properties which have been regarded as characteristic of living things, such as specificity of host range and the ability to reproduce and to mutate, it is nevertheless a protein molecule and as such may be regarded as non-living. It is possible that by virtue of its size, it is enabled to possess sufficient organization within the molecule to endow it with such properties. As such, it would represent a link between the type of organization within the atom or molecule with which chemists have concerned themselves and the type of organization within the cell with which biologists have been concerned."

The attendance at Atlantic City was large, being variously estimated from four to five thousand, of which 2,400 were officially registered. At the various sessions fourteen hundred papers were presented. Despite the variety of these offerings, the audience rooms were filled to capacity. The scientific exhibition was especially well visited and its numerous exhibits attracted favourable comment. Special mention may be made the remarkable research exhibit of Dr. Irving Langmuir, the Nobel laureate in chemistry, who has produced the world's thinnest films.

The addresses of the retiring vice-presidents, given at various times, included the following :

Mathematics : Prof. T. H. Hildebrandt, of the University of Michigan, on "Recent Developments in the Theory of Integration" ; *Physics :* Prof. John T. Tate, of the University of Minnesota, on "Electron Impacts in Gases" ; *Chemistry :* Prof. Moses Bomberg, of the University of Michigan, on "Free Radicals" ; *Astronomy :* Dr. H. R. Morgan, of the United States Naval Observatory, on "Some Problems in Fundamental Astronomy" ; *Zoology :* Dr. Ross G. Harrison, of Yale University, on "Embryology and Its Relations" ; *Botany :* Prof. E. W. Sinnott, of Columbia University, on "Morphology as a Dynamic Science" ; *Anthropology :* N. C. Nelson, of the American Museum of Natural History, on "Prehistoric Archæology, Past, Present, and Future" ; *Psychology :* Dr. Robert M. Ogden, of Cornell University, on "The Psychology of Art : Naive Geometry" ; *Education :* Prof. F. B. Knight, of the University of Iowa, on "Data Related to Classroom Learning" ; *Social and Economic Sciences :* Dr. Shelby Harrison, of the Russell Sage Foundation, on "Winning Social Advance Through the Process of Accretion" ; *Historical and Philological Sciences :* Dr. George Sarton, of Harvard University, on "The Study of the History of 20th Century Science" ; *Agriculture :* Prof. H. K. Hayes, of the University of Minnesota, on "Agricultural Research in China".

The following officers were elected for the terms indicated in parenthesis :

President (1937) : George D. Birkhoff, of Harvard University ;

Permanent Secretary (1937–40) : Forrest R. Moulton, formerly professor of astronomy, University of Chicago ;

General Secretary (1937–40) : Otis W. Caldwell, of Boyce Thompson Institute for Plant Research ;

Treasurer (1937–40) : John L. Wirt ;

Elected Council Members (1937–40) : Vincent du Vigneaud, of George Washington University Medical School, and Sam F. Trelease, of Columbia University ;

Members of the Executive Committee (1937–40) : Edwin G. Conklin, of Princeton University, and Henry B. Ward, professor emeritus of the University of Illinois ;

Member of the Board of Trustees of Science Service (1937–39) : J. McKeen Cattell, editor of *Science ;*

Members of the Finance Committee (1937–40) : Arthur Keith, of the United States Geological Survey, and (1937–38) Charles S. Baker, Munsey Building, Washington, D.C. ;

Members of the Committee on Grants (1937–40) : A. T. Poffenberger, of Columbia University, and Jacob G. Lipman, of the New Jersey Agricultural Experiment Station ;

Vice-Presidents of the Sections (1937) :
W. D. Cairns, Oberlin College (Mathematics) ;
Harvey Fletcher, the Bell Telephone Laboratories (Physics) ;
Farrington Daniels, the University of Wisconsin (Chemistry) ;
Philip Fox, the Adler Planetarium and Astronomical Museum (Astronomy) ;
Kirtley F. Mather, Harvard University (Geology and Geography) ;
Ralph S. Lillie, the University of Chicago (Zoological Sciences) ;
F. E. Denny, the Boyce Thompson Institute for Plant Research (Botanical Sciences) ;
John R. Swanton, the United States Bureau of American Ethnology (Anthropology) ;
A. T. Poffenberger, Columbia University (Psychology) ;
Stuart Rice, United States Central Statistical Board (Social and Economic Sciences) ;
R. C. Archibald, Brown University (Historical and Philological Sciences) ;

J. W. Barker, Columbia University (Engineering);
Esmond R. Long, the University of Pennsylvania (Medical Sciences);
E. C. Auchter, the United States Bureau of Plant Industry (Agriculture);
Ralph Tyler, Ohio State University (Education).

Secretaries of the Sections (1937–40):
E. R. Hedrick, the University of California at Los Angeles (Mathematics);
H. A. Barton, the American Institute of Physics (Physics);
Neil E. Gordon, of Johns Hopkins University (Chemistry).
Harlan T. Stetson, the Massachusetts Institute of Technology (Astronomy);
Howard Meyerhoff, Smith College (Geology and Geography);
George A. Baitsell, Yale University (Zoological Sciences);
J. T. Buchholz, the University of Illinois (Botanical Sciences);
W. M. Krogman, Western Reserve University (Anthropology);
Leonard Carmichael, the University of Rochester (Psychology);
E. P. Hutchinson, 11 Centre Street, Cambridge, Mass. (Social and Economic Sciences);
Joseph Mayer, Library of Congress (Historical and Philological Sciences);
F. M. Feiker, the American Engineering Council (Engineering);
Malcolm Soule, the University of Michigan (Medical Sciences);
M. F. Morgan, the Connecticut Agricultural Experiment Station (Agriculture);
P. M. Symonds, Columbia University Teachers College (Education).

HENRY B. WARD.

The Wellcome Trust

SIR HENRY WELLCOME, who died on July 25, 1936, at the age of eighty-two years, was known as the creator of a great manufacturing business and also for the active interest he took in archæological and geographical exploration, the social welfare of native races and the promotion of fundamental research in sciences on which the progress of medicine depends. Beginning so long ago as 1894, he founded in that year the Wellcome Physiological Research Laboratories, and two years later a corresponding centre for chemical research. In 1899, he established the Wellcome Tropical Research Laboratories at Khartoum, where the late Sir Andrew Balfour worked as director for twelve years, doing notable work on the control of malaria and the investigation of other tropical diseases. In 1913 the Wellcome Bureau of Scientific Research was brought into being to control the various research laboratories already operating, and then followed the Historical Medical Museum, the Museum of Medical Science and the Entomological Field Laboratory. All these institutions, with the exception of the physiological and entomological laboratories, are now housed in the magnificent Wellcome Research Institution in Euston Road, London. This was Sir Henry's crowning gift; the corner-stone was laid in 1931 by the late Lord Moynihan, who said that the ceremony might well be regarded as referring to the corner-stone of a long life's work.

By his will, Sir Henry provided for the continuance of the Wellcome Research Institution, the trustees appointed to administer the estate being Sir Henry Dale, F.R.S., director of the National Institute for Medical Research; Prof. T. R. Elliott, C.B.E., F.R.S., professor of medicine in the University of London; Messrs. G. Hudson Lyall and L. C. Bullock, members of a London firm of solicitors; and Mr. Martin Price, chartered accountant.

The accompanying statement has now been issued by the five trustees:

As the trustees appointed by the will of the late Sir Henry Wellcome, we ask you to be good enough to publish this letter in order to clear up any misconception which may have arisen with regard to the effects of the will. We are led to make this statement by the number of appeals for contributions to various research undertakings which have already reached us. For reasons mentioned below the trustees will not be able to consider any such applications in the immediate future.

In January 1924 the Wellcome Foundation Limited was formed for the purpose of taking over the whole of the business activities of Burroughs Wellcome and Co.; and the various scientific research institutions and museums established by the late Sir Henry Wellcome, who held the whole of the share capital.

By the terms of the will the shares of the Wellcome Foundation are now vested in us as trustees, and the activities of the Foundation throughout the world will be carried on, in collaboration with the trustees, by a Board of Directors of which the present Governing Director is Mr. George E. Pearson, who has been closely associated with the late Sir Henry Wellcome for more than forty years.

It will be realized that owing to the magnitude of the testator's estate, a very large sum has to be found for death duties. Provision has also to be made for:

(*a*) A welfare fund for the benefit of employees of the Wellcome Foundation Ltd., and its associated companies.

(*b*) The payment of certain specified annuities to relatives and others personally connected with the testator.

(*c*) The erection and maintenance of a building in Minnesota to be dedicated as a memorial to the testator's parents.

Subject to these prior charges, the remainder of the divisible profits will be utilized in accordance with the testator's instructions in the following manner:

(i) For the maintenance of "The Research Undertaking Charity", which is a fund for the advancement of medical and scientific research work in any part of the world conducive to the improvement of the physical conditions of mankind, and in particular for the discovery, invention and improvement of medicinal agents and methods for the prevention and cure of disorders, and the control or extermination of insect and other pests which afflict human beings and animal and plant life, and also for the organization, equipment and expenses of special research expeditions and commissions.

(ii) For the maintenance of "The Museum and Library Charity", which is a fund for the establishment or endowment of research museums or libraries in any part of the world and for the collection of information of every kind connected with the history of medicine, surgery, chemistry, bacteriology, pharmacy and allied sciences, which in the opinion of the trustees may be desirable.

This statement of the position has been somewhat delayed by the fact that the testator imposed upon all his trustees the obligation, before undertaking the trust, to enter into a covenant not to be engaged in or in any way to assist in any concern which carried on a business in competition with Burroughs Wellcome and Co. Three of the trustees had no difficulty in entering into this covenant immediately after the testator's death, but the two medical and scientific trustees felt that certain words in the covenant might be held to restrict them unduly in the performance of their official and general duties to medical science, and to imply their particular concern with the business interests of the Foundation. The matter has now been considered by the High Court of Justice, which has made an order allowing them to enter into a covenant in a form removing any such unacceptable implication and enabling effect to be given to what was known to have been the testator's intention.

No trustee, director, or any other person holds for himself or in his own right any shares in the Wellcome Foundation, and all the divisible profits in each year will be devoted to the various purposes named in the will and indicated above.

We believe this to be the first example, in Great Britain at least, of a testamentary disposition by which the whole of the profits from a great manufacturing and trading organization, after certain personal and memorial bequests have been fulfilled, are permanently dedicated to the advancement of knowledge for the general benefit of mankind.

G. HUDSON LYALL,
H. H. DALE,
L. C. BULLOCK,
MARTIN PRICE,
T. R. ELLIOTT.

The proviso which, by order of the Court, may be added by a trustee to the covenant required of all the trustees under the will of Sir Henry Wellcome, reads as follows :

"PROVIDED that nothing in this Covenant shall be held to prevent me in the exercise of my proper function in any appointment held by me in the public service or under any publicly or privately endowed organisation for the promotion of medical research or under any University in Great Britain from giving advice on scientific matters to any person or persons solely for the purpose of rendering scientific discovery available for the general use and without pecuniary reward or other personal advantage to myself."

Prize Awards for 1936 of the Paris Academy of Sciences*

THE LOUTREUIL FOUNDATION

Researches on Fixed Problems.—Pierre Auger (3,000 francs), for his researches on cosmic physics requiring a stay at the Jungfraujoch Laboratory ; Abel Brion (3,000 francs), for his researches on the pathological physiology of the kidney in animals ; Raymond Cahen (2,000 francs), for his researches on tolerance to morphine in the rat and rabbit ; Claude Charmetant (3,000 francs), for his researches on the electrolysis of chlorides, bromides and iodides in aqueous alcoholic solutions ; H. Girard (1,000 francs), for the study of blood groups and the transfusion of blood in animals ; Henri Laugier (3,000 francs), for his researches on circulation reactions during emotion ; Gustave Lesbouyries and Maurice Berthelon (2,000 francs), for their researches on the genital hormones of animals ; Paul Marsais (2,000 francs), for the continuation of his studies on the diseases of the vine, especially mildew and its treatment ; Louis Nattan-Larrier (6,000 francs), for helping him continue his work on the serological condition of the development of normal tissues and cancers ; Paul Nottin (3,000 francs), for his researches on the action of the impurities of sulphuric acid due to the Glover tower on alcoholic fermentation ; the Besançon Observatory (5,000 francs), for the organization of a French office of isostatic reduction ; Maurice Pierre (3,000 francs), for the study of Hering's nerve in domestic animals ; Antoine Poidebard (5,000 francs), for his researches on submarine photography at Tyre ; Emile Roubaud (5,000 francs), for his researches on the locust ; Henri Simonnet (2,000 francs), for his chemical and physiological researches on the fate of morphine in the animal organism ; Charles Alluaud (4,000 francs), for his zoological researches in the Sahara ; Jean Gruvel (5,000 francs), as a contribution to an expedition to Indo-China for the study of the ichthyological fauna.

* *Continued from p.* 162.

Purchase of Laboratory Material.—Emile André (3,000 francs), for the purchase of a polarimeter for the determination of rotatory power as a function of the wave-length ; Henri Lafuma (3,500 francs), for the purchase of a testing machine for refractory products ; Marcel Véron (3,500 francs), for the purchase of a spectrobolometer.

Publications.—Comité de Physique du Globe des Colonies (8,000 francs), for the publication of the "Annales de Physique du Globe de la France d'outremer" ; Fédération française des Sociétés de Sciences naturelles (5,000 francs), for the publication of the "Faune de France" ; André Guillaumin, for assisting in the publication of a new guide to the collection of living plants in the Jardin des plantes ; Louise Nouvel (3,000 francs), for the publication of a work on the biology of the Natantia crustaceans.

Grants to Libraries.—Ecole nationale vétérinaire d'Alfort (5,000 francs), for preparing a card index and completing its foreign periodicals ; Ecole national vétérinaire de Toulouse (6,000 francs), for completing its collections ; Ecole polytechnique (6,000 francs), for the purchase of scientific publications ; Institut national agronomique (6,000 francs), for the completion of its collection of foreign periodicals.

MME. VICTOR-NOURY FOUNDATION

René Bourret (2,500 francs), for his work on the snakes of Indo-China; Elisabeth Jérémine (2,500 francs), for researches in petrography; Robert Didier and Paul Rode (2,000 francs), for their work on the mammals of France; Jules Guiart (2,000 francs), for his book on the parasitic cestodes obtained during the voyages of Prince Albert of Monaco, 1886–1913; Jacques Pochon (2,000 francs), for his work on the role of a cellulolytic bacterium of the paunch in the digestion of cellulose in ruminants; Henri Stehlé (2,000 francs), for starting his work on the flora of Guadeloupe; André Thomas (2,000 francs), for work in experimental cytology; Voldemar Vilter (2,000 francs), for his work on the formation of the feather and its histological mechanism; Elisabeth Sylvain-David (2,000 francs), for the publication of a memoir on the Foraminifera.

GENERAL FOUNDATIONS

The Pierre Lafitte Foundation to Robert Bureau, for his researches on the origin of atmospherics in wireless telegraphy and on the use of electro-magnetic waves for recording observations made in captive balloons; the Millet-Ronssin Foundation between René Herpin (4,000 francs), for fitting up his laboratory of marine zoology, Fernand Obaton (3,000 francs), for his cinematographic studies of the movements of plants and the organization of a research centre of this nature at the Sorbonne, and Nicholas Théobald (3,000 francs), for his work on fossil insects.

THE VILLEMOT FOUNDATION

Aimé Cotton (40,000 francs), for his researches at Bellevue with the large electro-magnet of the Academy; Pierre Augustin Dangeard (10,000 francs), for his botanical studies; Roger Heim (12,000 francs), for the study of the cryptogam material collected by him in Madagascar and the publication of the results; Gaston Julia (5,000 francs), for the mathematical circle which meets at the Henri Poincaré Institute for the study of current mathematical questions; Laboratoire central d'électricité (10,000 francs), for the purchase of apparatus for researches on the determination of the ohm in absolute measure with high precision; Raoul Lecoq (10,000 francs), for his work on the study of vitamins in unbalanced food regimes; Père Lejay (10,000 francs), for work on solar phenomena at the Zi-Ka-Wei Observatory; Pierre Lesage (6,000 francs), for his researches on heredity in plants of the acquired physiological character, precocity; Berbard Lyot (30,000 francs), for his studies on the solar corona; Charles Mauguin (20,000 francs), for acquiring apparatus designed for the analysis of the crystalline structures of minerals; Jean Piveteau (10,000 francs), for resuming excavations in the celebrated Perrier deposit of Tertiary mammals; Hyacinthe Vincent (12,000 francs), for work relating to the etiology and pathogeny of certain infectious diseases.

The Charles Frémont Foundation to Jean Feytaud, for his researches on noxious insects and the organization of defensive measures against these enemies.

SPECIAL FOUNDATIONS

The Lannelongue Foundation to Mme. Gabriel Cusco; the Hélène Helbronner-Fould Prize to Mme. Marie Phisalix, for her work on snake poisons; the Girbal-Baral Foundation to Mlle. Yvette Cauchois (10,000 francs), for her studies on the spectrography of the X-rays, and Roger Gautheret 10,000 francs), for his studies on the culture of plant tissues.

Air Resistance of Passenger Trains

IN a paper read before the Institution of Mechanical Engineers on November 27, Mr. F. C. Johansen describes the results of experiments on the air resistance of passenger trains produced by modifying the shape and the smoothness of their surfaces, originally of L.M.S. pattern, in two different ways. In the first way, there was no general change in the external form of the coaches, but in the second way all coaches have smoothed bodies and faired under-carriages. The modifications introduced involved no marked alteration from the conventional appearance except for fairings on the engine, tender and the tail end of the last coach, the object being to show what reductions in air resistance could be achieved without any radical degree of stream-lining.

In the first way, the reduction of the longitudinal force was of the order of 20 per cent and decreases with the increase of the length of the train, since the reduction is mainly due to the locomotive and the first coach. In the second way, the reduction of the longitudinal force was much larger, being of the order of 50 per cent, the more effective lining being due to the all-smooth coaches. In the ideal train the corresponding reduction of the force would be about 75 per cent. The experimental results lead to the following recommendations and conclusions.

The air resistance of a train of conventional British type is equivalent to about $0{\cdot}0016\ V^2$ lb. per ton of train weight, where V is the speed in still air in miles per hour. The air resistance can be reduced by 50 per cent without drastic departure from conventional design and by 75 per cent by ideal stream-lining. With speeds of 100 m.p.h., the corresponding fuel economy would be about £1 per hour.

It was found that the air resistance was augmented by side winds, this effect being mainly due to frontal pressure on exposed surfaces. Curiously enough, the worst natural wind is not directly ahead but ranges from 30° to 60° on either side of this direction. Stream-lining measures are more effective in side winds than in direct winds. The gaps between the coach bodies of an ordinary train account for very little of the total air resistance. A surprisingly large proportion of the air resistance of a coach is contributed by the bogies and under-carriage structure. A fair shape at the tail end of a train reduces air resistance to an extent which is more marked the more complete the stream-lining.

The full benefit of measures to reduce air resistance can be realized only if the locomotive and the coaches are all stream-lined. The final conclusion the author arrives at is that the ideal stream-lined train is a continuous cylindrical body with well-rounded ends, having a polished surface free from external fittings and irregularities. A tubular surface, incorporating a stressed skin of sheet metal, would be very suitable.

Science News a Century Ago

The Polarization of Heat

WHEN Whewell was publishing his "History of the Inductive Sciences", Forbes wrote to him on January 31, 1837 : "I feel gratified by the prominent place you have given to my experiments as bearing upon the theory of Heat. . . . But I must mention for yourself, if not for your book, that the discovery of the polarization of heat was not the necessary consequence of applying the thermo-multiplier to the investigation, which would have been a poor achievement, seeing it was another man's invention ; but that Melloni had first applied the instrument to the tourmaline question, and answered in the negative (*Ann. de Chemie*, vol. 55) ; then Nobili, the inventor, attempted to repeat Berard's experiment with the most approved piles, and with results quite null (*Bib. Universelle*). So that I conclude that, when I published my experiments, the question of polarization was negatively answered by persons operating with every advantage which I possessed, and indeed seemed to be set at rest. My discovery was the application of mica as a polarizing substance, first by transmission, then by reflection ; and I have shown that repeating Nobili's experiment—the same as Berard's and Powell's—the quantity of heat reflected from glass is so excessively minute that the errors might well equal the total effect. I think you have not mentioned total reflection and circular polarization.

"As to simple reflection, Melloni should be mentioned alone, but I claim double refraction."

The Zoological Society

AT a meeting of the Zoological Society held on February 2, 1837, the Rev. John Barlow being in the chair, it was stated that the receipts for the preceding month had been £2,146 12*s*. 2*d*. and the expenditure £1,019 6*s*. 3*d*. The number of visitors to the menagerie was 1,666, from whom £42 14*s*. was received, and the number of visitors to the museum 219, from whom £4 1*s*. was received. It was also stated that Mr. Yarrell had agreed to act as secretary without emolument, provided an assistant secretary was appointed, which the council had taken steps to do. The number of mammalia in the menagerie was 294, the number of birds 693 and the number of reptiles 27.

Dr. John Latham (1740-1837)

DR. JOHN LATHAM, an eminent ornithologist and archæologist, and one of the many celebrated truants of medicine, who died on February 4, 1837, was born in 1740 at Eltham in Kent, the son of a surgeon. He was educated at Merchant Taylors School and studied medicine under John Hunter. He practised for many years at Dartford, where he acquired a considerable fortune which enabled him to retire in 1796 to Romsey and devote all his energies to the study of archæology and ornithology. He was elected F.S.A. on December 15, 1774, and F.R.S. on May 25, 1775, and took a leading part in the foundation of the Linnean Society in 1788. He was the author of a "Synopsis of Birds" published in 1785, to which he added supplements in 1787 and 1802, and in 1790 brought out an abstract of this work entitled "Index Ornithologicus". Owing to financial losses, he was compelled to sell a great part of his library and museum, but with a rare courage, at the age of eighty-one years, he attempted to restore his fortune by an enlarged edition of his "Synopsis" entitled "A General History of Birds" which appeared between 1821 and 1828 in eleven volumes at Winchester, to which he had moved in 1820. He also took part in the revision of the second edition of Pennant's "Indian Zoology" published in 1793, and contributed several papers to the *Philosophical Transactions*, *Transactions of the Linnean Society* and *Archæologia*.

The subject of this note must not be confused, as was done in his obituary notice in the *Gentleman's Magazine* of July 1837, with another Dr. John Latham, Harveian orator in 1794 and president of the Royal College of Physicians in 1813–20.

Baron Desgenettes (1762-1837)

FEBRUARY 3 marks the centenary of the death of one of the most eminent medical men in Napoleon's army, Baron Réné Nicolas Dufriche Desgenettes. He was born at Alençon on February 23, 1762, and after studying medicine at Montpellier and Paris, he qualified at Montpellier in 1789 with a Latin thesis on the lymphatics. The next two years he spent at Montpellier, and then returned to Paris, where he enjoyed the society of some of the most illustrious savants of the time, such as Pelletan, Tenon, Sabatier, Condorcet, Vicq D'Azyr and Louis. On the advice of the last two, he joined the army, where in 1794 he first made the acquaintance of Napoleon. Two years later he was appointed physician and lecturer to the recently established Val-de-Grâce Military Hospital and Medical School, where he published several works on education and the treatment of war diseases, and took an active part in the foundation of two medical societies.

The next step in Desgenettes' career was his appointment by Napoleon as principal medical officer in the Egyptian and Syrian campaigns, in which he distinguished himself by his heroism and devotion to the sick and wounded. In 1802 he was made head of the Val-de-Grâce Hospital and shortly afterwards Inspector General of the Health Service of the French army. In 1805 he was sent to Spain to study the epidemic which was ravaging Cadiz, Malaga and Alicante. After taking part in the campaign in Prussia and Poland, he was made prisoner by the Russians, but was released by the Czar in gratitude for his care of the Russian wounded. At the battle of Waterloo he served as chief medical officer of the army and of the Imperial Guard. In 1822, owing to the sweeping changes made by the Frassinous régime, he was ousted from the chair of hygiene to which he had been appointed by the Directory, but was restored to it in 1830.

Desgenettes belonged to several learned societies, including the Paris Academy of Sciences, and was one of the first members of the Paris Academy of Medicine founded in 1820. He was a copious writer, his chief works being "Notes on the History of the Army in Italy" (1797), "The Medical History of the Army in the East (1802) and "Essays on Medical Biography and Bibliography" (1825).

University Events

CAMBRIDGE.—At Queens' College, Dr. G. P. McCullagh has been elected to a reserved fellowship. Dr. McCullagh is a former scholar of the Queen's University, Belfast, where he took his M.D. in 1931 and was Riddel demonstrator in pathology from 1932 until 1935. In 1935 he was appointed a University demonstrator in pathology at Cambridge.

GLASGOW.—The curators of patronage have appointed Dr. John W. S. Blacklock, lecturer on the pathology of diseases of infancy and childhood at the Royal Hospital for Sick Children, to the St. Mungo (Notman) chair of pathology at the Royal Infirmary. Prof. Blacklock will be, *ex officio*, pathologist to the Royal Infirmary.

A gift of £10,000 has been promised by Imperial Chemical Industries, Ltd., towards the cost of erecting the new Chemistry Institute at Gilmorehill. The cost is estimated at £200,000, and £118,000 has been assured by the Carnegie Trustees for the Scottish Universities.

Prof. E. B. Bailey has resigned from the chair of geology on his appointment to the directorship of the Geological Survey. His resignation will take effect from March 31, 1937.

LONDON.—The title of professor of geology (oil technology) in the University has been conferred on Mr. V. C. Illing, in respect of the post held by him at the Imperial College—Royal School of Mines; that of reader in physiology in the University on Dr. W. H. Newton, in respect of the post held by him at University College, and that of emeritus professor of education in the University on Sir T. Percy Nunn, on his retirement from the University professorship of education at the Institute of Education.

The degree of D.Sc. in horticulture has been conferred on Mr. H. V. Taylor, of the Imperial College—Royal College of Science; and that of D.Sc. in hygiene on Mr. Thomas Bedford, an external student.

OXFORD.—In Convocation on January 21 the honorary degree of D.Sc. was conferred on Dr. John D. Pollock, chairman of Metal Industries Limited, and of the British Oxygen Company, a Carnegie Trustee and benefactor to the Engineering and Physics Departments of the University.

Societies and Academies

Paris

Academy of Sciences, January 4 (*C.R.*, **204**, 1–76).

LÉON LECORNU: The suppression of friction.

CHARLES ACHARD and MAURICE PIETTRE: Researches on the blood serum and muscular plasma in the fœtus.

LOUIS LÉGER and MLLE. MARCELLE GAUTHIER: *Graminella bulbosa*, a new genus of parasite entophyte of the larvæ of Ephemerids of genus *Bœtis*.

CARLOS BIGGERI: The singularities of analytical functions defined by potential series.

GEORGES VALIRON: The variations of the modulus of integral or meromorph functions.

JEAN ROUBAUD-VALETTE: The use of hypercomplex numbers for establishing the equations of a relativist wave mechanics.

C. DAUZÈRE: The electrical conductivity of the air in a potash mine in Catalonia. From the experiments described it would not appear that potassium has any marked effect in increasing the ionization of the air above granite rocks.

FÉLIX EHRENHAFT: An experimental method for finding the errors of determination of the size of an object by the microscope.

RENÉ FREYMANN: The absorption spectra in the near infra-red of solutions of alcohols in ether or dioxan: oxonium formation. The disappearance of the (OH) band from the infra-red spectrum of alcohols in certain solvents (ether, dioxan, acetone) is interpreted as being due to the formation of an oxonium compound.

WILFRIED HELLER: An attempt at a classification of syneresis.

MLLE. SUZANNE ESTRADÈRE: Relations between indices of shock, cracking, the oxidation of hydrocarbons and its thermal effects.

ALBERT PORTEVIN and DIRAN SÉFÉRIAN: The influence of elements added to steel on the nitrogen absorption on fusion in the arc. The addition of carbon, manganese and silicon tends to reduce the absorption of nitrogen: special elements (except titanium) increase the absorption.

HENRI MOUREU and GEORGES WETROFF: The existence and the stability of the phosphonitril radical, PN, and the synthesis of phosphorus dichloronitride. Attention is directed to the analogy between the groups CN and PN. The paranitride $(PN)_n$, treated at about 500° C. with chlorine, does not give nitrogen and PCl_5 as might be expected, but an addition compound, $(PNCl_2)_3$.

GUSTAVE VAVON and ISRAËL CHILOUET: The bornylamines.

HENRI LONGCHAMBON: The characteristics of the palygorskites. The examination of a considerable number of specimens proves the close analogy between palygorskites and sepiolites, and confirms the hypothesis of Fersmann, that palygorskites are derived from sepiolites by the isomorphic replacement of magnesium by aluminium.

GILBERT MATHIEU: The two large tectonic units of Vendée.

HENRI V. VALLOIS: The duration of life in fossil man. The character utilized for the determination of the age was the synosteosis of the cranial sutures. Out of 173 subjects, only three appear to have survived more than fifty years. It is probable that in Palæolithic and Mesolithic times death coincided with the decline of the physical powers.

ROBERT KÜHNER: The nuclei and their divisions in the carpophore, especially in *Mycena*.

PIERRE P. GRASSÉ: Hemaphrorrhea, reflex reject of blood and air by the phymateid Acridians. When *Dictyophorus oberthuri* is handled, bubbles of froth appear at various points of the body, and this froth was found to be composed of blood and air.

GEORGES TEISSIER: The biometrical comparison of two species of the genus *Maia*.

JEAN ROCHE and RENÉ COMBETTE: The physical state of globin and molecular weight of the methæmoglobin obtained by the combination of protohæmatin with globin.

MLLE. CAMILLE CHATAGNON: The urinary elimination of bromine after ingestion of sodium bromide.

YVES RAOUL: A new synthesis of hordenine. Tyramine is prepared by heating tyrosine under reduced pressure at 250° C., and this is methylated by means of formaldehyde in the presence of formic acid. At the boiling point, a 50 per cent yield of hordenine is obtained: at the ordinary temperature after a month, a 16 per cent yield is obtained.

Amsterdam

Royal Academy (Proc., 39, No. 10, Dec. 1936).

A. KAPPERS: The spread of primitive humanity and its links with the more differentiated races, as revealed by cephalic and cranial index curves.

L. S. ORNSTEIN: Scattering of neutrons in matter (4).

J. CLAY and H. F. JONGEN: The absolute intensity of cosmic radiation at sea-level.

E. COHEN and A. K. W. A. VAN LIESHOUT: The influence of mechanical deformation on the velocity of transformation of polymorphous metals (3). The influence of metallic admixtures (2).

E. DUBOIS: Racial identity of *Homo soloensis* Oppenoorth (including *Homo modjokertensis* von Kœnigswald) and *Sinanthropus pekinensis* Davidson Black.

H. BRINKMAN: A continuously acting cloud-chamber.

E. GORTER, L. MAASKANT and G. J. VAN LOOKEREN CAMPAGNE: The spreading of fibrinogen.

I. LIFSCHITZ: Dissymmetrical synthesis in the case of complex metallic salts (2).

J. WESTERVELD: The granites of the Malayan tin-belt compared with tin-granites from other regions.

S. T. BOK: The branching of dendrites in the cerebral cortex.

T. REICHSTEIN, E. LAQUEUR, I. E. UYLDERT, P. DE FREMERY and R. W. SPANHOFF: An active crystalline substance from the cortex of the supra-renal gland—corticosterone (see also NATURE, Jan. 2, p. 26).

Geneva

Society of Physics and Natural History, November 5.

P. ROSSIER: (1) Observations of the comet 1936*a*. Photographs taken on July 23 and 29, 1936. The spectrum is of the normal cometary type, with carbon and cyanogen bands. (2) Relations between the colour index and effective wave-length of a star. Starting with an approximate expression for the index, the author shows that the colour index is a linear function of the effective wave-length, the coefficients of which bear a simple relation to the sensibility constants of the receivers considered.

DON ZIMMET and DUBOIS-FERRIÈRE: Vitamin C in human saliva, and paradentoses.

November 19.

P. ROSSIER: (1) Determination of the sensibility constants of receivers of radiant energy by means of scales of colour indices and of effective wave-lengths. The application of the theory of first approximation of the author to a particular case gives constants of the same order of magnitude as those determined by other methods. (2) Apparent character of a variation of a photographic extinction with atmospheric humidity. The variation of the sensibility of photographic plates with the humidity explains an extinction which the author had thought could be attributed to atmospheric absorption. (3) The star *BD* 4114 = *HD* 193092. Photographic observations of this star now suspected to be variable.

L. MEYER: Visual observations of Nova Lacertæ 1936.

Washington, D.C.

National Academy of Sciences (*Proc.*, 22, 621–672, November 15).

EDWIN HUBBLE: Effects of red shifts on the distribution of nebulæ. A discussion of five surveys providing homogeneous counts of nebulæ leads to two opposed views. Assuming the displacements towards the red in the spectra of nebulæ are velocity shifts, the universe is closed, very small, packed with matter to the threshold of perception, and the rate of expansion has been slowing down. If the displacements are not velocity shifts, then the universe approximates to a homogeneous expanding model in which spatial curvature and rate of expansion are inappreciable. Presumably the 200-in. reflector will provide definitive tests between these models.

FELIX G. GUSTAFSON: Inducement of fruit development by growth-promoting chemicals. Such substances as indole-propionic, -acetic, and -butyric acids and phenylacetic acid, when applied in lanoline to the cut style of an ovary, cause growth resembling that resulting from fertilization, but no seeds were ever found. Mature fruits without seeds were produced in tomato, petunia, *Salpiglossus* and pepper.

WILLIAM J. ROBBINS, VIRGINIA B. WHITE, J. E. MCCLARY and MARY BARTLY: Importance of ash elements in the cultivation of excised root tips. The addition to a nutrient solution of agar or filter paper, or water-extracts or the ash of either, even for a limited period (24–48 hours) increases the average growth of root tips 5–6 times. It is suggested that, since root tips have little store of ash elements, they should be useful for the study of mineral elements essential for growth in higher plants.

C. B. DAVENPORT and WILLIAM DRAGER: Growth curve of infants. It resembles that of a monomolecular autocatalytic reaction, but is modified by a period of accelerated growth at 6–8 months, and a period of retarded growth at 16–18 months. The growth curve is not controlled, even early in life, by any single reaction.

DONALD F. JONES: Mutation rate in somatic cells of maize. While such mutations are an important factor in aberrant development, they are much less frequent than changes produced by somatic segregation.

CURT STERN and DOROTHY DOAN: A cytogenetic demonstration of crossing-over between *X*- and *Y*-chromosomes in the male of *Drosophila melanogaster*.

G. A. MILLER: Number of the Abelian groups of a given order.

CHESTER STOCK: Titanotheres from the Titus Canyon formation, California. This formation is of Oligocene age and occurs in the Death Valley region. Two specimens, one forming a new genus and species, are described and illustrated.

E. WIGNER: Saturation of exchange forces.

A. VAN HARREVELD and C. A. G. WIERSMA: The triple innervation of the crayfish muscle. Two of the fibres identified appear to give contraction and the third inhibits it.

S. S. STEVENS and E. B. NEWMAN: The nature of aural harmonics. The aural harmonics were observed directly by analysing the electrical potential generated in the cochleas of animals by means of an oscillograph and a wave-analyser.

Forthcoming Events

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

Saturday, January 30

BRITISH MYCOLOGICAL SOCIETY, at 11.—(at University College, Gower Street, London, W.C.1).—Symposium on "Antagonism of Micro-organisms" to be opened by Prof. W. Brown, discussion to be opened by G. Samuel.

Monday, February 1

SOCIETY OF ENGINEERS (at Geological Society), at 6.—A. S. E. Ackermann: "Scientific Paradoxes and Problems".

ARMSTRONG COLLEGE, NEWCASTLE-UPON-TYNE, at 6.30.—Prof. M. Polanyi: "The Transition State in Chemical Reactions" (Thirty-sixth Bedson Lecture).

Wednesday, February 3

INSTITUTION OF MINING ENGINEERS, at 11.15.—Annual General Meeting to be held in the rooms of the Geological Society, Burlington House, Piccadilly, London, W.1.

QUEEN MARY COLLEGE, at 4.—Prof. F. E. Fritsch, F.R.S.: "Special Aspects of Algal Ecology" (succeeding lectures on February 10, 17, 24 and March 3).*

Thursday, February 4

CHEMICAL SOCIETY, at 5.—Discussion on "The Transition State in Reaction Kinetics" to be opened by Prof. M. Polanyi.

Friday, February 5

SOCIETY OF CHEMICAL INDUSTRY (GLASGOW SECTION).—Dr. J. T. Dunn: "The Service of Science to Industry" (Jubilee Memorial Lecture).

ROYAL INSTITUTION, at 9.—Dr. Stanley Kemp, F.R.S.: "Animal Life in the Antarctic".

Saturday, February 6

SCHOOL NATURE STUDY UNION, at 3.—Thirty-third Annual Conference to be held at University College, Gower Street, London, W.C.1.

Prof. Walter Garstang: "The Songs of Birds".

Appointments Vacant

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

HEAD of the Merton Central Evening Institute, Merton Park, S.W.19—The Registrar (January 30).

ASSISTANT TOBACCO OFFICER in the Department of Agriculture and Lands, Southern Rhodesia—The Official Secretary, High Commissioner for Southern Rhodesia, Rhodesia House, 429 Strand, W.C.2 (January 30).

FORESTRY ASSISTANT (Grade III) in the Forest Products Research Laboratory, Princes Risborough—The Establishment Officer, Department of Scientific and Industrial Research, 16 Old Queen Street, S.W.1 (February 3).

ASSISTANT LECTURER IN SCIENCE AND MATHEMATICS in the Liverpool City Technical College—The Director of Education, Education Offices, 14 Sir Thomas Street, Liverpool, 1 (February 5).

UNIVERSITY LECTURER IN ANATOMY in the University of Cambridge—Dr. F. J. W. Roughton, Department of Physiology (February 6).

LECTURER IN INDUSTRIAL CHEMISTRY in the Cardiff Technical College—The Director of Education, City Hall, Cardiff (February 6).

INSTRUCTOR LIEUTENANTS (honours degree in mathematics, physics, chemistry or engineering) in the Royal Navy—Director, Education Department, Admiralty, 5 Millbank, London, S.W.1 (February 8).

MECHANICAL AND ELECTRICAL ENGINEERS (temporary) in the Directorate of Works and Buildings, Air Ministry—Secretary (W.B.9), Air Ministry, Adastral House, Kingsway, W.C.2, by postcard (February 8).

SENIOR MECHANICAL ASSISTANTS and SENIOR ELECTRICAL ASSISTANTS (temporary) in the Air Ministry—Secretary (W.B.9), Air Ministry, Adastral House, Kingsway, W.C.2, by postcard (February 8).

A PHYSICIST in the Aeronautical Inspection Directorate, Test House, Kidbrooke, London, S.E.3 (non-metallic materials section)—Secretary, Air Ministry (S.2.D), Adastral House, Kingsway, W.C.2 (February 8).

ASSISTANT EXECUTIVE ENGINEER in the Public Works Department of the Federated Shan States, Burma—High Commissioner for India, General Department, India House, Aldwych, London, W.C.2, by postcard (February 11).

ASSISTANTS (GRADE II AND III) at the Royal Aircraft Establishment, South Farnborough, Hants; *Ref.* 336*A*, for the writing of technical and descriptive matter; *Ref.* 327*A*, to assist in bench and flight testing; *Ref.* 314*A*, for structural strength and aerodynamic calculations—Chief Superintendent, Royal Aircraft Establishment, South Farnborough, stating appropriate reference number (February 12).

DIRECTOR OF THE FITZWILLIAM MUSEUM in the University of Cambridge—The Vice-Chancellor (February 23).

LECTURER IN PHYSICS AND MATHEMATICS at the Croydon Polytechnic—Education Officer, Education Office, Katharine Street, Croydon (February 27).

DIRECTOR OF THE LABORATORY of the Freshwater Biological Association of the British Empire—Prof. P. A. Buxton, London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1 (February 28).

STEVENSON LECTURER IN CITIZENSHIP in the University of Glasgow—Secretary (February 28).

SENIOR LECTURER IN SOCIAL ANTHROPOLOGY in the University of the Witwatersrand, Johannesburg—The Secretary, Office of the High Commissioner for the Union of South Africa, South Africa House, Trafalgar Square, London, W.C.2 (March 31).

TEACHER OF MATHEMATICS AND SCIENCE in the Junior Technical School of the Northampton Polytechnic, St. John Street, London, E.C.1—The Secretary.

UNIVERSITY LECTURER IN ANATOMY in the University of Cambridge—The Professor of Anatomy.

ASSISTANT CIVIL ENGINEERS in the Civil Engineer-in-Chief's Department, Admiralty—Civil Engineer-in-Chief, Admiralty, S.W.1 (mark envelopes "A.C.E. Decr.").

CIVIL ENGINEERING ASSISTANTS in the Drawing Office, Admiralty, Civil Engineer-in-Chief's Department—Civil Engineer-in-Chief, Admiralty, S.W.1, marked D.O.X.

Official Publications Received

Great Britain and Ireland

Check-Lists of the Forest Trees and Shrubs of the British Empire. No. 2: Nyasaland Protectorate. Edited by Dr. J. Burtt Davy and A. C. Hoyle. Pp. 111. (Oxford: Imperial Forestry Institute.) [121

Saorstát Éireann: Roinn Talmhaiochta (Department of Agriculture): Brainse Iascaigh (Fisheries Branch). Report on the Sea and Inland Fisheries for the Year 1935. (P. No. 2357.) Pp. 32. (Dublin: Government Publications Sales Office.) 9*d*. [121

Ministry of Health. Midwives Acts, 1902 to 1926. Report on the Work of the Central Midwives Board for the Year ended 31st March 1936. Pp. 12. (London: H.M. Stationery Office.) 2*d*. net. [131

The Scientific Proceedings of the Royal Dublin Society. Vol. 21 (N.S.), No. 44: Fertilization and Proembryo Formation in *Sequoia*. By W. J. Looby and J. Doyle. Pp. 457–476+plates 13–14. 2*s*. 6*d*. Vol. 21 (N.S.), No. 45: The Convection of Heat and Materials in the Stem of a Tree. By Prof. H. H. Dixon. Pp. 477–486. 1*s*. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.) [141

Other Countries

U.S. Department of the Interior: Geological Survey. Bulletin 847–B: The Rosebud Coal Field, Rosebud and Custer Counties, Montana. By W. G. Pierce. (Contributions to Economic Geology, 1934–36.) Pp. v+43–120+plates 5–21. 1.25 dollars. Bulletin 864–C: Mineral Deposits of the Ruby–Kuskokwim Region, Alaska. By J. B. Mertie, Jr. (Mineral Resources of Alaska, 1933.) Pp. v+115–245+plates 2–7. 25 cents. Bulletin 870: Geology and Ore Deposits of the Bayard Area, Central Mining District, New Mexico. By Samuel G. Lasky. Pp. vi+144+17 plates. 80 cents. Bulletin 871: Mineral Resources of the Region around Boulder Dam. By D. F. Hewett, Eugene Callaghan, B. N. Moore, T. B. Nolan, W. W Rubey and W. T. Schaller. Pp. vi+197+14 plates. 45 cents. (Washington, D.C.: Government Printing Office.) [41

Skrifter utgitt av det Norske Videnskaps-Akademi i Oslo. 1. Mat.-Naturv. Klasse, 1936, No. 7: Land-Locked Waters; Hydrography and Bottøm Deposits in Badly-Ventilated Norwegian Fjords, with Remarks upon Sedimentation under Anaërobic Conditions. By Kaare Münster Strøm. Pp. 85+9 plates. (Oslo: Jacob Dybwad.) 9.50 kr. [81

U.S. Department of Agriculture. Circular No. 408: Wireworm Infestation Trends accompanying certain Crop Rotations in the Pacific Northwest. By F. H. Shirck and H. P. Lanchester. Pp. 10. (Washington, D.C.: Government Printing Office.) 5 cents. [81

Indian Forest Records (New Series). Vol. 2, No. 1: A Survey of the Damage to Teak Timber by the Beehole Borer (*Xyleutes ceramica* Wlk.) throughout the Main Teak-bearing Forests of Burma (Lepidoptera–Cossidæ). By D. J. Atkinson. Pp. 98+12 plates. (Delhi: Manager of Publications.) 4.10 rupees; 7*s*. 9*d*. [111

The Pasteur Institute of Southern India, Coonoor. The Annual Report of the Director for the Year ending 31st December 1935, togethre with the Twenty-ninth Annual Report of the Central Committee of the Association for the Year ending 31st March 1936. Pp. 89. (Coonoor: Pasteur Institute.) [111