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## Protection of Aborigines in West Australia

ANOTHER chapter has been added to the annals, too often distressing, of the aborigines of Australia in the report on conditions in West Australia which is referred to elsewhere in this issue (p. 798). The Commissioner, Mr. H. D. Moseley, to whom the investigation was entrusted in 1934, discloses a situation which in certain respects is sufficiently grave; but happily his statement does not endorse the allegations of callousness and brutality in the treatment of the aborigines to which currency has been given.

For some time, public opinion in Australia has shown a slow but steady growth in the direction of a more rational and considered policy in the treatment of the aborigines. The movement began with the efforts of the late Dr. H. Basedow some years ago to secure substantial reserves of land, upon which aborigines still living under tribal conditions might be ensured in their liberty to range over an area adequate for the exercise of their primitive economy as 'food-gatherers' in the technical sense of the term employed by the anthropologist. Unfortunately this—in the modern view uneconomic—mode of livelihood demands a considerable stretch of undisturbed country for the support of even a small group of people, and although the policy of preserving land for the exclusive use of the native, from which white settlement is barred, of late years has been followed on the whole with consistency, constant vigilance has had to be exercised by anthropologists and others interested in the welfare of the black-fellow to protect him against those who have desired the development of the land for economic uses and to their own advantage. That these efforts have not always been entirely successful is suggested by recent representation to the authorities that the aborigines were in danger of suffering privation through being forced off their hunting grounds by encroachment on their land.

In many respects the aborigines of West Australia have been more fortunate than their fellows in other States. On the whole, conditions have favoured the survival of their tribal organisation to a greater degree than elsewhere except, perhaps, in the central area and in the Northern Territories. The growth of white settlement in West Australia until the opening of the gold fields in the latter part of the nineteenth century was slower and more sparse than in most of the other parts of Australia, and the development of the northern



area, where the nearest approach to untouched tribal conditions still exists, was late. The distinction to be drawn between conditions in the northern and southern areas of the State is clearly to be discerned in the report of the Commissioner, where there is a lamentable picture of degeneration as it occurs among the aborigines of the southern area owing to longer and closer contact with white civilisation. It is especially apparent in the pitiable situation of the half-caste, which has arisen out of the undesirable conditions attendant on the proximity of aboriginal camps to the towns.

Partly as a consequence of this late development, the problem of the aboriginal in West Australia has been approached on the whole with a greater sense of responsibility and in a more enlightened spirit than would have been possible in an earlier day. Policy has been inspired by a genuine, if not always well-directed, desire to secure the well-being of the blackfellow. That policy has been applied for some time past through officials who not only had sympathy with the native point of view, but also had knowledge of aboriginal tradition and organisation. The crux of the problem has been, and continues to be, the aboriginal spoiled by too close contact with white civilisation, who at best lives by casual employment, and on the fringe of the towns often will end by becoming a more or less permanent burden on the community.

To admit that the system of aboriginal protection in West Australia is not without its merits is not necessarily to argue that it is beyond reproach. A perusal of the report of the Commissioner on present conditions would do much to remove that illusion, even though there is a suggestion that friction between missionary and squatter may have been responsible for some of the more serious accusations which have been bandied about; while the denunciation of labour conditions on the stations as virtual slavery would appear to belong to that class of hysterical overstatement which seems inseparable from all agitation for reform. Yet, when all allowances are made, it would be difficult to frame stronger expressions of animadversion than certain sections of this report. This can be conveyed only imperfectly in a summary.

In carrying out his duties of investigation, Mr. Moseley wisely did not confine himself to the examination of witnesses, but travelled about the State to inspect conditions himself. In this way he covered some 14,000 miles within the year. On the whole, his report on conditions in the north

cannot but be regarded as favourable. The 'bush' native, he agrees, is at his best when left alone, and he recommends that in order to ensure this, the lands at present in occupation by bush tribes should be secured to them as reserves, and that further reserves should be declared, to anticipate closer white settlement. Nor does he find that conditions among the natives on the stations, whether privately owned as pastoral farms or Government-owned, are unfavourable. Occupation suited to the character and capacities of the native is open to them in pastoral pursuits. He criticises the Government stations, however, for not keeping the natives sufficiently fully employed.

In these circumstances, Mr. Moseley is by no means in favour of the policy of locating all aborigines on reserves. Throughout the report he stresses the advantage, and indeed the necessity, of finding suitable occupation for the aborigines. On the stations, they are already engaged in suitable pastoral pursuits, and the children receive a preliminary training for these pursuits in the natural order of things. Removal to the reserves, even if an attempt were then made to bring them more under the influence of the code of white civilisation, as has been suggested, "would not react to their advantage". In another section of his report, while considering the proposal in connexion with the aborigines of the southern area, he points to the overcrowding of the reserves which such removal would entail.

If Mr. Moseley finds little on which to comment in the social and economic condition of the aborigines of the north—even the so-called slavery, whereby no wages are paid, is shown to be beneficial to the native rather than an economic advantage for the farmer—the case is far otherwise when the question of health and provision of medical attention is under consideration. The lack of provision for early diagnosis and hospital treatment is made the subject of severe comment. In fairness, it must be pointed out that responsibility for the inadequacy of the measures for dealing with leprosy, which call for the most serious strictures, are not entirely those of the State, as the care of leprosy comes under the authority of the Federal Government—affording material for consideration by those who advocate that the entire responsibility for the aborigines should be handed over to Federal authority. Mr. Moseley offers certain suggestions for dealing with the provision of medical treatment; but he regards the question as one of such gravity as to



warrant the appointment of a medical man to hold the office of district protector of the aborigines.

Stricture of the lack of proper medical attention and hospital accommodation is not confined to conditions in the northern area only, though there, owing to the conditions of settlement, it presents the more serious problem. In the southern area it is a problem which can be solved by the enlargement of existing hospital arrangements, although these, it may be mentioned, are also severely criticised, both for their character and their limited extent.

Apart from the medical question, the problems of the southern area are essentially different from those of the northern area—the Commissioner notes, with a surprise that is almost naïve, the relative unimportance of the half-breed element in the north. The grave problems of the south—and they are indeed grave—are the half-castes and persons of aboriginal descent, the character of the Government settlements, and the situation of aboriginal camps in proximity to the towns. Nothing could well be stronger than the criticisms which are levelled against existing conditions. They constitute a grave indictment of the methods of administration, and call for no further comment. Here Mr. Moseley recommends what is virtually a wholesale clearance and the provision for able-bodied aborigines and the half-castes of Government farm stations, which will allow of agricultural and horticultural allotments, and give facilities for training very much on the same lines as the provision which has been made in Queensland.

While conditions such as those censured at the Moore River settlement must be attributed to lack of supervision and as such chargeable to the administration, the report recognises that the system, and not the responsible official, the Chief Protector of the Aborigines, is to blame. The Chief Protector has been chained to his office at Perth, and it has not been possible for him to perform his proper function of travelling and inspection. Much of the work of his Department, it is admitted, has been highly successful; but it is pointed out that the system of honorary protectors has not functioned, except in the granting of permits for employment.

It is evident that if, and when, the changes, administrative and other, recommended in this report are brought into effect, the Department for the Protection of the Aborigines will be a vastly more costly undertaking than it is at present. To an outside view it certainly would appear that a duty which must necessarily entail a heavy

expenditure to make it worth while at all, has suffered in performance from economy. In this connexion, perhaps, the relevant figures may be left to speak for themselves. Of all the States of the Australian Commonwealth, West Australia has by far the greatest number of aborigines under its control. They approach thirty thousand (29,021). Next come the Northern Territories (under Federal control) with 19,336, and Queensland, with 16,957. The lowest is South Australia with 3,407, and New South Wales comes next with 9,724. On the other hand, West Australia is proportionately the lowest in expenditure, her aboriginal administration costing £28,340 per annum as against Queensland, £41,128, New South Wales, £53,124 and South Australia, £23,000. While cost per head would be no fair criterion, owing to the difference in the conditions under which the natives live, for the cost of 'bush' natives is low and small numbers entail relatively heavy expense, yet when every allowance is made, the figure for West Australia seems far too low in comparison with that of other States. It would appear that undue exercise of economy has allowed the practice of the State to fall below the standard of modern policy in dealing with the aborigines.

Mr. Moseley's report is a valuable document. Its outstanding feature is its constructive character and its grasp of realities, sympathetic, but unclouded by sentiment. In this connexion, however, it must be recognised that it takes a very definite line that does not entirely coincide with the aim of those who have advocated a liberal policy in dealing with the Australian aboriginal. Only in part does it endorse the segregation of the blackfellow from white civilisation on reserves; where by contact with white civilisation native organisation has broken down, either in part, as on the stations, or has become wholly degenerate, as near towns and settlements, the measure suggested is occupation and training under supervision or protection along lines which, following present trends, eventually will make the aboriginal self-respecting and self-supporting. On no other condition does Mr. Moseley see in the degenerating blackfellow and the half-caste anything but a danger to the community. If his policy be adopted, it remains to be seen whether the difference in conditions in Australia will favour a course, which, eminently reasonable as it seems in itself, has not as yet proved an unqualified success when applied elsewhere.



## Reviews

Sir Charles Parsons

*Scientific Papers and Addresses of the Hon. Sir Charles A. Parsons, O.M., K.C.B., F.R.S.*  
 Edited by the Hon. G. L. Parsons. With a  
 Memoir by Lord Rayleigh, with Appendices.  
 Pp. xxviii+260+8 plates. (Cambridge: At the  
 University Press, 1934.) 15s. net.

THE foreword by Lady Parsons gives the *raison d'être* of this book; she did not live to see its publication. It is issued with "the hope of helping the interested reader to appreciate the genius, the perseverance and the indomitable courage of Sir Charles," she writes, and this it does completely; while the personal reminiscences of Lord Rayleigh give us a charming picture of a great inventor from many points of view. An appendix contains a complete list of Sir Charles's published papers from 1885 onwards, and in the volume are printed a number of these sufficient to illustrate the range of his activities and the development of his ideas.

The steam turbine and its story occupy the major part of the book. Sir Charles Parsons's first published utterance on the subject occurs in a discussion at the Institution of Civil Engineers on a paper on "High Speed Motors" by Gisbert Kapp in November 1885. The earliest paper printed in the volume is dated December 1887 and gives an account, read before the North-East Coast Institution of Engineers and Shipbuilders, of a turbine of early design applied to the working of dynamo electric machines. There is a gap until we come to 1897. The application of the compound steam turbine to the purpose of marine propulsion, a paper read, at the suggestion of Sir William White, to the Institution of Naval Architects, tells of the *Turbinia* and her trials during which a mean speed of 31.01 knots was obtained.

Law suits and difficulties over patents had caused delay; a cruel experience had taught Sir Charles that the path of the inventor is no smooth road; but the *Turbinia* was a great success and henceforth, with some setbacks it is true—his losses of the *Viper* and the *Cobra* in 1901, though in no way connected with the turbine machinery, were heavy blows—the tale is one of progress and marked success; the latest paper printed, an address in 1909 to Section G (Engineering) of the British Association meeting in South Africa, describes turbines of 150,000 kilowatts. The indicated horse-power of the *Turbinia* about thirty years earlier had been 1,576 horse-power.

The story, as we follow it in the inventor's own

words, is of fascinating interest, and while in this part of the volume it relates mainly to the turbine, we come from time to time on remarks of much wider application. Thus in an address to the Institution of Junior Engineers of 1899, Parsons concludes thus: "It may be remarked that in the history of engineering progress the laws of natural selection generally operate in favour of those methods which are characterised by the greater simplicity or greater efficiency whether these advantages be great or small".

These were the methods Parsons ever followed until they led him to success. His address in 1904 to Section G of the British Association deals with invention. Generally, he writes, "what is usually called an invention is the work of many individuals each one adding something to the work of his predecessors", and then after an account of the internal combustion engine, he asks, "Could not this very valuable invention have been introduced in a much shorter time by more favouring circumstances", and his reply is that "a great deal might be done". As part of his answer he discusses a matter which for long occupied his attention, the exploration by means of a deep shaft of the lower depths of the earth. The means for securing in such a shaft a pressure and temperature at which man could work are considered and the estimate is reached that a shaft 12 miles deep would take 85 years to complete, that the temperature at the bottom would be 272° F. and the cost £5,000,000. The address concludes with the statement that the value to the world of the benefits due to the tools left by inventors as a heritage to the human race has on the average exceeded by ten thousand-fold the money spent on making and introducing the inventions.

The volume contains two or three addresses of special interest. In 1919, Parsons was president of the British Association meeting at Bournemouth. The year marked the centenary of the death of Watt and thus led to an interesting comparison between the turbine and Watt's engine, to which "consuming from five to seven pounds of coal per horse-power, mankind owes the greatest permanent advances in material welfare recorded in history". Engineering and the War occupies a large portion of the address, which concludes with a reference to the work of the Department of Scientific and Industrial Research constituted in 1915.

In his address to the Institute of Physics in 1924, Parsons again deals with the inventor. He states that at one period during the War, the Boards of Invention and Research received more than 2,000 inventions and suggestions a week, of



which only a minute fraction of 1 per cent were in any way helpful, while scarcely any were of practical value—a result due to the lack of scientific knowledge and methods of thought among inventors.

In 1893 Parsons carried out a number of experiments on carbon at high temperatures and under great pressures with the view of obtaining a dense form suitable for arc lamps and the filaments of incandescent lamps. The experiments led to an attempt to produce diamonds; an account of these was given in a paper to the Royal Society in 1907, and the conclusion then reached was that in none of the experiments designed to melt or vaporise carbon under pressure has the residue contained more than a suspicion of black or transparent diamond. The experiments were continued, and Sir Charles gave a detailed account of his work to the Royal Society in the Bakerian Lecture of 1918. It is a remarkable paper, giving details of a long series of experiments in which almost every conceivable combination of pressure and temperature was tried, but with almost entirely negative results. The greatest pressures, estimated to reach momentarily about 300,000 atmospheres, were obtained by firing a 0.303 inch bullet from a rifle into a hole of the same diameter in a steel block partially filled with various substances containing carbon. In two cases "a few crystals" were formed (probably from friction). The bullet had grazed the side of the hole, producing a small quantity of molten iron. The results of all the experiments are given in an appendix, which is not printed in the volume under notice. They are chiefly negative. The few that were favourable were generally attributable to the presence of iron. This appendix is a wonderful memento of Parsons's "genius, perseverance and indomitable courage". It covers 16 pages (small print) of the Royal Society *Transactions*; it is called an abridged schedule, but it contains a record of some 290 experiments of which about 25 are stated to have shown some indication of diamonds. "A few crystals", "some crystals", "one crystal 0.5 mm. long which burnt in oxygen", "several crystal plates very like diamond" are the words used to describe these few results. In some 90 per cent of the experiments the result is "Nil", meaning no diamond formed.

The volume concludes with an account of the auxelophone by Mr. Carnegie, an instrument for augmenting sounds used in 1906 by Sir Henry Wood in his orchestra, and some details of Parsons's work in improving optical glass.

In these pages, we see Sir Charles as a great inventor; to realise the man we turn to Lord Rayleigh's delightful memoir. They met at a garden-party in Cambridge during the British

Association meeting of 1904, and some six years later their friendship led to a visit to Parsons's home at Ray. Lord Rayleigh gives an amusing description of his untidy study with a writing table in the window, from which Lady Parsons occasionally removed cigarette ends, burnt out matches, etc.; no housemaid was allowed to touch it; in one corner a gorgeous casket presented to him when made a freeman of the city of Newcastle; on a table at the side a cage containing a white cockatoo, sometimes a trial to his visitors, never to its owner; on the table in the centre of the room a litter of books and papers; but no bookcase and no adequate collection of books of reference, either in the house or in his room at the works; a few simple tools, but no workshop.

There is an instructive story from a Cambridge contemporary, a fellow oarsman in the Lady Margaret boat of 1878. One day after a training breakfast, he told the crew he had an engine which is going to run faster than any engine to-day. To the reply "Rot", he produced a paper model, and when he blew into it the wheels flew round; the oarsmen were not interested and to show their contempt put Parsons and his engine under the table, a foretaste of the reception the first turbine was to receive and of the struggles of its inventor. Another story illustrates his treatment of a difficulty which threatened to be disastrous. It was the morning on which the *Viper* was to run her official Admiralty trial. After a preliminary run, the crew struck for higher wages. Parsons knew his own mind, and the men walked off the ship. He collected a casual crew from the quay, borrowed some men from the firm which had built the boilers and the hull, and with this scratch crew the *Viper* ran her trial and did 37 knots.

Though 11th wrangler at Cambridge, in later life Parsons never used his mathematics to solve a problem. When invited to listen to some analytical solution, he would say: "I like something geometrical. I never was very good at analysis and now I have forgotten all I knew".

There is much more of interest in these intimate reminiscences. Like most inventors, Parsons was alive to the importance of maintaining a secret until properly protected; hence a bottle of some harmless preparation of carbon was labelled 'ARSENIC', and a simple wooden model of a propeller hidden behind his books. He was usually inclined to be silent and listen to what others had to say to him; sometimes he would speak, and as when on one occasion, after discussing some question relating to engines with a naval officer, a chance acquaintance at the club, the latter afterwards inquired, "Who is that contradictory old gentleman? He seems to think he knows more about the engines of my ship than I do myself".



Parsons hated to be beaten. Some of his friends, Lord Rayleigh among them, thought there was little prospect of success in the elaborate experiment on the diamond: his reply when this view was put before him was: "I think it ought to be tried." The trials were expensive. Dr. Stoney estimated that they had cost £30,000. Parsons's reply was, "We have now made a bit of money and deserve to have some fun". Within a few days of his death, he had dwelt on his hopes of having a shot at the 200-inch mirror for the proposed great telescope at Pasadena.

Lord Rayleigh tells us that his purpose has been to bring before the readers of the volume the personality of one of the greatest figures in the engineering world of this or any other time. For his successful picture he has well earned the congratulations and the thanks of his readers. Our thanks too are due to the Hon. G. L. Parsons for his skilful editing of this selection of the papers of his distinguished uncle. R. T. G.

### Manometric Methods in Biology

*Manometric Methods: as Applied to the Measurement of Cell Respiration and other Processes.* By Dr. Malcolm Dixon. Pp. xii+122. (Cambridge: At the University Press, 1934.) 5s. net.

MANOMETRIC methods have long been used in biology, and when one considers that the earliest specimens of the two principal types of instruments dealt with in the book under review were devised by Barcroft and Haldane so long ago as 1902 and 1908 respectively, it might perhaps appear inappropriate to call the manometric method an essentially new one. Only during the last decade, however, have manometers become so important in many different branches of medical and biological science. The reason for this, as Sir Frederick Gowland Hopkins points out in his foreword, is to be found in the fact that the method has in that time been especially developed for the study of the time course of chemical processes, in homogeneous media as well as in more complex systems containing cells or cell-associations. In many of the fundamental chemical reactions of living cells, such as respiration, assimilation of carbon dioxide or nitrogen and many fermentations, gas exchange takes place; in others it is possible to bring about such exchanges by suitable procedure, as for example, the liberation of carbon dioxide from media containing bicarbonate as a result of lactic acid formation in glycolysis.

The main advantage of these methods for biological research is that many phenomena of cellular metabolism can be studied without

necessarily interfering with life and growth; it is especially important that many of the fundamental chemical processes occurring in animal organs are kept intact in sections of tissue. The tissue slice method is one of the many improvements of technique initiated by O. Warburg; but, independently of the development of the method in his laboratory, workers from the Cambridge School of Biochemistry, Dr. Dixon among them, had used the Barcroft differential manometer for the study of reaction rates. Much of the experience gained in this work has never before been published, and it is therefore appropriate that the detailed account of both the theory and the practical application of the differential manometer takes a prominent place in Dr. Dixon's book.

It is difficult to give a more fitting appreciation of the book than that expressed in Sir Frederick Gowland Hopkins' foreword, and it may therefore suffice here to state that it gives a complete survey of the principal types of instruments and methods as well as a critical assessment of their merits and shortcomings. There is no doubt that the book will be of great help to all present and prospective users of manometric methods. H. B.

### Antarctic Foraminifera

"Discovery" Reports. Issued by the Discovery Committee, Colonial Office, London, on behalf of the Government of the Dependencies of the Falkland Islands. Vol. 10. *Foraminifera*, Part 3: *The Falklands Sector of the Antarctic (excluding South Georgia)*. By Arthur Earland. Pp. 208+10 plates. (Cambridge: At the University Press, 1934.) 37s. 6d. net.

THE third part of this great monograph on the Foraminifera collected by the Discovery expedition deals with the area called the Falklands sector of the Antarctic Ocean exclusive of the South Georgia waters. It lies south of the convergence line where the cold Antarctic water meets the warmer water of the subantarctic area.

It was shown in the first part of the monograph that in the Falkland Islands area, north of the convergence line, there are several species of Foraminifera that are characteristic of the Pacific ocean, and in the second part that in the shallow waters round South Georgia there is no evidence of this Pacific influence.

In the Antarctic sector the Pacific species were more numerous than might have been expected and in addition to several new species, fully described in this part, there were thirteen species which seem to have a purely circumpolar distribution.

One of the most interesting results of this



investigation is the discovery of a very well-marked difference between the foraminiferous fauna of the Bellingshausen Sea and the Weddell Sea. These two seas are separated by the long tongue of land, called Graham Land, which projects northwards in the direction of Cape Horn. If in the comparatively recent geological times there was a land barrier across what is now Drake Strait, this difference in the foraminiferous fauna between the two seas separated by Graham Land may be accounted for, and the absence of Pacific forms from the South Georgia seas may be due to the diversion of the drift northwards by Graham Land

and the comparatively shallow waters immediately north of it.

These are only some of the general considerations which form a distinguishing feature of this important report, and it should prove to be of considerable interest to many workers in other fields of marine zoology as well as to systematists of the Foraminifera.

The third part of the report fully maintains the high standard of excellence set by those that have preceded it, as regards the detailed analysis of the dredgings, the description of the species and the very beautiful illustrations.

### Short Notices

*Tollens—Elsner Kurzes Handbuch der Kohlenhydrate.* Vierte, völlig neubearbeitete Auflage, von Dr. Horst Elsner. Pp. xxii+627. (Leipzig: Johann Ambrosius Barth, 1935.) 39 gold marks.

DR. ELSNER has undertaken the formidable task of reviewing the literature on carbohydrates to the end of 1933, and compressing the material into one volume. This has involved the curtailment or omission of many important topics, such as the glycosides, the biochemical transformations of sugars and technical processes, all of which have been dealt with by experts in recent monographs. The number of compounds described is so great that relatively little space has been available for the critical examination of theories. Nevertheless, properties or reactions which are known to be of fundamental importance in the elucidation of molecular structure have been discussed in considerable detail, and the text has been amply supported by references to original papers at the foot of each page.

Among topics of theoretical interest which are briefly described are stereoisomerism and nomenclature, ring-chain tautomerism, enzyme action, the synthesis of monosaccharides and the investigation of molecular configuration. Monosaccharides occupy the largest section and among these *d*-glucose is naturally prominent. In discussing structural problems, the author stresses the importance of the brilliant studies in methylation by Howarth and his colleagues. Turning to the polysaccharides, it is pointed out that there is general agreement as to the nature and mode of linking of the units in the chain of cellulose. Chemical evidence is here supported by X-ray measurements. The actual length of the chain in the macro molecule is not so simple a problem to settle, and different methods give somewhat different results at present. From chemical evidence Haworth and Hirst have calculated that the chain contains between 100 and 200 glucose units. This result is in fair agreement with that of Stamm, which is based on measurements of the velocity of sedimentation in the ultra-centrifuge, and those of H. Mark and K. H. Meyer, derived from X-ray measurements, while Herzog's osmotic data point to rather higher

values. On the other hand, Staudinger's viscosity determinations, which are less general in application and perhaps more empirical in character, generally give still higher values.

The volume is well printed and annotated and should prove to be a valuable work of reference. At the end will be found a useful chart showing clearly the configuration of the various aldoses and the corresponding alcohols and acids.

*Air Ministry: Meteorological Office. The Meteorological Observer's Handbook, 1934 edition.* (M.O. 191.) Pp. viii+152+32 plates. (London: H.M. Stationery Office, 1934.) 5s. net.

THE previous edition of this useful handbook appeared in 1926. In the present edition the most important change occurs in the section on clouds, which has been revised in the light of the new "International Atlas of Clouds and States of the Sky" published in 1932. There are also modifications relating to observations of the state of the ground and to the scale of velocity equivalents of the Beaufort numbers as derived from records of anemometers exposed at abnormal heights above the ground. Like the "Meteorological Glossary", the "Observer's Handbook" in its special function of giving instructions for the taking of routine observations, both instrumental and non-instrumental, at climatological stations is encyclopædic in scope. We are not sure that the various kinds of precipitated or deposited moisture are in every case so clearly defined as could be desired. Thus though it is implied that 'drizzle' is fine rain, that is, rain consisting of very small drops, and may be heavy, moderate or slight, there seems to be a tendency in official practice to look upon drizzle as a distinct species of precipitation from rain, instead of as one of many varieties of rain which it really is. Snow also may fall in fine 'drizzling' particles. Then surely the most obvious difference between hoar-frost and rime is that the latter, which is frozen fog-drip, collects copiously on leafless twigs and branches of trees.

As suggestions for improvements are asked for in the preface, we should like to recommend fuller and



wider instructions for observing the sky and its portents. In these days when official meteorology is becoming so intensively developed, scarcely enough attention is being paid to open-air or landscape meteorology. We believe that even official forecasters will see the danger inherent in the growing attitude of mind typified by the countryman who, when asked what he thought about the weather, replied that he had not heard the 'wireless'.

L. C. W. B.

*Automatic Protection of A.C. Circuits.* By G. W. Stubbings. Pp. viii+293. (London: Chapman and Hall, Ltd., 1934.) 15s. net.

THE subject of the automatic protection of electrical circuits and systems has grown to great importance, this being very largely due to the growth in size of transmission systems and distribution networks. The present book discusses at some length the theory of protective transformers, relays and their inter-connexion, and a great deal of useful information is given. The work is presented in a very clear, but not too mathematical a manner, plentifully illustrated with simple line diagrams.

The chapter on symmetrical components is extremely valuable. The introduction of a vector operator which imparts rotation through  $120^\circ$  is, of course, a development of the original Steinmetz notation. It is, however, necessary that the fundamental principles should be clearly presented, and in this connexion it is unfortunate that a loose statement should have crept in at the bottom of p. 81. It is there stated that "the phase voltages, between lines and neutral of a three phase system . . . form a closed triangle". This is not generally true, as can be seen at once if the case be considered where there is a short-circuit between one line and the neutral. With a little amplification the statement could be corrected.

Further chapters on protection of electrical machinery, cables and transmission lines, and the testing and maintenance of protective gear follow, and a useful bibliography and glossary of terms are given.

The work can be thoroughly recommended to all those whose work brings them into contact with the protection of A.C. circuits.

P. K.

*Reports of the Progress of Applied Chemistry.* Issued by the Society of Chemical Industry. Vol. 19, 1934. Pp. 840. (London: Society of Chemical Industry, 1935.) 12s. 6d.; to Members, 7s. 6d.

THE publication of this annual volume of reports is an event which few chemists allow to pass unnoticed. Indeed, it marks an annual opportunity, particularly valuable to those whose duties prevent frequent contact with colleagues working in other spheres and whose close perusal of current literature is necessarily confined to their own vocational interests, to bring up to date their general knowledge of progress in the principal branches of chemical industry. The twenty-six chapters comprising the reports for 1934 have been entrusted to authors whose competence to assess relative values and to make informed comment is

unquestioned, and the abundance of references to original sources of information gives the book the status of a permanent work of reference. It is not easy to select any part as meriting exceptionally honourable mention; nevertheless, Dr. E. Stedman should be congratulated on his detailed discussion of the chemistry of the hormones and vitamins, whilst the chapter on intermediates and colouring matters, contributed by Dr. E. H. Rodd and Dr. S. Coffey, is a masterpiece of thoroughness and compression. The first report, entitled "General, Plant, and Machinery", is attractively written; the section on explosives covers the period 1933-34.

A. A. E.

*An Introduction to the Modern Theory of Valency.*

By Dr. J. C. Speakman. Pp. vi+157. (London: Edward Arnold and Co., 1935.) 4s. 6d. net.

DR. SPEAKMAN'S book is an unpretentious volume, in which he has been content to give his own impressions of modern valency theory, without necessarily indicating the sources of the views assimilated for this purpose. The resulting blend is, however, on the whole well-balanced and satisfactory, and is presented in a clear and attractive form. Special interest attaches to a chapter of twelve pages on "The Application of Wave Mechanics to Valency Problems", since these conceptions are fundamental to all modern theories of valency. The chapter is written in simple language and contains much that is suggestive. It is a matter of regret to the reviewer that the scope of the book did not justify an extension of this chapter to include the explanation of quantum numbers and the interpretation of Pauli's exclusion principle on the basis of wave-mechanics; but such an exposition demands an advanced knowledge of quantum theory, which very few chemists possess, and it is therefore probable that it must be left to a chemically-minded physicist to interpret these conceptions to them.

T. M. L.

*Birds of Great Britain and their Natural History.* By

W. P. Pycraft. Pp. 206+17 plates. (London: Williams and Norgate, Ltd., 1934.) 7s. 6d. net.

TO the student who wishes to identify the birds of the British Isles, this book has no message; indeed it mentions by name only a very small proportion of the birds of Britain, and in this respect its title is misleading. But it brings together and classifies from a natural history point of view many odd items of information difficult of access to the majority of amateur ornithologists, yet needful for an intelligent interest in the structures and habits of our birds. The treatment of the facts is suggestive and speculative, and while speculation appears to the reviewer to be sometimes hasty and information occasionally inaccurate, there is great merit in the way in which unsolved problems are openly laid upon the table. Works of this type are much needed, since they may suggest to the amateur naturalist lines along which he may still make valuable contributions to science, at a time when the niceties of the racial discrimination of British birds have almost barred him from a field where once he held his own.



## The Approach to the Absolute Zero \*

THERE is no upper limit to the temperatures which could conceivably be reached; in marked contrast to this, there is on the low temperature side a sharp boundary at  $-273.1^{\circ}\text{C}$ .—the absolute zero of temperature. The boiling point of the most volatile gas, helium, lies about  $4^{\circ}\text{C}$ . above this limit; by reducing the pressure over liquid helium, it is easy to reach a temperature of  $1^{\circ}\text{K}$ ., whilst  $0.7^{\circ}\text{K}$ . has been attained by the use of extremely powerful pumps. The contrast between the ease with which a high temperature can be generated—an electric torch is an example—and the complicated apparatus necessary to obtain a low one, is striking. It is due essentially to the fact that when a substance is heated there is not only an increase in its energy, but also in the internal disorder among its particles. In illustration, there is complete disorder in a gas, whereas a substance cooled sufficiently to cause it to crystallise has its constituents arranged with a high degree of order. In all affairs, it is easier to decrease order than to increase it; it is highly improbable that shaking a tray containing a number of black and white balls would increase the regularity of their arrangement.

In the last example, the orderliness depends on one variable only; the possibility of attaining low temperatures depends on the fact that the orderliness among the molecules of real substances is governed by more than one variable. Consequently, orderliness introduced by the agency of a change in one variable, say, the volume, has its effect on the other variables, such as the temperature. From this point of view, a method commonly used for liquefying helium operates as follows: as the gas is compressed, the decrease in volume tends to increase the order, so that the disorder due to the heat motion has to increase; in other words, the temperature rises. The compressed gas is now cooled, which increases the total order again, and when it expands again, the resulting decrease in order due to volume must be compensated by an increase in the thermal orderliness, that is, by a fall in temperature.

In the practical application of this method, starting at moderate temperatures, the cooling effects obtained are quite small, owing largely to the overwhelming heat capacity of the container. At low temperatures this difficulty disappears, since, for example, at  $12^{\circ}\text{K}$ ., 1 c.c. of helium gas at 100 atmospheres has the same heat capacity as 1 kgm. of copper.

Fig. 1 is a diagrammatic sketch of the actual

apparatus used for liquefying helium and for reducing its temperature after liquefaction. The helium is contained in *C*, *D* being the liquid hydrogen bath, and the space *S* being evacuated. The vessel *E* can be filled with liquid helium through the tube *T*, and is of a shape suitable for applying a magnetic field to its contents. By lowering the pressure in *E*, the temperature can be brought down to about  $2^{\circ}\text{K}$ . The gas thermometer is represented by *G*.

At very low temperatures, the gas thermometer is impracticable and one other means of measuring temperatures is to utilise Curie's law, according to which the susceptibility of a paramagnetic substance is inversely proportional to its absolute temperature. This method has the great advantage that it increases in sensitivity as the temperature is lowered.

It has already been remarked that the lowest temperature reached by decreasing the temperature over liquid helium was about  $0.7^{\circ}\text{K}$ . No substantial progress is to be anticipated by this method, and we have to seek some other disordered systems than gases on which to operate. Such systems are to hand in the paramagnetic salts mentioned above. In them, there are elementary magnets which, owing to the thermal agitation, are directed at random. When a magnetic field is applied, the magnetic orderliness is increased, so that the thermal order decreases, that is, the temperature rises. If the substance is now cooled by contact with its surroundings, so as to increase the total order, and the field afterwards removed, order is transferred from the magnetic to the thermal mode, and the temperature falls again. This method was proposed by Debye and Giauque about ten years ago, and has been successfully used in recent years by Giauque, de Haas, and K rti and Simon.

Iron ammonium alum, with a field of 14,000 gauss, gives by this method temperatures down

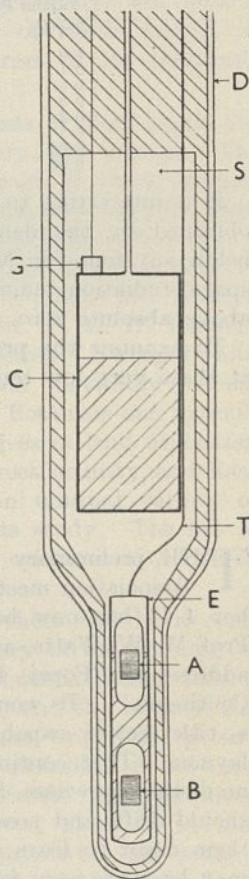


FIG. 1.

\* Substance of a discourse delivered at the Royal Institution by Dr. F. Simon on Friday, February 1.



to 0.04° K., whilst with potassium chromium alum, and the large magnet of the Leyden laboratory, de Haas has reached 0.015° K.

Insulation at these temperatures is an easy matter, since radiation becomes negligible, whilst the vacuum round the substance is very high on account of the low temperature itself. This is illustrated forcibly in the accompanying table, which shows the vapour pressures of helium (the gas with the highest vapour pressure) at various temperatures.

Vapour Pressures of Helium	
$T$ (°K)	$p$ (mm.)
1.0	$1.5 \times 10^{-1}$
0.7	$3.2 \times 10^{-2}$
0.5	$2.5 \times 10^{-3}$
0.3	$7 \times 10^{-10}$
0.2	$3 \times 10^{-13}$
0.1	$3 \times 10^{-21}$
0.05	$4 \times 10^{-32}$
0.03	$6 \times 10^{-103}$

It is interesting to note that the temperatures obtained by the demagnetisation technique are below any found in Nature. Even in inter-stellar space, radiation maintains a body at least 2° K. above absolute zero.

To examine the properties of other substances at these very low temperatures, a small pellet is

made by mixing the substance to be examined with the paramagnetic salt. By this means, several new supra-conductors have been discovered, though even at 0.05° K. there are metals which do not show supra-conductivity. Again, it immediately becomes evident if the specific heat of the admixed body is abnormal, and consequently gives an indication of any phenomena involving energy changes in this region.

Finally, it must be emphasised that research in this low temperature region will be productive of fresh results; the effort to progress towards the absolute zero is not merely directed to the creation of fresh 'records' but to actual study of changes associated with energy increments of such magnitude that only in this region can they be observed.

During the course of the lecture, the liquefaction of helium by the method explained above, of compressing the gas to 100 atmospheres, cooling it to 12° K. with solid hydrogen and then allowing it to expand, was demonstrated. The phenomenon of supra-conductivity in lead was shown at the temperature of the liquid helium, the current being produced and its existence shown by magnetic means.

### Norwich Meeting of the British Association

THE preliminary programme of the British Association meeting in Norwich on September 4-11 has now been issued. The president, Prof. W. W. Watts, announces the subject of his address as "Form, Drift, and Rhythm of the Continents". It would be difficult to conceive a title better capable of intriguing thoughtful laymen. That continents possess form they will no doubt appreciate, but the ideas that continents should drift, and possess rhythm, ought to make them eager to learn. It is to be hoped that it may be made easy for them to do so, for, to say truth, the Association in its endeavours in recent years to apply the advancement of science to the needs of its members, by reinforcing the voices of presidents through amplification, has been singularly ill-served as a rule.

The building in which the address will be given is not yet settled, but the other rooms which will be in use by the Association are very conveniently placed. In St. Andrew's Hall, formerly the fifteenth century church of a Dominican foundation, the business of the Reception Room will have a most imposing setting. None of the section rooms is so much as half a mile from it; seven of them are immediately adjacent to it. Norwich, once the visitor has learned the intricacies of its medieval streets, is unusually well provided with the type

of accommodation demanded by the Association. As for the lodging of visiting members, the local committee, foreseeing some possibility of difficulty if members were left to make their own arrangements, offer to procure hotel or other accommodation for them, and indeed advise them not to communicate with hotels direct. In this connexion it should be remembered that those who wish to combine a holiday with the meeting, and are not too closely tied by the business of the Association, have unusual opportunity to obtain pleasurable accommodation elsewhere than in the city. The preliminary programme includes a long list of hotels (with prices) at Bacton, Caister, Cromer, Gorleston, Yarmouth, Holt, Lowestoft, Mundesley, Overstrand, Scole, Sheringham, West Runton and Wroxham, as well as in Norwich itself.

The two customary evening discourses are announced. That by Dr. S. J. Davies will deal with Diesel engines in relation to coastwise shipping—a subject of topical interest (as it may be surprising to some to know), for the number of coastwise trading vessels which make their way up-river to Norwich has increased of late years. The other discourse will enter a field of still wider public interest: Dr. C. S. Myers will speak on the help of psychology in the choice of a career.



The programme announces a distinguished series of addresses by the sectional presidents. Dr. F. W. Aston will speak in Section A on the story of isotopes. The address in Section B, by Prof. W. N. Haworth, will introduce a discussion on the molecular structure of carbohydrates. Prof. G. Hickling in the geological section will deal with some aspects of coal research. Prof. Balfour-Browne's address to Section D will be on the species problem. The geographical section will follow its president, Prof. F. Debenham, to the polar regions. Prof. J. G. Smith will give the address in Section F on economic nationalism and foreign trade. Mr. J. S. Wilson's address to the engineers will be on the stability of structures. In view of the regretted indisposition of Sir Cyril Fox, who was to have presided over Section H, the Association is fortunate indeed to have enlisted the services of Sir Arthur Smith Woodward, who, as it happens, has not previously presided over that Section; he will address it on recent progress in the study of early man. The address to the physiological section will be given by Prof. P. T. Herring on the pituitary body and the diencephalon; that to Section J (Psychology) by Dr. Ll. Wynn Jones on personality and age; and Section K (Botany) will hear Mr. F. T. Brooks on some aspects of plant pathology. Dr. A. W. Pickard-Cambridge's address to Section L (Education) will deal with education and freedom, and Dr. J. A. Venn will speak to the agricultural section on the financial and economic results of State control in agriculture.

It is well known that last year, in preparation for the Aberdeen meeting, the Council of the Association issued to the organising sectional committees a reasoned statement inviting their special attention to subjects bearing upon the relations between science and the welfare of the community. Good effect was given to this request, and the results were favourable in respect of the additional public interest aroused by the meeting, while the daily and non-technical Press showed its appreciation of the choice of material provided for it by noticeably avoiding trivialities of its own creation. This year the Council reminded the committees of its previous memorandum, and brought these considerations to their notice; and already there is no lack of subjects of public interest in the Norwich programme. The Association is to make striking use of its mechanism for joint sectional meetings in bringing together engineers and psychologists to discuss the application of science to traffic problems. Among other subjects which may be instanced in this connexion are those of noise and of lubrication in Section A; Section D will find itself near enough to the east coast to continue its practical interest in the

herring; Section E will consider local town-planning and land utilisation. Section F has its usual array of important economic problems for discussion, and will also deal with the chronology of the world crisis, on which a committee of the Association will shortly publish a full report. Hearing and aids to hearing will be considered by the Sections of Physiology (I) and Psychology (J); the place of psychology in the training of teachers by Sections J and L (Education). Section L will stage demonstrations illustrating physical education. Section M (Agriculture) will base a discussion on the results of State control in agriculture upon the address of its president, Dr. Venn.

The local scientific interests of East Anglia are great and varied, as is very well known. The geologists will be within reach of classic ground for glacial geology, and none will willingly miss the unusually valuable opportunity offered by a few days' tour of coastal and inland sections in Norfolk from Hunstanton to Cromer and Bacton, under the guidance of Prof. P. G. H. Boswell, immediately before the meeting. Geologists and anthropologists together will inevitably discuss early man in East Anglia. Botanists and agriculturists will interest themselves in land utilisation in the unique area of the Breck country, and East Anglia offers Section M an unusual variety of agricultural activities for its study. The list of proposed excursions offers evidence of all these interests and more besides.

In Section D (Zoology) there will be a commemoration of the centenary of the landing of Darwin in the Galapagos Islands (which falls a few days after the meeting) and the birth of the Darwinian hypothesis of the origin of species. For the Association, as the custodian of Darwin's home at Downe, such an occasion is appropriate for remembrance. Moreover, there is in this subject a throw-back, so to say, to the last meeting of the Association at Norwich, in 1868; for J. D. Hooker was the president of the Association then, and had much to say of Darwin, while in Section D the Rev. M. J. Berkeley as president paid high tribute to him, though the voice of another clerical speaker was still uplifted in doubt, and associated the varieties of forms and species with "laws of nature inscrutable to us".

An evening reception by the Lord Mayor and Lady Mayoress (Mr. and Mrs. P. W. Jewson) is announced to take place in the Castle Museum, and a statelier setting could scarcely be found elsewhere. H.M. Lieutenant for Norfolk, Mr. Russell J. Colman, and Mrs. Colman, will give a garden-party in the beautiful grounds of Crown Point.



## The Royal Academy Exhibition

IT is always of interest to the student of natural science to see the impression which the objects of his study produce upon the artistic eye. In respect of the range of nature study at the Royal Academy there is, however, a lamentable falling off in the matter of natural history. With the exception of Mr. Peter Scott's "Barnacle Geese in April" (210) there is scarcely anything of note, and the almost total absence of studies of big game, notably of the great carnivora, is very disappointing. Yet the material is not lacking, for there is a remarkably fine exhibition of contemporary big game pictures in a neighbouring gallery, not "mere transcripts of the objects of Natural History" but true artistic compositions.

Landscape, however, continues to be well represented. There is a large number of pleasing pictures of English scenes in which architecture provides the focal feature amidst natural surroundings. In the verdant landscape of the English plain a village church or a distant cathedral provides the artist with the massive and formal element which is lacking in a country from which the harder rocks are absent. Again, in the hilly landscapes we find studies such as that by Mr. Stanley Royle of "Mont Orgueil Castle, Jersey" (265), in which an architectural feature crowning an eminence develops the rocky forms to a pitch of steepness and a regularity of symmetry towards which Nature seems to strive but never quite attains. Such examples of artistic treatment provide a valuable lesson for the scientific observer, for the artistic outlook is more in accordance with the natural faculties of the eye than that which results from classifying objects by their physical qualities.

Among the most pleasing illustrations of the combination of architectural and natural features are those of bridges, with massive piers and arches spanning smoothly flowing water. In "A Welsh Bridge" (189) by Mr. Oliver Hall, the

combination is enhanced by a rocky background which harmonises with the massive masonry. This picture brings home very forcibly the need for scheduling such structures as ancient monuments for preservation, a lesson emphasised by Mr. Charles Cundall's beautiful picture of a sad event, "The Demolition of Waterloo Bridge" (447).

In the illustration of the seasons, the Academy will greatly miss the late Mr. J. Farquharson's snow studies, of which, however, the present exhibition contains one small example, "In Glen Garry" (558).

In natural scenery the mode of illumination is scarcely less important than the features themselves, and we are indebted to Mr. J. Olsson for his beautiful study of moonlight—"Moonlit Surf: Irish Coast" (297). There is also one very fine study made in the deepening darkness of the night, "Santa Maria della Salute, Venice" (532), the diploma work of Mr. Richard Sickert.

Mr. A. E. Kelly's "Mount Sefton, New Zealand" (669) is one of the few pictures of the scenery of distant lands. The want of studies of tropical scenery will be particularly felt by those who can recall the magnificent sunset effects in the equatorial belt.

Among the portraits are several of personal interest to the scientific community. Mr. Francis Dodd's "The Lord Rutherford of Nelson, O.M." (1207) is a strong drawing of a strong face. Mrs. Dodgson's drawing of the late Prof. H. H. Turner (1253) renders admirably the quiet humour of the eyes beneath a thoughtful brow. Mr. Augustus John has portraits of Lord Conway of Allington (284) and Prof. J. C. McLennan (288). Mr. George Harcourt gives us a portrait of Colonel R. E. B. Crompton (368) which reveals a vigorous personality, and in Sir James Crichton-Browne by Mr. Oswald Birley (314) we see a fine rendering of calm and thoughtful reminiscence.

VAUGHAN CORNISH.

## The Royal Jubilee

### ADDRESSES FROM THE ROYAL SOCIETIES OF LONDON AND EDINBURGH

IN addition to the messages of devotion and loyalty sent to the King from civic and governing authorities of the Empire at home and overseas, expressing congratulations to His Majesty upon the celebration of the silver jubilee of his accession, addresses were presented by a number of representative scientific societies. The addresses

submitted by the Royal Societies of London and Edinburgh are reprinted below.

TO THE KING'S MOST EXCELLENT MAJESTY

May it please Your Majesty,

We, Your loyal and dutiful subjects, the President, Council and Fellows of the Royal Society, humbly



beg leave to offer Your Majesty, the beloved patron of our Society, our respectful congratulations upon the completion of the twenty-fifth year of Your Majesty's reign.

The Royal Society of London since its foundation by King Charles the Second, has continued, under the illustrious patronage of each of Your Majesty's predecessors, to devote itself to the Promotion of Natural Knowledge, for which it was founded. During Your Majesty's reign, the advance of Science has exercised an ever increasing influence on human thought, and, in its practical applications, on the material conditions of man's life and activities. The Royal Society is proud to think that, with Your Majesty's continued patronage and approval, it has remained the centre for the recognition and promotion of the work of Your Majesty's subjects for the Advancement of Science throughout Your great Empire.

The Royal Society accordingly claims the proud privilege of being permitted to offer this loyal tribute of esteem to Your Majesty, on behalf of men of Science, not only in the Mother Country, but also throughout the Empire. It is offered in the earnest hope that Your Majesty, with Her Most Gracious Majesty the Queen, may long continue to reign over Your devoted and loyal subjects.

On behalf of the Council and Fellows of the Royal Society.

#### TO THE KING'S MOST EXCELLENT MAJESTY

May it please Your Majesty,

We of the Royal Society of Edinburgh bring to Your Majesty and to Her Most Gracious Majesty the Queen our humble and hearty congratulations on the happy issue of the five-and-twenty years during which Your Majesty has ruled over a loyal and devoted people.

These years of Your Majesty's reign mark a great epoch in History. War has shaken the world and changed the lives and thoughts and circumstances of men. But the devotion of the people to Your Majesty's Throne and Person has deepened and strengthened through all the changes and tumults of the age.

In this Royal Society the Natural and Physical Sciences are our daily occupation and task. Never have these Sciences flourished more than under Your Majesty's protection nor have they ever been more diligently applied to the service and advantage of mankind. Now for the first time in all the world men go their daily journeys above the clouds: all nations and languages send speech and music through the air: and Your Majesty's voice is grown familiar in Your people's ears even to the ends of the earth throughout Your world-wide Empire and Dominions.

And that Your Majesty may long be spared in health and wealth to live and reign this Society will Ever Pray.

#### Obituary

SIR JOHN ROSE BRADFORD, BART., K.C.M.G., C.B.,  
C.B.E., F.R.S.

THE death of Sir John Rose Bradford, on April 7, after some months of increasing disability, will be deeply regretted in many scientific circles. Born in London on May 7, 1863, as the son of Abraham Rose Bradford, a naval surgeon, he was educated at University College School, University College, and University College Hospital, London, and had a brilliant career as a student, published physiological papers before he became qualified medically, and was specially interested in biology. His papers, however, were mainly physiological, and covered a wide field: on the electrical phenomena associated with secretion; on the innervation of the blood vessels; and particularly on the renal function, which he later extended to the subject of uræmia and disease. He probably hesitated about his life's work, whether strictly scientific work or medicine, for he was elected George Henry Lewes student in physiology in 1888, his predecessors being C. S. Roy (1879), L. C. Wooldridge (1882), and C. S. Sherrington (1884), and his immediate successors G. N. Stewart and E. H. Hankin jointly (1889). The decision was made when he accepted accelerated appointment as assistant physician to University College Hospital. His physiological researches gained him the fellowship in 1894 of the Royal Society, of which he was later secretary (1908-15). He thus, like his teacher,

Sydney Ringer, combined the attitude of an all-round biologist with that of a practising physician.

At the Royal College of Physicians of London, Sir John was elected a fellow in 1897, gave the Goulstonian lectures on the pathology of the kidneys (1904), the Croonian lectures on Bright's disease and its varieties (1920), the Lumleian lectures on the clinical experience of a physician during the campaign in France and Flanders in 1914-19, and the Harveian oration (1926) on the debt of medicine to the experimental method of Harvey, which may be read as supplementary, and as showing the other side of the shield, to the debt of science to medicine, the subject of Sir Archibald Garrod's Harveian oration of 1924.

Though a general physician, as shown in his Lumleian lectures, Sir John was best known for his work on kidney disease; he wrote standard articles in the second edition (1908) of the "System of Medicine" (Allbutt and Rolleston) on the general pathology of the renal functions and on nephritis, and a special form of nephritis became known as "Rose Bradford's kidneys". In the same "System" he also gave the accounts of diabetes insipidus and gout, the latter being a revision of the original article by Sir William Roberts, whose niece he married in 1899. He brought out a small work "Clinical Lectures on Nephritis" (1898), but, though he had plenty of material, he never, from the number of other activities, had time or perhaps the inclination



to write the treatise he could have done so well.

Among Sir John's many official appointments were that of professor-superintendent of the Brown Institution, Wandsworth, in his comparatively early life; member of the Mosley Commission (1904) to study educational methods in the United States of North America, for which he reported on the relations of hospitals to medical schools, clinical laboratories, and the teaching of medical pathology; senior medical adviser to the Colonial Office, the Medical Department of the Admiralty, and the Grocers' Company; chairman of University College Committee; senator of the University of London; president of the London and Counties Medical Protection Society, and a member or chairman of numerous committees. Most conscientious, un-

obtrusively modest and endowed with a marvellous memory, he was an ideal chairman, and nowhere was this better shown than when president of the Royal College of Physicians of London (1926-31). It may well be said of him as a man that he earned "honour, love, obedience, troops of friends".

HUMPHRY ROLLESTON.

WE regret to announce the following deaths:

Prof. Auguste Marie, professor of microbiology in the Institut Pasteur, Paris, known for his work on rabies, cancer and tetanus, on March 30, aged seventy years.

Mr. J. Milton Offord, president of the Quekett Microscopical Club, on May 4, aged seventy-four years.

## News and Views

### The Royal Jubilee Broadcast

THE birth and development of modern radio broadcasting are not least among the items of progress in our civilisation, which have taken place during the twenty-five year period the termination of which was commemorated last Monday by the Royal Jubilee celebrations. An excellent example of the present possibilities of broadcasting technique was provided on this occasion by the special programme from the B.B.C. stations, which enabled listeners in all parts of the Empire to visualise the scene in London, including the crowds, decorations and the Royal procession, and to participate in the thanksgiving service held in St. Paul's Cathedral. The issue of the *Radio Times* of May 3 contains an illustrated description by the Outside Broadcast Director of the B.B.C. of the arrangements which were made to carry out this programme. Special microphones, with local control points, were erected at Temple Bar, Ludgate Circus and on the front of St. Paul's Cathedral, from which was given a commentary on the Royal procession as it approached St. Paul's; while in the Cathedral itself, seventeen microphone circuits were provided for the adequate handling of the thanksgiving service. The suitable mixing of the various portions of the programme received along the total of twenty-seven circuits was carried out by one man, who was situated in the temporary control room erected over one of the vestries in the north-east corner of the Cathedral. This control room was connected to Broadcasting House by six outgoing circuits, two of which were utilised by a foreign commentator.

It says much for the foresight with which the arrangements were made and for the thoroughness with which each person concerned carried out his work, that the programme was accomplished without a fault of any description. The whole network of interconnecting cables was entirely underground and was provided by Post Office engineers; at no point inside or outside St. Paul's were there any visible

signs of broadcasting. As a broadcast of sound effects, interspersed with brief commentaries, the programme was satisfactory. Much, however, was inevitably left to the imagination in order to visualise the glamour and splendour of the scene which was being portrayed. Is it too much to hope that by the next occasion when a similar ceremony is to be broadcast, the sound picture will be supplemented by a vision programme, perhaps even in full natural colour?

### Association of British Chemical Manufacturers

JUBILEES are occasions of rejoicing and congratulation, but they provide us also with opportunities for taking stock both of our national resources and of the use we are making of them; so that when, after due examination and consideration, the celebrations are followed by renewed resolutions and by more fully informed and co-operative effort, they can fairly claim to have made a contribution of more than passing value to our national progress. Many organisations, national and sectional; political, ecclesiastical and industrial; philanthropic and learned societies, and indeed societies representing every phase of corporate life, will in 1935 be concerned to view with a critical eye their progress throughout the years of His Majesty's reign. In so far as they can show that their attempts to make the world a better place to live in have been honest, sensible and attended by a reasonable measure of success, they will receive a meed of applause; in so far as they discover how better to carry out the purposes for which they were brought into existence, they will equally merit the approval of sympathisers. The year 1935 is one in which chemical organisations in Great Britain will take decisions of exceptional significance. They have long been considering how they can more adequately serve their science and more effectively promote its application for the benefit and prosperity of the community. Proposals which are now under consideration have been put forward with that end in view. One of the



organisations concerned, the Association of British Chemical Manufacturers, has recently published a brief survey of its work since its formation in 1916.

THE Association of British Chemical Manufacturers, which now has a membership roll of 117 firms representing a capital of more than £200,000,000, originated from the proposals of a committee representing the Chemical Society, the Society of Dyers and Colourists, and the Society of Chemical Industry, called at the suggestion of the first-named to consider the best methods of promoting co-operation between British chemical manufacturers. Additional objects served by the Association are: to provide British chemical industry with a medium for the expression of its views; to further technical organisation and promote industrial research; to facilitate the development and extension of British industries by keeping in touch with progress in chemical knowledge and practice; and to encourage closer co-operation between chemical manufacturers and the various universities and technical colleges. These desirable objects have been steadily borne in mind by the Association, the annual reports of which show a long record of achievement, and it has been prominently associated with all movements of importance since its formation. From its early days, the Association has maintained a service to keep members informed of the import and other statistics essential to their work, to keep them apprised of all directions in which new manufactures are needed, and yet at the same time to prevent useless overlapping by unnecessary duplication of effort. The Association is closely concerned with questions of safety in chemical works, with matters arising out of the Import Duties Act, with negotiations leading to new commercial treaties with foreign countries, with the incidence of acts such as the Dyestuffs Act and the Patents and Designs Act, with transport and with exhibitions. The monthly summary of information on chemical trade can be purchased by non-members.

#### Jubilee Exhibition at the Science Museum

To mark the occasion of His Majesty's Silver Jubilee, a pictorial exhibit illustrating the more outstanding inventions and conspicuous developments of the past twenty-five years has been arranged at the Science Museum, South Kensington. This exhibition was opened to the public on May 1 and will remain on view during the whole of the month. The main advances in the pure sciences, astronomy, mathematics, physics, chemistry, meteorology and geophysics are illustrated, together with their more important applications; for example, photographs are shown of the planet Pluto (which was discovered in 1930), modern methods of upper air investigations, radio-gramophones, 'talking pictures' equipment, infra-red photography and modern methods of prospecting. Of special interest is the series of photographs showing the rapid advances which have recently been made in our knowledge of the constitution of the atom, and the structure of the atomic nucleus. Progress of chemical industry is shown to include many important developments such as the

low-temperature carbonisation of coal, the manufacture of insulin, artificial silk and plastic products; while in the case of glass manufacture, reference is made to the improvements resulting from the introduction of machine processes and the influence on the glass industry of the widespread use of the motor-car. Among other subjects represented may be mentioned the development of aircraft, ships, locomotives, motor-vehicles, steam turbines, oil and marine engines, while the advances in electrical power and communication are illustrated by modern electric power stations, automatic telephones, radio-communication and television.

#### Award of Kelvin Medal to Sir Ambrose Fleming

THE Kelvin Medal of the Institution of Civil Engineers, which is awarded triennially as a mark of distinction in engineering work or investigation of the kinds with which Lord Kelvin was especially identified, was presented to Sir Ambrose Fleming by Sir Kingsley Wood, Postmaster-General, on May 7. Referring to our dependence on the universities for the inception of new scientific methods and scientific knowledge, Sir Kingsley said that thanks are due to Sir Ambrose not only for his own contributions, but also for the inspiration he has given to generations of students, which have spread over the world in ever-widening circles like the wireless waves themselves. Sir Ambrose was one of those pioneers in the science of radio, who worked under both physical and financial difficulties, and yet succeeded in placing at our disposal a means of communication of thought, sound and vision. Broadcasting may well be one of the greatest factors in drawing together the nations of the world. Sir Kingsley said that mass production in research produces results, but at a relatively higher cost than the research of inspired and gifted individuals, which has hitherto characterised the majority of the investigations carried out in Great Britain.

#### Viruses and Heterogenesis

THE definition and nature of life have been favourite subjects for ancient and modern discussion. Sir Henry Dale, armed with many recent exact data, stated in the Huxley Memorial Lecture on "Viruses and Heterogenesis", delivered at the Imperial College of Science on May 2 (London: Macmillan and Co., Ltd. 1s. net), the dilemma which confronts those who attempt to decide whether all the viruses which cause disease are self-propagating micro-organisms or whether some of them do not originate from the tissues of the host. Admitting that their minute size is perhaps the most important obstacle to accepting the smallest viruses as frankly living, he pointed out that there is an unbroken series from a virus of about the same size as the smallest bacteria with a diameter of 750 m $\mu$  to the virus of poliomyelitis estimated at 10 m $\mu$ , which approaches the size of a protein molecule; the diameter of a molecule of egg-albumin has been calculated as 4.33 m $\mu$  (1 m $\mu$ =one millionth of a millimetre). The long category of viruses has several



characters in common, making it very difficult to draw an arbitrary line at a certain size as criterion for separating two classes of entirely different natures.

SIR HENRY referred to Huxley's discussion of biogenesis and abiogenesis, and to the recurring claims for the origin of life from dead matter, including the 'spontaneous generation' of worms, maggots and bacteria, and the repeated victories of the advocates of biogenesis. He stated his personal opinion that the similar claim that viruses have their origin by heterogenesis in the tissues of the host would in the future be disproved and that the doctrine that like breeds like would triumph in this field also. Sir Henry emphasised the fact that viruses are obligatory parasites and suggested that the minute filterable particles are only a stage in the life of the infective agent, which might be able to reconstitute larger and more complete forms inhabiting the cells of the host where they cannot now be recognised or their size determined. He propounded the view that our theoretical problem is not to determine the lowest limit of size compatible with the minimum required for a living reproductive cellular unit, but to determine what is the minimal portion of such a unit which might be adequate for its reconstitution under favourable conditions.

#### Royal Institution: Annual Meeting

MAY 1 was the day of the annual meeting at the Royal Institution, when the members received the report of their committee of visitors on the state of the Institution during the year 1934, and when the election of officers took place in accordance with the time-honoured procedure. The three scrutineers were sent to watch the three balloting glasses during the half-hour that the ballot must remain open; at the end of the time they marched out to the private room appointed for the counting of the votes; and in due course they returned, to report to the meeting the names of the officers, managers and visitors elected for the year 1935-36. The president is to be the Right Hon. Lord Eustace Percy; the treasurer, Sir Robert Robertson; the secretary, Major Charles E. S. Phillips; new managers are Prof. E. N. da C. Andrade, Sir Frederick Berryman, Prof. A. Fowler, Sir Richard Paget, Prof. A. O. Rankine, Dr. G. C. Simpson, Mr. W. J. Tennant and Mr. James Whitehead. The visitors report testified to increased membership, to improved attendance at the lectures and to a year of varied activities in the Institution. The accounts show a financial position which cannot but be gratifying to the members and to their treasurer, Sir Robert Robertson, who has had charge of the finances since 1929, one of the most eventful and at times anxious periods in the Institution's history. The report of the Davy Faraday Research Laboratory records valuable progress during the year in the researches, largely on the structure of organic molecules, directed by Sir William Bragg. In the unavoidable absence of the president, Lord Eustace Percy, the meeting was conducted by the honorary secretary, Major Phillips; and it was remarkable for the felicitous terms of a speech in

which the thanks of the members were given to the president for his services during the past year by Sir James Crichton-Browne, of whom the evidence of *Who's Who*, that he is now in his ninety-fifth year, is difficult to credit.

#### Atomic Arrangement in Metals and Alloys

PROF. W. L. BRAGG, in the twenty-fifth annual May Lecture before the Institute of Metals on May 8, dealt with the inner structure, or atomic arrangement, of metals and alloys. In general, when one metal is alloyed into another a series of phases appears. Metal *A* dissolves a certain amount of metal *B* with a gradual alteration in properties as the proportion of *B* increases. At a certain composition, a limit is reached, and for greater amounts of metal *B* a new phase appears as separate crystals of quite different properties mixed with the first phase. Regions of single and double phase alternate as the composition varies from pure *A* to pure *B*. These phases are the nearest approach in an alloy system to the chemical compounds formed by combining elements. X-ray analysis has shown that each phase has its own definite pattern, such as a cubical array with atoms at corners and centres, or at corners and centres of faces. The pattern changes from phase to phase. One of the most striking generalisations about alloy patterns to which X-ray analysis has led us is the empirical Hume-Rothery rule, which states that the ratio of free electrons to atoms in a structure is the same for alloys with the same pattern. H. Jones has recently shown how the alloy pattern affects the binding energy of these free electrons, and so has given a reason for this rule. Another point brought out by the X-ray analysis is that the method of arrangement of the atom amongst the positions of the phase pattern can be varied widely. The phase pattern is an entity apart from the way the atoms are distributed, in marked contrast to ordinary chemical compounds. The study of the movements of the atoms amongst the positions, as affected by heat treatment, can be made the basis of a very interesting theory; at high temperatures the atoms are shuffled up in a random way, while at low temperatures they sort themselves out into a regular alternation. The importance of this work is that it provides a basis for the chemistry of compounds formed between metals.

#### A National Statistical Service

THE establishment in Great Britain of a special statistical council comprised of business men, bankers, economists and members of the general public charged with the task of instituting a National Statistical Service was recommended by Mr. Roy Glenday in opening a discussion on "The Use and Misuse of Economic Statistics" before the Royal Statistical Society on April 16. This new body would not itself collect statistics, but would devote its energies to co-ordinating the statistical work now being performed by Government departments, private bodies and individuals. Mr. Glenday pointed out that international trade has reached a crisis in its fortunes



since the 'white' populations are rapidly approaching stagnation—that of Great Britain is actually on the eve of a decline—yet we have no means of measuring the industrial and commercial changes which this entails. No organisation has been evolved to collect the statistics and other information which it is imperative to possess, and instead we are continuing to press forward with reorganisation schemes in housing, education and transport at home and to expand food and raw material supplies overseas as if world populations are destined to go on expanding at the old rate and with their age distribution unchanged. The fundamental statistical facts and trends in regard to our economic life should become as much part of the common stock of ideas on which all act, as are certain of the fundamental facts of physics and chemistry.

#### Economics of Progress

THE James Seth Memorial Lecture at the University of Edinburgh was delivered on April 26 by Mr. Roy Glenday, economic adviser to the Federation of British Industries, who took as his subject "The Economic Consequences of Progress". There is a limit, he said, beyond which it is unhealthy to allow growth to proceed even in a community which takes special care not to overstep the frontiers of its own territory. Conflict will still inevitably arise in the process of growing, under the pressure of congestion between the members of the different groups or subdivisions into which the community of necessity splits its territory and occupations. No matter what may be the basic plan of subdivision adopted, there is a limit to the size of economic structure which can be erected on it with safety. The United Kingdom, however, still possesses enormous resources, and the solution Mr. Glenday favours is the one which accepts present tendencies as both reasonable and inevitable. They should be encouraged by promoting a flow of migrants from Great Britain, not for the purpose of developing the land and country-side of the Dominions and Colonies but to enlarge their industries and towns. Given supplies of cheap capital, there are no insuperable obstacles to a redistribution of population between the over-populated Mother country and the under-populated Dominions overseas. This would be as much to their advantage as to ours. In Canada, for example, the railways could serve a population three times its present size.

#### Guide to National Collections

AMONG the numerous suggestions which have been put forward of means whereby the public might be stimulated to visit in greater numbers the museums and national collections in London, that of a general guide covering all the collections has been one of the most attractive. It has been pointed out that few, outside those who are technically or professionally interested, know where to find exhibits which will illustrate subjects on which they desire to be better informed, while even among the learned and scientific public, not many could without hesitation state off-hand the range and purpose of each

unit in the series. A "Brief Guide to the National Museums and Galleries of London" (H.M. Stationery Office, pp. 106. 6d. net) has now been issued in accordance with a recommendation of the Standing Commission on Museums and Galleries in the hope, as expressed by Lord d'Abernon, the chairman, in a prefatory note, that "this guide, giving in compendious form the salient facts of interest concerning each of the Institutions, may stimulate public interest, both at home and abroad, in the unrivalled resources of the National Collections". It is not intended to supersede individual guides and handbooks, but to supplement them by giving briefly within a single cover information relating to the origin, purpose, range and arrangement of each, together with much useful and practical information, such as how to get there, time of opening and closing, charge for admission, if any, and the like. Especially helpful is a series of street-maps, showing the approaches. The information is clear, direct and comprehensive and there are some excellent illustrations. Experience will show whether the information is given in a form which will attract those for whom it is intended. Should the demand justify, it will be revised annually. Copies may be obtained at H.M. Stationery Office sale branches or through any bookseller, as well as at the museums.

#### University of London Buildings

MR. T. LL. HUMBERSTONE sends us a copy of a letter he has sent to the Clerk of the London County Council relating to the provision of an open space on part of the site of the new buildings of the University of London at Bloomsbury. He informs us that since his election as a member of the Holborn Borough Council in November last, he has found that an undertaking was given by the University to the Council and also to the London County Council that the University would "preserve a garden area with trees and grass equal in size to, but not necessarily identical in location with, that now existing in Torrington Square gardens". It appeared after inquiries made by Mr. Humberstone that this undertaking was not carried out by the layout of the buildings. Representations were therefore made, with the result that a new design and layout have been prepared, providing approximately an acre of additional open space in the form of three bays on the Malet Street frontage, giving this façade a crenelated form. Mr. Humberstone is the author of a valuable historical work on "University Reform in London" and contributed to NATURE of July 9, 1932, a long article on the development of the University and the design of the new Buildings.

#### British Oil from Coal

THE first train load of 100,000 gallons of oil made by low-temperature carbonisation from British coal went to the new plant of Imperial Chemical Industries, Ltd. at Billingham from the Barugh (Yorks) works of Low Temperature Carbonisation Ltd. on April 26. The train, which was drawn by two locomotives, consisted of 34 tanks of 3,000 gallons each and weighed



nearly 1,000 tons gross. On arrival at Billingham the oil, which is made from coal by the coalite process, is being submitted to hydrogenation and converted into about 100,000 gallons of petrol. This is the first time that a bulk consignment of oil obtained by low-temperature carbonisation has been treated by a hydrogenation plant in Great Britain. Tests carried out by Imperial Chemical Industries, Ltd., and H.M. Fuel Research Board show that this oil is particularly suitable for conversion into petrol by hydrogenation, and the event constitutes a notable achievement in the history of the coal and coal oil industry in Great Britain.

#### The B.B.C. Annual

THE *B.B.C. Annual* for 1935 (London: B.B.C. 2s. 6d.) is the successor to the *B.B.C. Year Book* for 1934. This Year Book, after a fairly successful career, has been discontinued. The first section of the *Annual* gives a history of the Corporation's programme policy for the last five years. The second section is the Corporation's report to the listeners of Great Britain. A report is also given of the activities of the Empire service. We are told that the object is not merely to give a recital of past programmes remembered or forgotten, but to explain and make comments on them. Old problems have to be reconsidered and new problems are always arising. So a new section is started called the 'forum', which is to be a market place for the expression of ideas by authors, who are wholly free and solely responsible for what they write, and is not a pulpit for making pronouncements. It contains some interesting articles discussing amongst other subjects international broadcasting, free speech, music and radio drama. There is also an excellent short obituary notice of the late Mr. J. H. Whitley, who devoted himself during the last years of his life to guiding most successfully the progress of this great national corporation.

#### Dorothy Temple Cross Research Fellowships

THE Dorothy Temple Cross research fellowships in tuberculosis for the academic year 1935-36 will shortly be awarded by the Medical Research Council, and applications should be lodged with the Council not later than June 1, 1935. The object of these fellowships is to give special opportunities for study and research to persons "intending to devote themselves to the advancement by teaching or research of curative or preventive treatment of tuberculosis in all or any of its forms". Candidates must be British subjects. The fellowships will preferably be awarded to candidates who wish to make their studies or inquiries outside the borders of Great Britain. They will be awarded for one year as a rule, but in special cases may be renewed. The value of the fellowships awarded will depend in each case upon the standing and qualifications of the candidate, but will not be less than £350 per annum, payable monthly in advance. Travelling and some incidental expenses will be paid in addition. It may also be possible to award a senior fellowship of considerably greater

value to a specially well-qualified candidate wishing to undertake an intensive study of some particular problem of tuberculosis at a chosen centre of work in another country. Further particulars and forms of application are obtainable from the Secretary, Medical Research Council, 38 Old Queen Street, Westminster, S.W.1.

#### Leaflets on Disease of Fruit Trees

THE Ministry of Agriculture has recently issued Collection No. 1 of Leaflets on Fungus and other Diseases of Fruit Trees, price 1s. 6d. net. This collection contains a copy of each of the leaflets on the subject at present issued by the Ministry, and is bound up in portfolio form so that when a new leaflet or a revised edition of an old one is published an insertion or substitution can readily be made. Sectional vol. 1, which contained the same leaflets in a permanently bound form is, therefore, superseded, as it is hoped that the new arrangement will prove of greater convenience. Those who desire to receive a copy of each new or revised leaflet as it is issued, in order to keep their portfolio up to date, may do so on payment of a nominal annual registration fee. Full particulars concerning this matter may be obtained from the Secretary, Ministry of Agriculture and Fisheries, 10, Whitehall Place, London, S.W.1.

#### Cultivation of Soft Fruits

OWING to the imposition of import duties, soft-fruit growers in Great Britain have been able to find a satisfactory market for home-grown fruit during the past two seasons. The issue of a second edition of Bulletin No. 4, "Soft Fruits", by the Ministry of Agriculture (London: H.M.S.O. 1s. net) will, therefore, be particularly welcomed as it will enable the grower to make the fullest use of his protected position. The principal fruits dealt with in the bulletin remain as before, namely, strawberries, gooseberries, currants, loganberries, raspberries, figs and melons, though the subject matter has been considerably revised. Sections on the cultivation of blackberries and dewberries have, however, been included in the new edition, owing to their increasing popularity. The cultivation of nuts is now omitted, as it is hoped to issue fuller information on nut culture as a separate bulletin.

#### New Zealand Scenery

THE active steps taken by the New Zealand Government to preserve the original scenery of the Dominion are noted in the report on scenery preservation for the year ending March 1934. During the year, more than thirty new reserves were announced. They varied in size from small historic sites to areas of several hundred acres, the largest being about 9,000 acres in the Canterbury district, where a great area of beech bush has been set aside. The total area of scenic reserves in New Zealand is now about a thousand square miles, divided into about as many different parts. The Act of 1908 under which such area can be dedicated to public care has now been amended to allow of any landowner applying to



have his land declared a private reserve. This will help to maintain the scenic amenities of New Zealand.

#### The North-East Passage

SINCE Baron A. E. Nordenskiöld in the *Vega* made the North-East Passage in 1878-79, other ships have followed the same route; but it was not until 1932 that the journey was made in one season. In that year Capt. O. J. Schmidt took the ice-breaker *Siberiakov* from Archangel to Vladivostok. It is now reported by Science Service that in 1934 the ice-breaker *Theodor Lütke*, commanded by Capt. Nikolaev, went from Vladivostok to Murmansk in eighty-three days. It should, however, be noted that heavy ice was encountered, and that the passage would have been impossible for a less powerful vessel. These achievements hold out little prospect for an ordinary unprotected trading vessel making use of the route for through passages.

#### Study of Malnutrition

A PUBLIC meeting, organised by the Committee against Malnutrition, will be held at the Conway Hall, Red Lion Square, London, W.C.1, on Thursday, May 16, at 8 p.m., to consider the health and nutrition of women and children in Great Britain. The chair will be taken by Prof. V. H. Mottram, and Miss Eleanor Rathbone, M.P., Dr. Janet Vaughan, and Prof. Marrack will be among the speakers. Tickets at 1s. each can be obtained from the Honorary Secretary, Mr. F. le Gros Clark, 190 Eagle Street, Holborn, W.C.1. The Committee against Malnutrition, which is a non-party organisation and has been in existence for a little more than a year, was established to obtain information respecting under-nourishment among families of unemployed and low-paid workers, and to co-ordinate efforts towards securing adequate nourishment for all. It publishes a bi-monthly bulletin, and organises propaganda on the subject. The annual subscription is 5s.

#### Announcements

THE King has been graciously pleased to command that the African Society shall henceforth be known as "The Royal African Society".

DR. WALLACE RUDDALL AYKROYD has been appointed by the governing body of the Indian Research Fund Association to the post of director of nutritional research under that Association.

A MEETING, followed by a discussion, will be held by the British Science Guild in association with the Engineers' Study Circle on Economics, on Thursday, May 16 at 5.30 p.m. in the Lecture Theatre of the Institution of Civil Engineers, Great George Street, S.W.1, when a report on schemes and proposals for economic and social reforms will be presented by Lieut.-Col. J. V. Delahaye. Tickets (for which there is no charge) are obtainable on application to the Secretary of the British Science Guild, 6 John Street, Adelphi, W.C.2.

THE North East Coast Institution of Engineers and Shipbuilders, Newcastle-on-Tyne, will celebrate the attainment of its jubilee by a series of meetings

to be held on July 16-19, in Newcastle-on-Tyne. The celebrations will open with a reception at Armstrong College. On July 17 there will be a meeting to confer honorary fellowships, after which three papers will be read dealing with developments in ship construction during the past fifty years. On July 18 papers on marine engine construction, including turbines, reciprocating steam engines, boilers and heavy oil engines, and on recent progress in electrical and general engineering, are to be read, and on the following day Sir Westcott Abell will deliver a citizens' lecture on "Ships through the Ages".

WE regret that in the article on "Canadian Water Power Developments in 1934", in our issue of April 27, p. 642, it was stated that the investment represented by the present development is estimated at 1,743,000 dollars. This should read 1,743,000,000 dollars.

"CATTLE IN THE TROPICS" is the title of a booklet by Prof. Cecil Wood of the Imperial College of Tropical Agriculture, Trinidad (Government Printing Office, Port-of-Spain, 1934). It gives much useful information on the species and breeds of cattle suited to tropical conditions, their utilisation as draught animals and for meat and milk production, harnessing, feeding and general care, breeding and improvement. Sections are also devoted to their health and the diseases which affect them, and to the organisation of the industry.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A professor of physiology in University College, Dundee (University of St. Andrews)—The Secretary (May 17). A temporary assistant engineer in the Ministry of Transport—The Establishment Officer, Ministry of Transport, Whitehall Gardens, London, S.W.1 (May 17). Chemists for the War Department chemist, Woolwich Arsenal—The Under-Secretary of State (C.5), The War Office, London, S.W.1 (May 18). A secretary to the Advisory Council for Technical Education in South Wales and Monmouthshire—The Advisory Council, County Hall, Cardiff (May 18). A teacher of mechanical engineering and a teacher of electrical engineering in the Schools of Technology, Art and Commerce, Oxford—The Secretary for Education, Education Office, George Street, Oxford (May 20). An animal husbandry expert under the Imperial Council of Agricultural Research, India—The High Commissioner for India, General Department, India House, Aldwych, London, W.C.2 (May 25). A lecturer in mathematics in the Royal Naval College, Greenwich—The Adviser on Education, Admiralty, Whitehall, S.W.1 (May 31). An assistant professor of science in the Indian Institute of Science, Bangalore—The Director (June 1). An assistant inspector of ancient monuments for Wales—The Establishment Officer, H.M. Office of Works, Westminster, London, S.W.1 (June 3). An inspector of agriculture in the Department of Agriculture and Forests, Sudan Government—The Controller, Sudan Government London Office, Wellington House, Buckingham Gate, London, S.W.1 (June 10).



## 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. 794.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

### Relation of the Posterior Lobe of the Pituitary Gland to Anæmia and to Blood Formation

It has been shown (Dodds, Noble and Smith<sup>1</sup>, Dodds and Noble<sup>2</sup>) that it is possible to prepare an extract of the posterior lobe of the pituitary gland which, when injected subcutaneously or intravenously into animals, will cause an intensive hæmorrhagic lesion of the acid-bearing area of the stomach, from which the animals usually recover completely. Chronic ulcers may also be produced.

During the course of study of the biological properties of this extract, further interesting facts have been observed. If rabbits be injected subcutaneously with 150 mgm. of the acetone picric acid extract of the posterior lobe of the pituitary, or alternatively with 40 c.c. of standard B.P. pituitary extract, a number of them develop a definite severe macrocytic anæmia. The following table shows the typical hæmatological picture produced by this treatment.

Rabbit No. 363 ♂ 2.0 kilo.				
Time	W.B.C.	R.B.C. (Million)	Hæmoglobin gm. per 100 c.c.	Reticulocytes
	10,400	6.15	13.9	Per cent
	9,800	5.95	13.9	0.50
	20 c.c. B.P. Pituitrin s			0.75
Injection	11,600	6.00	13.6	2.00
1 day	8,600	5.45	12.3	0.10
2 days	12,000	5.95	11.8	0.50
3 "	15,400	3.10	8.4	8.00
5 "	9,800	2.35	7.5	17.00
6 "	9,600	2.88	7.5	21.00
8 "	13,400	2.36	6.8	24.00
9 "	9,800	3.03	7.0	20.00
10 "	8,800	2.83	7.6	9.00
12 "				

The anæmia appears quite suddenly on the fourth to fifth day, the red blood count frequently being as low as one million cells per c.mm. A marked leucocytosis, up to 50,000 white cells per c.mm., is often associated. The hæmoglobin falls proportionally less than the red blood count. A reticulocyte response commences on the fifth to sixth day and usually continues for seven to eight, reaching a peak about the ninth day. Reticulocyte counts up to 50 per cent have been observed. Examination of the blood smear shows the red cells to be well filled with hæmoglobin. Anisocytosis is present to a marked degree. Many large macrocytes and an occasional microcyte are seen. Poikilocytosis is slight. Nucleated red cells have been observed. Platelets appear normal. Leucocytes are mainly of the multi-nuclear type.

A series of control experiments have shown that hæmorrhage occurring from gastric lesions is not sufficient to explain these changes. Also control extracts of other tissues have not given any response on injection. If the animal be killed there are definite changes in the spleen, such as hæmorrhagic infarcts. The bone-marrow appears to show signs

of hyperplasia. The secretion of bile is greatly increased, as shown by a visible gross excess in intestines and faeces.

So far as we are aware, this is the first time these changes have been produced by an extract of a normal gland. The interpretation of these results is at present obscure. The possibility arises that the control of blood destruction by the reticulo-endothelial system may be vested outside the system itself and may reside in the posterior lobe of the pituitary gland. The reticulocyte response may be secondary to the anæmia, or alternatively may be due to the effect of the extract of the posterior lobe of the pituitary on the stomach causing it to produce an excess of the intrinsic factor, which in its turn acts upon the bone-marrow. Intensive investigations are being conducted into these points at the present time.

We wish to thank Dr. L. E. H. Whitby for kindly examining our data and for his opinion on the blood picture.

E. C. DODDS.

R. L. NOBLE.

Courtauld Institute of Biochemistry,  
Middlesex Hospital,  
London, W.1.  
April 23.

<sup>1</sup> Dodds, E. C., Noble, R. L., and Smith, E. R., *Lancet*, 2, 918; 1934.

<sup>2</sup> Dodds, E. C., Noble, R. L., *J. Soc. Chem. Ind.*, 52; 1934.  
*Chemistry and Industry*, p. 1026.

### The Contractile Factors of the Chromosome Micelle

In a recent article in these columns<sup>1</sup> and in a paper presented to the Royal Microscopical Society on February 20, 1935<sup>2</sup>, I put forward a model of a chromosome as an aggregate of polypeptide protamine molecules in association with nucleic acid. It is unfortunate that data of a physico-chemical nature by means of which this hypothesis can be tested and rendered more precise are at present very meagre. It is, therefore, specially important to make the fullest use of such facts as are available, and in particular of those relating to the variable geometrical configurations of chromosomes, which are of the highest degree of delicacy and reliability<sup>3,4</sup>. These are of particular importance in view of the recent work on the giant chromosomes in the salivary glands of *Drosophila*, *Chironomus* and *Sciara*<sup>5</sup>. I have, therefore, undertaken a systematic survey of these data and wish, in this preliminary announcement, to direct the attention of cytologists to the various contractile factors which the chromosome micelle may be expected to possess.

(1) The intramolecular or intermolecular contractile factors which depend upon electrostatic (salt-forming) attractions between basic and acidic ionised groups, belonging to the same<sup>6</sup> or different molecules.



These factors have already proved important in the case of keratin<sup>7</sup>.

(2) The intermolecular contractile factor due to a variation in the number of ionised groups belonging to single molecules. This factor, which has not yet made its appearance in the literature of protein chemistry, is nevertheless an obvious possibility. The number of ionised groups possessed by a nucleic acid molecule<sup>8</sup> varies considerably with pH. The chromosome micelle—a protamine nucleate aggregate<sup>9</sup>—will therefore be capable of strikingly different configurations for different pH values, the nearer the pH approaches to the isoelectric point of the protamine nucleate the greater being the degree of contraction. In view of the differential density of nucleic acid along the length of the chromosome, differential condensation (heteropycnosis)<sup>4</sup> is naturally to be expected. This type of contractile factor also offers a simple interpretation of the results lately obtained by Kuwada and Darlington with ammonia vapour and with acetic and nitric acid<sup>3</sup>.

(3) The intramolecular contractile factor as exemplified by keratin<sup>7</sup>. In the case of keratin a contractile factor of 2 in particular has been attributed to intramolecular folds of the nature of linked pseudo diketo piperazine rings. Evidently there may be other and more considerable degrees of contraction if the rings in question are formed not by two consecutive amino acid residues but by a run of 3, 6, 7, 10, 11, . . . ,  $4n - 2$ ,  $4n - 1$  residues. The first of these, yielding a contractile factor rather greater than 8/3, may be the explanation of the contractile factor of about 3 recently announced for myosin films<sup>10</sup>. I now suggest that the chromosome micelle, evidently less stable than myosin and considerably less stable than keratin, will prove capable of a grosser type of folding, which will yield a far higher factor than the 2 of hair and the 3 of myosin.

(4) The intramolecular contractile factors due to the sharing of an electron by the ketonic oxygen and the hydrogen atom belonging respectively to the carbon and nitrogen atoms in the backbone of a protamine molecule<sup>11</sup>.

(5) The macroscopic 'twizzling' factor as exemplified by keratin fibres<sup>12</sup>. This contractile factor is of quite different type from the three preceding ones. It is 'macroscopic' in the sense that it is a property not of individual molecules but of the micelle as a whole.

D. M. WRINCH.

Mathematical Institute,  
Oxford.  
April 6.

<sup>1</sup> NATURE, 134, 978, December 22, 1934.

<sup>2</sup> "Chromosomes and their Structure". (In course of publication in the *J. Roy. Micro. Soc.*)

<sup>3</sup> C. D. Darlington, "Recent Advances in Cytology". London, 1932. Y. Kuwada and T. Nakamura, *Mem. Coll. Sci., Kyoto*, 9, 129-139; 1933. Y. Kuwada and T. Nakamura, *ibid.*, 9, 343-366; 1934. N. Shinke, *ibid.*, 9, 367-392; 1934. P. Ch. Koller and C. D. Darlington, *J. Genet.*, 29, 159-173; 1934.

<sup>4</sup> C. D. Darlington, *Cytologia*, 4, 229-240; 1933.

<sup>5</sup> T. S. Painter, *J. Hered.*, 25, 465-476; 1934. C. W. Metz and E. H. Gay, *Proc. Nat. Acad. Sci.*, 20, 617-621; 1934. R. L. King and H. W. Beams, *J. Morph.*, 56, 577-588; 1934. H. J. Muller and A. Prokofieva, *Comptes Rendus de l'Acad. des Sciences de l'U.R.S.S.*, 4, 74-83, October 11, 1934. P. Ch. Koller, NATURE, 135, 69, January 12, 1935.

<sup>6</sup> Reference should be made to the literature of the 'zwitterion', specially to L. J. Harris, *Biochem. J.*, 24, 1080-1097; 1930.

<sup>7</sup> W. T. Astbury and H. J. Woods, *Phil. Trans. Roy. Soc., A*, 232, 333-394; 1933. W. T. Astbury, "Fundamentals of Fibre Structure". Oxford, 1933.

<sup>8</sup> P. A. Levene and L. W. Bass, "Nucleic Acids", New York, 1932.

<sup>9</sup> D. Jordan Lloyd, *J. Int. Soc. of Leather Trades' Chemists*, 245-258; 1933.

<sup>10</sup> W. T. Astbury, NATURE, 135, 95, Jan. 19, 1935.

<sup>11</sup> D. Jordan Lloyd, *Biol. Rev.*, 7, 254-273; 1932.

<sup>12</sup> A. Stanberry and B. Byerley, *J. Text. Inst.*, 295T, 1934.

## $\alpha$ -Tracks in Presence of Strong $\gamma$ -Radiation

IN investigations of nuclear transformations, it is sometimes desirable to be able to observe  $\alpha$ -particles (or protons) in the presence of strong  $\gamma$ -radiation. This has already been successfully accomplished by means of an ionisation chamber connected up to a valve-amplifier and oscillograph (as in the investigations of Chadwick and Goldhaber<sup>1</sup> on the photo-disintegration of heavy hydrogen).

It may be of interest that, under suitable conditions, it is also possible to observe  $\alpha$ -particles in the presence of strong  $\gamma$ -radiation by the Wilson cloud method. The accompanying photograph (Fig. 1) shows the tracks of  $\alpha$ -particles from polonium deposited on the outside of the brass cylinder A, in the presence of  $\gamma$ -rays from a 25 mgm. emanation tube placed inside A.

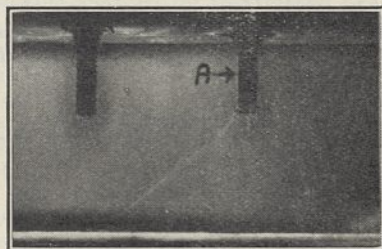


FIG. 1.

The best conditions appear to be obtained with hydrogen in the chamber, at an initial pressure of about 40 cm. mercury, and a high expansion ratio somewhat above 1.4. Under these conditions, about 60 per cent of the  $\alpha$ -tracks observed in the absence of  $\gamma$ -radiation are still observed when a source of about 25 mgm. is placed in A. The conditions become rapidly worse if the strength of the source is increased much above 30 mgm. and this appears to be about the maximum unfiltered emanation source that can be placed inside the chamber without destroying the cloud tracks of  $\alpha$ -particles.

About five hundred photographs were taken with the cylinder A covered with beryllium, and a 20-30 mgm. emanation source inside A, in order to investigate further the disintegration of beryllium by  $\gamma$ -rays, observed some time ago by Szilard and Chalmers<sup>2</sup>. No  $\alpha$ -tracks were observed. Assuming that tracks of range  $R$  cm. in air are actually produced, this means that the cross-section for the photo-disintegration of a Be nucleus is less than about  $5 \times 10^{-30} R^{-1} \text{ cm}^2$ .

D. CAMERON.

Physical Laboratory,  
University,  
Manchester.

<sup>1</sup> NATURE, 134, 237; 1934.

<sup>2</sup> NATURE, 134, 494; 1934.

## The Spectral Selective Photo-Electric Effect

ZENER has recently<sup>1</sup> discussed Fowler's theory<sup>2</sup> of the spectral selective photo-electric effect, and concludes that it is incapable of explaining the observed order of magnitude of the emitted current. Inasmuch as a direct calculation<sup>3</sup> of the photo-electric emission from a pure metal yields a spectral distribution curve



differing only slightly from typical experimental curves for selective emitters, except as regards order of magnitude, the author considers Zener is right in stressing this last point as the main feature to be explained by a successful theory. Nevertheless, Zener's objection is not sufficient to dispose of Fowler's theory.

Fowler suggested that the surface potential variation of a selective emitter would be ideally of the form shown (Fig. 1), having an intermediate hollow between metal and vacuum; and he showed further that the boundary transmission coefficient for such a field would have a maximum for energies for which standing waves could form in the hollow. Zener objects to this that such a boundary transmission coefficient would lower the emission in general, but leave it unaltered at the selective maximum. The further objection could be raised, that since the transparency level would be in use for a relatively wide frequency range, the spectral sensitivity curve would show quite a broad selectivity band, instead of the observed sharp maximum.

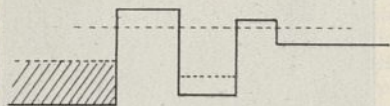


FIG. 1.

Both these objections, however, depend upon the fallacious argument that the emission from a metal with such a boundary field will be obtained essentially by multiplying the emission from a simple barrier by the appropriate boundary transmission coefficient. The fallacy is as follows. If the Schrödinger equation is set up for an electron in the boundary field (Fig. 1), and solved for bound states, it is found that for those energies for which standing waves could form in the hollow, the electron density is very strongly concentrated therein. Electrons in these states behave very similarly to atomic electrons, and give a correspondingly large transition probability. The result is that, in spite of the smallness of the boundary transmission coefficient, the emission is on the whole large, while a steep maximum occurs for the combination frequency between the critical states forming standing waves in the hollow. Experimental spectral distribution curves thus seem to be well reproduced by the theory.

If Fowler's theory is to be criticised, it must be on account of the predicted normal velocity distribution function. This has two maxima, corresponding to the states forming standing waves in the surface, and the relative position of the maxima depends upon the frequency of the incident light. Clear experimental evidence on this point would be of the greatest interest.

Details of the calculation will be published elsewhere.

K. MITCHELL.

Department of Mathematics,  
University of Leeds.

### A Rapid Practical Method of Demagnetisation involving High Frequency\*

THE impossibility of demagnetising loosely packed or unrestrained particles of such material as that described previously in these columns<sup>1</sup> and the difficulty in demagnetising some of the new magnet steels prompted experiments which have produced a rapid method for substantially complete demagnetisation of all ferromagnetic substances.

In direct opposition to the generally recommended procedure of using slow reversals and slow reduction of magnetic fields, it has been found that very rapid reversals of the field polarity and rapid reduction of the field strength are much more effective for the demagnetisation of material with high coercive force, especially when in a state of fine division. In fact, the partially reduced hematite powder described in the previous note may now be conveniently demagnetised for the first time.

The condition for effective demagnetisation may be brought about inside a solenoid by passing a damped oscillating discharge, or a series of such discharges, through the solenoid windings. An 'induction furnace' used with a 3-kva. high-frequency converter operates in this way but furnishes much more power than necessary. Economically operated units have been built in which a direct current passing through solenoid windings has been repeatedly interrupted by a rotary make-and-break switch, across the gap of which a condenser had been connected. The current, the number of turns in the solenoid, and the capacity of the condenser were regulated so as to give practically instantaneous demagnetisation of a substance without undue loss of power, a sufficiently accurate balance of capacity against inductance being obtained when a spark rather than an arc was produced on breaking the circuit. The speed of the switch was sufficient to ensure at least one complete oscillatory discharge to take place while the material was passing through the solenoid.

A logical explanation of the effectiveness of this method for treating powders may be furnished by the supposition that the rate of magnetic field reversal is greater than that to which the poles of the magnetic substance can conform, thus permitting the particles to be caught in a more favourable position for demagnetisation than if time were permitted for their orientation in the prevailing magnetic field. The fleeting high peak amperage of the damped oscillations, and internal shocks caused by the effect of high-frequency discharge, may also be contributing factors.

This new H.F. method is applicable to any case where demagnetisation is desired. It has been of considerable assistance in the laboratory in conjunction with the determination of the magnetic properties of powders; it is recommended for use in routine laboratory testing of bars or rods of iron and steel, and it may prove to be almost indispensable when the new magnet steels with coercive forces of 500-900 or more are encountered. The method can also be adapted to the commercial removal of permanent magnetism from minerals to permit better separation in processes involving magnetic concentration of ores.

A literature search following the observations

\* Published by permission of the Director, U.S. Bureau of Mines. (Not subject to copyright.)

<sup>1</sup> C. Zener, *Phys. Rev.*, **47**, 15; 1935.

<sup>2</sup> R. H. Fowler, *Proc. Roy. Soc., A*, **128**, 123; 1930.

<sup>3</sup> G. Wentzel, "Sommerfeld Festschrift", 79; 1928. H. Fröhlich, *Ann. Phys.*, **7**, 109; 1930. I. Tamm and S. Schubert, *Z. Phys.*, **68**, 97; 1931. A. Sommerfeld and H. Bethe, "Geiger-Scheel Handbuch der Physik", 2nd ed., 24/2, 468; 1933. K. Mitchell, *Proc. Roy. Soc., A*, **146**, 442; 1934.



recorded above has revealed the fact that although a demagnetising effect by damped, oscillating, H.F. magnetic fields was noted by Henry and afterwards studied by Rayleigh, Rutherford, Marconi and others, none of the investigators seems to have realised the relation of this theoretical work to practical demagnetisation.

C. W. DAVIS.

Metallurgical Division,  
United States Bureau of Mines.  
Feb. 5.

<sup>1</sup> Gottschalk, V. H., and Davis, C. W., "A Magnetic Material of High Coercive Force", *NATURE*, 132, 513, Sept. 30, 1933.

### Variations in Interference Colours on Copper and Steel

THE high values of the refractive index of copper and iron make it probable that only slight changes of colour would be observed on varying the angle of incidence of the light. With burnished metal surfaces, changes of larger magnitude than expected (giving  $\mu = 2.4$  for copper oxide and  $\mu = 1.8$  for iron oxide) were observed with angles of incidence up to  $78^\circ$ , together with strong scattering of the complementary colours. At larger angles of incidence general reflection predominated, and all colour vanished except a slight effect due apparently to the metal itself.

Some curious results were observed on strips of metal cleaned with fine emery paper. The direction of the scratches was parallel to the length of the strip, and in the direction of increasing thickness of the oxide film. At angles of incidence varying from  $70^\circ$  to  $80^\circ$ , the change in the second order colours was marked in the direction of the scratches. However, no change whatever (except increase in the generally reflected light) could be observed when the illumination was perpendicular to the lines of the scratches.

In this case the strips were mounted on a spectrometer table and the telescope replaced by a microscope. It then appeared that the colour of each filament remained unaltered, but that reflection occurred along a different line as the angle of incidence increased. Thus though the angle of incidence on the plane of the metal surface had varied widely, the angle of reflection from the coloured filaments in the surface had varied but slightly.

We wish to thank Abdel Hamid Effendi for the care he has taken in preparing the metal strips.

F. H. CONSTABLE.  
M. NAZIF.  
H. ELDIN.

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Giza, Egypt.

### Rationalisation of Scientific Publication

THE Publication Committee of the Society of Public Analysts and Other Analytical Chemists has discussed a reference (p. 358) in a leading article in *NATURE* of March 9 to the abstracts published by the Society in its journal, and I am instructed by the Committee to direct your attention to inaccuracies in the strictures contained in that article.

It is not true, as the article states, that the abstracts in *The Analyst* are merely later duplications or variations of abstracts already published by the Bureau of Chemical Abstracts. On the contrary, they are made directly from the original papers, and are frequently published before the abstracts issued by the Bureau. These points, however, are of minor significance as compared with the character of the abstracts themselves, which are constructed on completely different principles from those adopted by the Bureau. In the first place, all abstracts in *The Analyst* are given with sufficient detail to enable an analyst to try the method in his laboratory without having first to refer to the original paper. Secondly, every abstract is minutely scrutinised, first by a specialist in the subject, and then by the Publication Committee, and if the method is found to be unsound, or to be wanting in novelty, the abstract describing it is not published.

The principle adopted by the Bureau of Chemical Abstracts is different from this. Its object is to give the gist of the paper abstracted, leaving the reader to refer to the original paper if he wishes to obtain working details of any method. Doubtless this method of presenting abstracts saves space, but it cannot be claimed that it gives detailed working accounts of methods or affords any guidance to an analyst.

This Society is always willing to co-operate with other chemical societies, but attacks showing so little understanding of the objects and needs of a particular society will not tend to promote co-operation.

C. AINSWORTH MITCHELL  
(Secretary and Editor).

Society of Public Analysts.  
March 29.

MR. MITCHELL's letter in itself fully substantiates the statements made in the article. I do not think he is entitled to say that the article is in any way inaccurate. The substance of the charge is that the abstracts provided by the Society of Public Analysts in no way break fresh ground; they merely duplicate the effort which is expended by the British Chemical Abstracts, for example. Mr. Mitchell's letter shows clearly that the failure of the Society of Public Analysts to co-operate with the Bureau is due, first to a radical misconception as to what an abstract should provide, and second to the narrow specialist outlook which so largely frustrates efforts at co-operation.

With regard to the first point, it cannot be maintained that an abstract should provide the full working details required. If, as Mr. Mitchell appears to contend, an abstract is insufficient for the purpose of his Society, he is advocating essentially a policy of reprinting published information in whole or in part. This is in itself a lamentable source of duplicated effort and expenditure in the profession of chemistry, due, as Mr. Mitchell's letter shows, to the specialist's insistence in putting sectional needs before the general interest.

The reference to the Society of Public Analysts, however, was only made by way of illustrating a point in the article, which covers a great deal of ground. It would not have been in keeping with the spirit of the article to have elaborated the point, even had there been any wish to do so.

THE WRITER OF THE ARTICLE.



### Sense-Organs in *Malacobdella*

WHILE examining living specimens of *Malacobdella grossa*, Müll., under a binocular dissecting microscope (the specimen being extended under a glass slide in sea-water in the usual manner), I noticed a pair of minute structures on the head, which, so far as I can trace, do not correspond to anything previously described in this species. Fig. 1, drawn from a living specimen, shows these organs anterior to the cerebral ganglia, which send a small nerve in their direction. They have the appearance of small pits on the dorsal surface, suggestive of sense-organs. They are unpigmented.

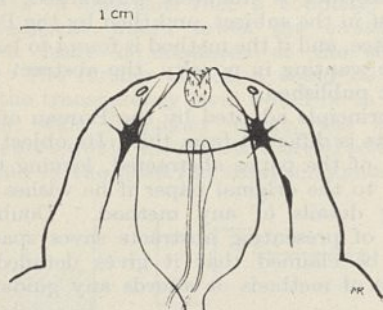


FIG. 1. Head of *Malacobdella grossa*, drawn from life.

I have examined serial sections of a specimen in which these 'organs' were seen during life, but so far have failed to find them; they have, however, been observed on several living specimens. They are more conspicuous in large specimens. If they are sense-organs, the fact is of some interest, since, except for the neuro-epithelial cells, *Malacobdella* has been supposed to be entirely devoid of these<sup>1,2</sup>. A cephalic slit is present in most Nemerteans in a variety of forms; and a reduced cephalic slit might well present the appearance shown. In some Nemerteans the cephalic slits are mere superficial depressions; and if, as a result of the semi-parasitic habit, these became reduced in *Malacobdella* to a vestige, they might be difficult to trace in preserved specimens, though visible during life.

The specimens were obtained in *Pholas* from the collecting ground known as 'Black Rocks', on the Anglesey shore at the eastern end of the Menai Straits. I can confirm the remarks of Gering<sup>3</sup> that the dimensions of *M. grossa* usually given are an understatement. Living specimens measuring 45 mm. long in a state of moderate extension have been obtained here, whereas the largest Kiel specimen observed by Riepen was 22 mm. in length, and the largest Iceland specimen 30 mm. Blanchard<sup>4</sup> records a maximum length of 40 mm. The frequency here is also high, practically 100 per cent of specimens of *Pholas* being infected, as compared with less than 60 per cent infection recorded by Riepen for the host *Cyprina* at Kiel.

My thanks are due to Dr. Stiasny Wijnhoff for advice and assistance with the literature.

L. H. JACKSON.

Zoology Department,  
University College,  
Bangor.  
March 14.

<sup>1</sup> Riepen, *Z. Wiss. Zool.*, 143; 1933.

<sup>2</sup> Burger, "Fauna und Flora des Golfes von Neapel", No. 22 1895.

<sup>3</sup> Gering, *Z. Wiss. Zool.*, 97; 1911.

<sup>4</sup> Blanchard, *Ann. Sci. Natur.* (Series 3), Paris; 1845.

### Discriminative Ability of a Parasitoid

It has recently been demonstrated<sup>1</sup> that *Trichogramma evanescens* and certain other parasitoids are able to distinguish between healthy hosts and those already parasitised. Hearing cannot enter; sight and touch have been ruled out; and it appears that the sense used is that of smell.

The discriminative ability is much finer than was supposed, as shown by the following experiment. A *Trichogramma* female was allowed to walk upon and to examine a number of host eggs, but not to parasitise them. The parasite was then removed and an equal number of clean hosts placed alternately among the others. A second parasite now introduced avoided the hosts that had been visited by the first, as though they had already been parasitised. The experiment has been performed several times, and there can be no doubt that *Trichogramma* females are able to distinguish clean hosts from those that have previously been merely walked upon by another female of their species, and that they avoid attacking the latter. They seem also to be able to distinguish hosts on which they themselves have walked from those which have been visited by another individual.

One of us (J. L.) is now working on the application of this result to the spatial distribution of *Trichogramma*; and has evidence that the parasites are aware when they are moving over a surface previously walked upon by another parasite.

This result renders intelligible a previous observation<sup>1</sup> on *Collyria calcitrator* and *Ibalia leucospoides*. Both of these parasitoids attack hosts which are buried in plant tissues and are therefore not available for examination. Yet they tend to avoid superparasitism. Possibly in these cases, too, the parasites are able to detect, on the surface of the wheat or of the wood, chemical traces indicating that another of their species has been there before them.

GEORGE SALT.  
J. LAING.

Sub-Department of  
Experimental Zoology,  
Cambridge.

<sup>1</sup> Salt, G., *Proc. Roy. Soc.*, B, 114, 455; 1934.

### *Apus cancriformis* in Great Britain

*Apus cancriformis* has been so rarely recorded in Great Britain that it is of interest to report its occurrence in 1934. Some dried mud was collected from a pond in the New Forest district for the purpose of rearing *Chirocephalus diaphanus*, which was known to occur there. Distilled water was added to the mud on August 9, 1934, and larvæ were first noticed on August 12. These larvæ proved, on examination, to be those of *Apus cancriformis*, and not of the expected *Chirocephalus*. Development proceeded, but many died. One individual measuring about 6 mm. across the carapace and 12 mm. from the anterior margin of the head to the base of the caudal furca was preserved on September 29. Another was exhibited alive at the Linnean Society's reception in October last.

A. D. HOBSON.  
JOSEPH OMER-COOPER.

Department of Zoology,  
Armstrong College,  
Newcastle-upon-Tyne.  
March 22.



## Chemistry of Œstrogenic Substances

WE wish to make the following comments on the communication by E. Friedmann in *NATURE* of April 20 (p. 622) under the above title:—

(1) Dr. Friedmann apparently believes that the Œstrogenic activity of synthetic compounds was first observed by Blum-Bergmann<sup>1</sup>, and afterwards verified by Cook, Dodds and Hewett<sup>2</sup> with compounds of analogous structure. The reverse is, of course, the actual sequence of events, as is shown by the reference to our original publication in the paper of O. Blum-Bergmann, wrongly quoted by Dr. Friedmann as O. Blum and E. Bergmann.

(2) If Dr. Friedmann had read our detailed publication<sup>3</sup> as well as our preliminary communication<sup>1</sup>, he would have realised that the generalisation which he now makes regarding the molecular conditions necessary for Œstrogenic activity does not accord with the facts. For example, our series of diols derived from 9:10-dihydro-1:2:5:6-dibenzanthracene contains inactive members as well as compounds having an extremely high order of Œstrogenic activity. Yet if Friedmann's generalisation were true they should all be active. Moreover, we have reported the Œstrogenic activity of certain hydrocarbons, which, of course, cannot conform to any rule concerning the relative positions of an aromatic ring and the carbonyl or hydroxyl group. In addition, we observed activity with ergosterol and calciferol, which contain no aromatic or analogous furane ring. In any event, the large doses of 1-keto-1:2:3:4-tetrahydrophenanthrene necessary to produce œstrus (50–100 mgm. in rats) preclude any far-reaching deductions from the inactivity of the isomeric 4-keto compound in similar doses. If, for example, the 1-keto compound had given positive results with doses of 0.1 mgm., and the 4-keto compound negative results with 100 mgm., there would have been more adequate basis for generalisation.

Our experiments (in collaboration with Mr. W. Lawson) on the biological effects of diols prepared by the action of Grignard reagents on various quinones continue to yield results of interest, which will be fully reported when they are complete.

J. W. COOK.

E. C. DODDS.

Research Institute, Cancer Hospital (Free),  
London, S.W.3.

Courtauld Institute of Biochemistry,  
Middlesex Hospital, London, W.1.

<sup>1</sup> O. Blum-Bergmann, *Naturwiss.*, **21**, 578; 1933.

<sup>2</sup> Cook, Dodds and Hewett, *NATURE*, **131**, 56; 1933.

<sup>3</sup> Cook, Dodds, Hewett and Lawson, *Proc. Roy. Soc., B*, **114**, 272; 1934.

## Refractive Index of Heavy Hydrogen

IN the course of the recovery of some heavy water residues by electrolysis, the gas ( $D_2$ ) was passed after purification through one side of the double tube (75 cm. in length) of a Rayleigh gas interferometer, while hydrogen gas produced by electrolysis of ordinary water and similarly treated was passed through the other side. A final steady shift of 24 drum divisions of the compensating plate was required to compensate for the difference of refractive index of the two gases. This is equivalent to 1.68 fringes of the mercury line  $\lambda = 5461$ , and hence the difference of refractive index of ordinary and heavy hydrogen in the visible region is

$(123 \pm 2) \times 10^{-8}$  at 760 mm., ordinary hydrogen being the greater. The gas passed when the final reading was observed was burnt and collected separately, and proved to be within 0.1 of 100 per cent heavy hydrogen ( $D_2$ ).

W. J. C. ORR.

King's Buildings,  
West Mains Road,  
Edinburgh.  
March 26.

## Deuterium Content of Naturally Occurring Water

THE deuterium content of naturally occurring water has so far been determined by two methods—from the mass-spectrogram of the hydrogen derived from it; and from the specific gravity of deuterium-free water. The former method<sup>1</sup> gave for the abundance ratio H/D the value  $5000 \pm 500$ , while two discrepant values<sup>2,3</sup> have been obtained by the latter, namely 9000 and  $5750 \pm 250$ .

In order to clear up this discrepancy, we have measured the specific gravity increase caused by electrolysis of tap-water (+2 per cent caustic soda). This method presupposes a knowledge of the separation coefficient  $\alpha$ , and is only susceptible of accuracy if  $\alpha$  is not too low and varies between fairly narrow limits. Experiments using water of known deuterium content had shown that for iron cathodes,  $\alpha$  (corrected for evaporation) has an unusually high value; in seven experiments  $\alpha$  had the extreme values of 8.65 and 11.0.

In three separate experiments, 240 c.c. of tap-water were reduced to 20 c.c. by electrolysis with iron cathodes and the increase in specific gravity measured. Taking  $\alpha = 11.0$ , the values obtained for the ratio H/D were 6640, 6390 and 6230 respectively, while for  $\alpha = 8.65$  the corresponding values were 6230, 5980 and 5840, giving for the most probable value H/D =  $6220 \pm 300$ .

This is in agreement with the value  $5750 \pm 250$  obtained by Johnston. His result and ours, taken together, suggest that the mass-spectrographic value is slightly too low, and are irreconcilable with the value of 9000.

A. J. EDWARDS.

R. P. BELL.

J. H. WOLFENDEN.

Balliol College and  
Trinity College Laboratory,  
Oxford.  
March 30.

<sup>1</sup> Bleakney and Gould, *Phys. Rev.*, **44**, 265; 1933.

<sup>2</sup> Ingold, Ingold, Whitaker and Whytlaw-Gray, *NATURE*, **134**, 661; 1934.

<sup>3</sup> Johnston, *J. Amer. Chem. Soc.*, **57**, 484; 1935.

## Philosophical Interpretation of Science

I HESITATE to reply to Prof. H. Levy's letter in *NATURE* of April 20 because the questions raised are matter for arm-chairs and midnight oil rather than correspondence. Some comment, however, must be made, so, leaving the justification of my own philosophical outlook for a more convenient occasion, I will simply refer briefly to the charge that I am representing my viewpoint as "a necessary consequence of scientific discovery".

I can only say that I do consider it a necessary consequence of scientific discovery. That, of course, does not prevent me from believing that others hold



different opinions: it simply leads me to think that they are mistaken. Frankly, I cannot conceive a better reason for holding an opinion than the belief that it is true. It may be, however, that Prof. Levy intended to charge me with trying to propagate my opinions among the uninitiated by disguising them as scientific facts. If so, I must say that the reader who could mistake the passage he quotes for anything but an attempt to interpret scientific procedure or who could regard any such interpretation as established truth, must be more uninitiated than one imagines readers of NATURE to be. Surely one cannot be expected to encumber every sentence with "in my opinion" or "it seems to me" or "I think that", when it is obvious that the matter dealt with belongs to the world of opinion and not to that of fact. But Prof. Levy does seem a little confused about vital distinctions, for he refers to my interpretation as "itself surely an experience", and asks whether I am not compelled to refuse my philosophy any status in the external world. Since he regards interpretation as experience, he has not begun to understand what I have been trying to say; and it certainly never occurred to me to claim that the external world contained philosophies.

It may not be superfluous to add that since the review from which Prof. Levy quotes was specifically concerned with the fact that one very eminent scientific man, whose insight I thought I acknowledged clearly enough, did not share my interpretation, an acute reader might have suspected that that interpretation was not indisputable. On the other hand, out of a multitude of scientific men who could be quoted in support thereof, I select for want of space, only two, 'tolerably known in the revolution'. In "Atomic Theory and the Description of Nature" (p. 1), Bohr writes: "The task of science is both to extend the range of our experience and to reduce it to order". In "The Meaning of Relativity" (p. 1), Einstein writes: "The object of all science, whether natural science or psychology, is to co-ordinate our experiences and to bring them into a logical system". Neither writer explains that he is merely expressing an opinion, or indeed shows any awareness of the "very many men of science" whose views Prof. Levy summarises.

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### Points from Foregoing Letters

INJECTIONS of an extract of the posterior lobe of the pituitary gland produce notable changes in the blood of rabbits, leading to anæmia, according to Prof. E. C. Dodds and Mr. R. L. Noble. The red blood cells show abnormal inequality in size (anisocytosis), some being very large (macrocytes), others of irregular shape (poikilocytes) or having a network pattern (reticulocytes). The spleen shows wedge-shaped areas (infarcts) due to hæmorrhage. From these changes the authors infer that the control of blood destruction may reside in the posterior lobe of the pituitary.

Chromosomes show great variation in size and shape. Dr. D. M. Wrinch discusses some of the factors that may give the constituent micelle of the chromosome the power to contract and change its shape. Among these factors are the attraction between basic and acidic groups, the variation of the number of such groups within the molecule due to changes in the folding-alkalinity of the medium (pH), the folding due to molecular linkage, as in keratin, etc.

Mr. D. Cameron discusses the best conditions under which tracks of  $\alpha$ -particles can be observed in the presence of strong  $\gamma$ -rays during processes of disintegration, and shows how to determine the cross-sections for the disintegration of the beryllium nucleus by quanta of action.

The liberation of electrons by light, a phenomenon of great importance in television, etc., shows in certain instances a strong narrow maximum as the wave-length of light is changed. Prof. Fowler has explained this selective effect as due to surface conditions, the original metal being covered with an electro-negative layer a few molecules thick and then again with a mono-molecular positive layer. This view has been opposed by Zener; Mr. K. Mitchell now claims that Zener's objections are not valid, and that Fowler's theory can explain the observed facts both qualitatively and quantitatively. He also shows that the theory leads to a peculiar form for the normal velocity distribution of electrons from a selective

emitter, and appeals for experimental evidence on this point.

Mr. C. W. Davis shows how, by means of high-frequency damped oscillations, materials of high coercive force can be demagnetised. The method should be useful in the determination of magnetic properties of powders, the testing of iron and steel bars, in processes involving magnetic separation of ores, etc.

The colour-changes of burnished surfaces of copper and steel seen at different angles are greater than expected from the refractive indices of their oxide films, according to Prof. F. H. Constable and Messrs. M. Nazif and H. Eldin. The authors also describe colour effects due to scratches on strips of these metals cleaned with fine emery paper.

Dr. L. H. Jackson submits a diagram and describes a pair of minute structures suggestive of sense organs on the head of *Malacobdella grossa*, a leach-like worm parasitic upon molluscs such as the chalk-boring piddock (*Pholas*).

The parasite insect *Trichogramma evanescens* shows greater ability than hitherto suspected in distinguishing between healthy egg-hosts and those already infected; Dr. G. Salt and Miss J. Laing believe that the sense used in discrimination is that of smell.

The synthesis of compounds having some of the properties of the natural sex hormone has lately attracted much attention. Profs. J. W. Cook and E. C. Dodds dispute Dr. Friedmann's views concerning the relation between oestrogenic activity and molecular structure as recently set forth in these columns.

Heavy water is rapidly becoming a commercial product and the proportion in which it is present in ordinary water is therefore important. From the increase in specific gravity following upon an electrolysis of tap water, Messrs. A. J. Edwards, R. P. Bell and J. H. Wolfenden calculate this proportion to be one part in 6,000, as against one part in 9,000 previously deduced from mass-spectrographic data.



## Research Items

**The Ovingdean Skull.** This remarkable trephined skull—a deformation, of which only two other examples of prehistoric date are known from Great Britain—is described by Dr. T. Wilson Parry and Miss M. L. Tildesley in *Man* of April. The skull was trawled from the sea about three quarters of a mile from the Sussex coast on January 12, 1935. It belonged to a man about sixty years of age, and its surface and texture denote that it had been interred. It is not complete. At the fore-part of both parietals, an inch from the middle line on either side, are two well-defined perforations. That on the right side is almost circular and measures  $1\frac{1}{8}$  in. by  $1\frac{1}{4}$  in. That on the left is roughly rhomboidal, the long diameter being  $1\frac{1}{4}$  inches and the antero-posterior  $1\frac{1}{8}$  in. The method of trephining employed was that of scraping the bone with a flint flake so as to produce a funnel-shaped hole with sides sloping downwards and inwards towards the lumen, a method followed in the third, or Carnac, phase of the neolithic. The operation was performed during life, as the bone shows a slight attempt at reparation. A severe septic periostitis followed, which must have lasted about six weeks. Miss Tildesley's examination indicates that there is nothing in the type of the skull to indicate its date. Similar shapes occur among the Coldrum skulls, but also elsewhere. Maximum breadth alone can be estimated. The fragment is 143 mm. broad and it is unlikely that the original maximum breadth was more than a millimetre or two more. This lies half-way between the greatest average found in the Beaker folk and the lowest found among the neolithic. The bone is hard, suggesting mineralisation, and light grey in colour. The circumstances suggest a cliff burial, which had fallen into the sea; but its colour and consistency are not the same as other bones from the chalk. At the same time, it is not of an appearance which would suggest that it had come from a submerged neolithic forest bed. The only clue to date is the trephining.

**Initiation in Southern Nigeria.** An account of certain aspects of the *Otu* system of the Isa sub-tribes of the Edo people of Southern Nigeria by Mr. H. L. M. Butcher (*Africa*, 8, 2) indicates the importance of this organisation, which in some respects resembles an 'age grade', in others a caste system, in the social system of the people under the Oba of Benin. As a democratic institution it developed most characteristically in remoter districts where the people were less subject to the power and influence of the Oba. Development, however, was not uniform, and local isolation has produced a number of variants. In some the importance of the passage from grade to grade is ignored. Members of the lowest grades in all groups alike are called 'sweepers of the streets', and consist of all youths who are able to do any work. They perform all communal tasks, such as hewing wood, drawing water, etc. Next are the 'adults' who are in the prime of their strength, and mostly have homes and families. They do such work as may be beyond the power of the youths. The senior members only fight in the serious wars, the minor raids being left to the younger men. Though they have no right to speak in the council, their numbers lend weight to their ideas. Above them are the 'junior elders', heads of families, seniors in the small divisions of

the villages, who in most cases have performed a ceremony to free themselves from communal labour, but are not yet members of the council. Finally, there are the 'elders', the repositories of justice and custom, at whose head is the senior elder. His is the final word in the council, and usually he serves the ancestral ju-ju. In most groups he is the administrative, as well as the religious, head of the community. With the *Otu* are associated two classes of ceremony: the first is a 'qualification' ceremony and the second the group of ceremonies by which promotion is gained within the *Otu*.

**Rats and Mice of the Pacific Islands.** Of the five forms of rats and mice found by the Whitney South Sea Expedition in the Pacific Islands, four are ship-borne, and have a world-wide distribution, the black rat, the Alexandrine rat, the brown or 'Norwegian' rat and the house mouse (G. H. H. Tate, *Bull. Amer. Mus. Nat. Hist.*, 68, 145; 1935). These were probably introduced before the advent of white men, and the distinction between their arrival and that of the species regarded as the only true colonist of the Islands, *Rattus exulans*, is only a matter of degree, for the latter also owes most of its spread to mankind. The native rats belong to the *concolor* group of Malaysia, but none of the island members of the group is identical with any living mainland species or with the forms found in Borneo, the Philippines, Celebes or New Guinea. They tend to be larger than mainland forms, and on some of the islands show slight anatomical modifications. Since all the rats and mice have been transported by man they must have followed his colonisation tracks, but this is not obvious from their present distribution since they show no diminution in number of forms from west to east. Probably the original course of distribution from the mainland was by way of Borneo and the Philippines via the Caroline Islands, rather than through New Guinea and the Solomon Islands.

**Newfoundland Fisheries.** In the Reports of the Newfoundland Fishery Research Commission, vol. 2, No. 2 (Annual Report for 1933, recently published), good progress in all directions is shown. Besides the technical research into the dried codfish industry and the nutritive value of the Atlantic salmon, the hydrographical and biological investigations are of special interest. There are now available for comparison complete data for both spring and autumn seasons in 1932 and 1933 and partial data for the autumn of 1931. In the last report (vol. 2, No. 1) it was stated that, compared with the conditions in the autumn of 1931, there was in 1932 a much larger influx of arctic water into the Newfoundland area and simultaneously a stronger and opposite influx of saltier water from the Atlantic occurring in the deeper water layers over the Banks. These conditions led to the production of a large body of 'mixed' water suitable for the multiplication of marine forms of life, so that the season on the Banks and the coasts sharing 'Banks' conditions was a good one for the fishery, there being a marked increase in the plankton. In the present report it is shown that this increase continued to a maximum point during the summer of 1933, but that in the autumn there was a sharp decline, apparently coinciding with a marked diminution in the general influx



of arctic water. In 1933 no salps were taken, indicating that Atlantic water, comparatively unmixed with water from other sources, did not invade the area; this is in accordance with the absence of high salinity water. The Copelata form a valuable guide to presence or absence of squid, the movements of which towards the coast of Newfoundland have in the two previous years followed the trend of *Oikopleura dioica*, and the marked increase of the cold water *O. vanhoeffeni* may perhaps always (as in 1933) precede a failure of the squid fishery for bait.

**An Ancient Egg.** The expedition to Texas, sent out by the Harvard University Museum, has discovered the world's oldest egg (Science Service, Washington, D.C.). It is the egg of a dinosaur which lived on the shores of a great inland sea during Permian times, and if the famous dinosaur eggs from the Desert of Gobi may be put at 100,000,000 years old, the age of this new discovery must be of the order of 225 millions of years. The egg, three inches long and rusty in colour, is unhatched and little distorted by the process of fossilisation. Although it cannot be definitely associated with any particular animal, it is believed to be the egg of a large lizard-like reptile, *Ophiacodon*, measuring about six feet from snout to tip of tail, and part of a skeleton of this creature was found near the egg.

**Germination of Lime Seed.** A very full study of the factors involved in securing prompt and abundant germination of the seeds of the lime is reported upon by J. Nelson Spaeth in Memoir 169 of the Cornell University Agricultural Experiment Station. His conclusion is that the pericarp is not important in delaying germination, but must be removed in order to treat the seed coat. Its removal is difficult because it is tough and leathery whilst the seed coat is hard and brittle. Seeds may be extracted by partially digesting the pericarp with concentrated nitric acid. Delay in germination is due to the impermeability of the seed coat; the water-excluding property depends apparently upon the compactness of the cellulose in the outer part of the palisade tissue of the seed coat, and treatment with concentrated sulphuric acid for 10-30 minutes renders the seed coat permeable without injuring the embryo within. In view of the factor causing impermeability, the important result follows that air-dry storage, which dries this impermeable cellulose layer, increases this impermeability, and as a result air-dried seeds after several years storage will remain impermeable to water for some years when placed in stratification.

**A Fungus Disease of Liverworts.** The *Gardens' Bulletin* of the Straits Settlements of January 26 contains an account of a new species of fungus, *Nectria egens*, parasitic upon a liverwort, *Leptolejeunia corynephora*. Mr. E. J. H. Corner is the author of the paper, and shows that the fungus is a superficial parasite the hyphae of which ramify in the grooves between the convex cell-walls on the surface of the liverwort thallus. Food is absorbed through hyphopodia, and the host is not visibly inconvenienced by the parasite. Several other species of *Nectria* are known to attack bryophytes. Characters of the new species are given by a Latin diagnosis, and Mr. Corner has compared it with another bryophilous species, *Neotiella crozalsiana*, a Discomycete fungus with very similar characters except for a "persistently juvenile form of cleisto-

carpic operculate apothecium". *Nectria egens* is, of course, a definite Pyrenomycete, and the paper raises interesting questions as to fundamental differences between Discomycetes and Pyrenomycetes, other than the form of the fruit body.

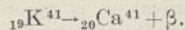
**Brown Rot Diseases of Fruit Trees.** Bulletin No. 88 of the Ministry of Agriculture and Fisheries is devoted to "The Brown Rot Diseases of Fruit Trees" (London: H.M. Stationery Office, 1935. 1s. 6d. net). It is, perhaps, rather significant that this imposing monograph, which is the work of Dr. H. Wormald, replaces a short leaflet of three or four pages. The Ministry has performed a useful service to the fruit-growing community in thus collecting Dr. Wormald's research papers and utilising his special knowledge to review the extensive literature on the subject. This has been accomplished without prejudice to the needs of the practical grower, for descriptions of symptoms and advice on control can easily be separated from the more technical part of the volume. The history of the appearance of brown rot fungi is traced since the first mention of *Monilia fructigena* by Persoon in 1796. It is only of recent years, however, that other fungi have been recognised as causal agents of brown rots. *Sclerotinia* (= *Monilia*) *fructigena*, *S. laxa*, *S. laxa forma mali*, and *S. fructicola* are described in the work under review, and cultural characters are also given. A valuable feature of the bulletin is its international nature, which allows a survey of geographical distribution of the fungi to be made, and also outlines their probable effects on commerce. Conditions conducive to infection, and the mode of entry into the host plant are adequately treated, whilst symptoms and control of brown rots on apple, pear, cherry, peach, nectarine, apricot, quince and medlar are described. Twenty-four pages of excellent half-tone illustrations enrich the text, and six pages of bibliography should be very useful to the plant pathologist.

**Chymase and Protease in Micro-organisms.** A year or two ago, Prof. Constantino Gorini showed that the ability of bacteria to coagulate milk may be revealed by pouring milk which has been lightly sterilised on to the surface of a culture of the organism on agar containing such stimulants as broth, peptone, vitamins, yeast water, blood, etc. In a paper read before the Reale Istituto Lombardo di Scienze e Lettere in November last and published in the *Rendiconti*, 67, parts 16-18, Gorini describes the results of the application of this method of examination to a number of bacteria of various types. Among these were 115 strains of *Streptococcus*, of different origins and belonging to 16 different pathogenic species. When inoculated directly into milk, these showed negative or irregular results. On the basis of the chymase and protease indications of the milk-on-agar cultures, it was found that the organisms were divided between the three types, *Streptococcus pyogenes*, *S. agalactiae* and *S. lactis*. The procedure is hence of diagnostic value in distinguishing between chronic mastitis specific to lactifers and harmless to man, and the acute mastitis the infecting agent of which is transmissible to man through the milk. A number (18) of strains of *B. typhi flavum* of various origins and eight physiological variants of *B. typhi*, Eberth, all displayed, however, similar behaviour, no differentiating criteria being observable. Extension of the method is suggested as a possible means of distinguishing between bacterial species.



**Apparent Magnitude in Scenery.** Scenery, being a pictorial impression of the outdoor world, does not lend itself to direct measurement, which impairs the spontaneous effect on which the impression depends. In a paper on "Apparent Magnitude in Natural Scenery" in the *Geographical Journal* of March, Dr. Vaughan Cornish attempts to discover some principles applicable to the study, using as his material outline drawings of landscape which he has been in the habit of making, without any direct measurement, during the past forty years. Thus, for example, he compares two alpine panoramas each including the rising sun, drawn at distances of four and forty miles respectively. In the latter case the sun's area was increased 3.16 times the former. The customary explanation is the mental comparison of magnitude between the unvarying sun and the varying angle of the landscape, and in other words that the mountains diminished in size as their distances increased and that the increase in the apparent size of the sun was inversely proportional to the change in the apparent magnitude of the mountains. But an examination of the drawings, of which the view-point was known, showed that the diminution in the apparent magnitude of the mountains was much less than the increase of their distance, and simple measurements revealed the fact that the distant mountains were subjectively magnified to the same extent as the sun. Another among many suggestions in the paper is that the more the eye takes in vertically the more it takes in horizontally and the less impressive are both dimensions.

**Radioactivity of Potassium and Rubidium.** Klemperer (*Proc. Roy. Soc., A*, March 15) has investigated some anomalous and interesting features of the  $\beta$ -decay of potassium and rubidium. According to Fermi's theory and Sargent's empirical rules, the decay period of a  $\beta$ -transformation is connected with the upper energy limit of the  $\beta$ -spectrum, and if these rules are applied to potassium, they give a period of a few minutes or a few days, according to whether the  $\beta$ -transition is of the 'allowed' or 'forbidden' type. The measured half decay period is of the order  $7.5 \times 10^{11}$  years on the assumption that the heavy isotope,  $^{41}\text{K}$ , is alone active, and it is therefore necessary to examine alternatives to the simple reaction,



It must be noted that  $^{40}\text{Ca}$  has never been found by mass-spectrum analysis of old potassium minerals. Gamow has suggested as alternative schemes, (1) the simultaneous emission of two  $\beta$ -rays, (2) an  $\alpha$ -decay, followed by the observed  $\beta$ -decay which comes from a short-lived halogen atom; and (3) a slow  $\beta$ -decay followed by the observed  $\beta$ -rays which come from short-lived calcium and strontium atoms. Klemperer has examined the first coincidence Geiger counters, and the second and third by chemical separations and the use of a linear amplifier. The results were negative in each case. He suggests that the  $\beta$ -rays come from undetected, rare, but still long-lived isotopes,  $^{40}\text{K}$  and  $^{86}\text{Rb}$ . The anomalous lifetime of these elements (with respect to the Sargent rules) would be explained if they had a large nuclear spin, the  $\beta$ -ray being then a kind of 'super-forbidden' transition. Newman and Walker (*Phil. Mag.*, April) also suggest that the radioactivity of potassium may arise from  $^{40}\text{K}$  or  $^{42}\text{K}$  and that of rubidium

from  $^{86}\text{Rb}$ ,  $^{87}\text{Rb}$  or  $^{88}\text{Rb}$ . Their suggestion that these isotopes could be produced experimentally by neutron bombardment is probably not practicable.

**Discovery of Mephitic Air.** In 1772, Daniel Rutherford (1749-1819), professor of botany in the University of Edinburgh, published his "Dissertatio Inauguralis de Aere Fixo Dicto aut Mephitico", in which he announced among other matters his discovery of 'noxious air', afterwards called nitrogen. In *Science Progress* (29, 650; 1935), D. McKie has made an interesting analysis of the part of the dissertation concerned with nitrogen and shows that, contrary to the usual statement, Rutherford did not use the name 'mephitic air' for this gas, but for the 'fixed air' (carbon dioxide) discovered by Black, referring to nitrogen as another species of noxious air. He found that when an animal was confined in a limited volume of air it presently expired and the air was reduced in volume and rendered incapable of supporting fire or life. Removal of 'fixed air' by alkali did not restore it to its former wholesomeness. The relations to Priestley's discoveries are considered, and it is concluded that Rutherford's work was quite independent. Rutherford did not arrive at any clear explanation of his results, and did not see that the 'noxious air' (nitrogen) was a constituent of the atmosphere, regarding it rather as air combined with phlogiston.

**A New Relativity Theory.** A second instalment of Sir Shah Sulaiman's new theory of relativity has appeared (*Proc. Acad. Sci. U.P. India*, 4, 217); the first part appeared in the same journal (4, 1) in August 1934. The author retains Euclidean space, and as much as possible of Newtonian dynamics, the chief deviation being the hypothesis that gravitational, electrical, and magnetic forces do not act instantaneously, but are propagated with a velocity nearly equal to that of light. Light is supposed to consist of 'radions' emitted from the surface of bodies, and gravitation of 'gravitons' from their entire mass. From these hypotheses four 'universal principles' are deduced. Two of these, akin to Doppler's principle and aberration, deal with the modification of the magnitude and direction of the gravitational force upon a moving body, and these are applied to the advance of the perihelion of Mercury, the deflection of light by gravitation, the spectral shift, and the experiments of Michelson and Morley, and of Bucherer. Another gives a formula for the relative velocity of two moving bodies, which is applied to the experiments of Fresnel and of Fizeau. The remaining one is applied (in outline only) to the fine structure of the hydrogen spectrum. The idea of an expanding universe is firmly rejected, though it is allowed that some nebulae, formerly part of our galactic system, have left it on parabolic paths. In short, an attempt is made to give an alternative explanation for the whole range of phenomena usually adduced in support of Einstein's theory. It is difficult to form a definite opinion whether the author's work is entirely sound, but he has evidently studied all the standard works. The mathematics has been checked by two competent mathematical physicists, and the work has been carried out with the encouragement of Prof. M. N. Saha. If it can stand the test of criticism, it will obviously be of great importance.



## Social and Economic Conditions of West Australian Aborigines

THE report of a Commission of Inquiry on social and economic conditions among the aborigines of West Australia and the working of the State system of protection, which was published on March 12 last, criticises strongly the inadequacy of the provision for medical attention, the inefficiency of the care for half-castes and the wasteful and unsatisfactory character of the management of the Moore River settlement. The Commissioner, Mr. H. D. Moseley, is doubtful of the success of the missions among the aborigines; and he finds that allegations of cruelty and ill-treatment of the aborigines, which have appeared in the public Press from 1930 onward, are without foundation.

In the north and north-west, natives on pastoral properties, the Commissioner reports, experience conditions which as nearly as possible approach their natural life. The work of the aborigines employed on stations takes an appropriate form, and the only criticism of the Government stations is that a greater effort should be made to keep the aborigines more constantly employed. The 'bush' natives are best left alone; and the land now occupied by them should be secured inalienably as a reserve and additional land should be set aside for reserve purposes in anticipation of closer white settlement in the northern area. The native is under no hardship through the non-payment of wages; and there is nothing approaching a condition of slavery. In the north-west, where the wage system has been in operation for some time, it has encouraged the gambling and squandering habits of the aboriginal.

To meet the inadequacy of the present medical attention available, the establishment of clinics and hospitals is recommended at four points to facilitate early diagnosis and treatment. Farther south, in the areas of closer settlement, increased hospital accommodation is recommended, the existing accommodation being both inadequate and undesirable in character. In addition to providing first-aid stores, employers of labour should be required to make payment into a medical fund on account of each employee; and in this connexion the present system of licenses for labour is criticised, as it does not require particulars of individual employees to be reported, but merely the total number employed. A system of registration is therefore recommended.

In dealing with leprosy, the inadequacy of the provision for segregation of detected cases awaiting transhipment to the leper hospital at Darwin, and the delay in evacuation are strongly criticised. It is suggested that the State should withdraw from the arrangement whereby leprosy is made a Federal

concern and provide a leprosarium of its own on one of the islands off the coast; but if this is impossible, that suitable arrangements should be made for isolating detected cases, while the inspection for leprosy and venereal disease, for which agitation has been going on since 1924, should be held forthwith.

If conditions in the sparsely settled north and north-west can be regarded as satisfactory on the whole, except as regards the medical question, it is far otherwise in the more closely settled south, where the aboriginal has come more closely into contact with white civilisation, and native camps are situated in close proximity to the towns. In the Moore River settlement, children and young persons are being educated and trained in close proximity to the camps for indigent aborigines, without proper measures being taken to keep them apart; hence most undesirable results, especially as affecting young girls. The buildings are inadequate, verminous and inefficient, and proper educational equipment is lacking. The care of half-castes is thoroughly inefficient and inoperative. So far as possible, camps should not be allowed to remain near the towns. It is recommended for both able-bodied aborigines and half-castes that a system of farm-stations should be established on which adults and parents could work on their own allotments, while the children were trained for suitable occupations. An extension of the existing arrangements for the training of girls for service and other occupations is also recommended.

In regard to the laws affecting aborigines, the most important measure suggested is the provision of special courts for the trial of 'bush' natives, in which the proceedings would be suited to the code of the native and such as he himself and the members of his tribe would understand. The holding of such courts might be part of the duties of a district protector on patrol.

It is pointed out how far the criticism of existing conditions is concerned with matters which can be attributed to the defects of the present organisation of protection, whereby the Chief Protector, assisted by more than a hundred honorary protectors, who do not function except to grant permits to employ labour, has been overburdened with office work and has been unable to travel and inspect actual conditions. A reorganisation is recommended in which the office of Chief Protector should be abolished, and his place taken by a secretary of the Department, who would be responsible for office detail, while the active work of protection would be in the hands of district protectors, of whom one, a medical man, should be appointed to the northern area forthwith.

## The Collection of Dew

By H. E. BECKETT and A. F. DUFTON

ARISING from the serious shortage of water in many districts during the summers of 1933 and 1934, the suggestion was made that the collection of dew would be profitable and that research should be undertaken into the economic design of dew-ponds. A little consideration showed that certain types of roofs, suitably insulated underneath, might act as economical and efficient collectors of dew.

If 'dew ponds' really do collect dew owing to the

cooling either of the water surface or of the surrounding banks below the dew point, by radiation to the night sky, even more dew should be collected on a thin metal roof of low thermal capacity, provided that the roof has an efficient radiating surface and is prevented from gaining heat from below.

In order to find whether sufficiently low temperatures could be obtained on thin metal sheets and to what extent these temperatures were affected by



surface treatments of the sheets and by the amount of insulation beneath them, four galvanised iron sheets, measuring 4 ft. 3 in. square, were supported off the ground and exposed out of doors at the Building Research Station. One sheet was left plain, another was formed into a shallow tank and filled to a depth of 1 in. with water; the two remaining sheets were whitewashed on the upper surface and one was provided with 7 in. of cork insulation underneath.

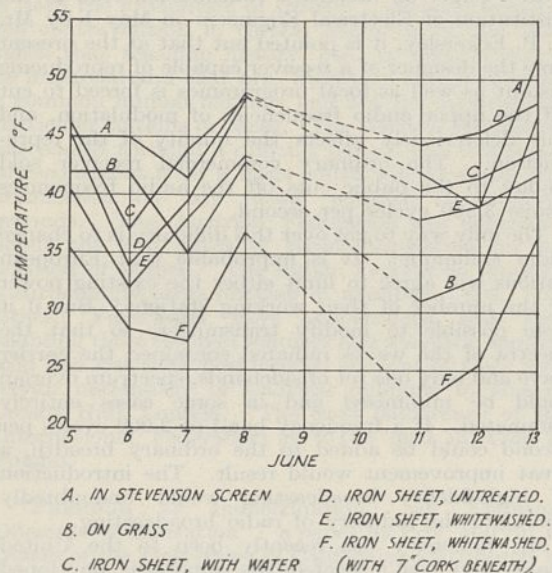


FIG. 1. Minimum temperatures.

Each sheet was provided with a thermocouple by means of which its temperature was recorded. The minimum temperatures recorded on a number of nights in June are shown in Fig. 1. It will be seen that the specimen which was whitewashed on top, to reflect the sun's heat by day and to radiate heat by night, and was heavily insulated beneath with cork, became appreciably colder than any of the other specimens, the lowest temperature recorded being 22° F., 20° F. below the screen minimum for the night.

The next step was to experiment on a larger scale with an actual roof, to find how much dew could be collected. For this purpose a section of a corrugated iron roof, 18 ft. 7 in. long by 11 ft. wide and having a pitch of  $7\frac{1}{2}^\circ$ , was provided with separate drainage. The roof was insulated underneath with two sheets of aluminium-faced asbestos paper, spaced 1 in. apart, the equivalent of about 1 in. of cork, and was whitewashed on top. The temperature of the iron sheets was recorded by means of a thermocouple.

Measurements were made on this roof on suitable clear nights from July to September, but the results were disappointing. Dew *could* be collected on nights most favourable for the loss of heat by radiation, but suitable nights were by no means frequent, and, even then, the amount of dew collected was small. A typical record is given below.

## Dew Collection on Night of Sept. 21-22

Minimum roof temperature . . . . .	28° F.
Minimum screen temperature . . . . .	361° F.
Grass minimum . . . . .	29 <sup>5</sup> F.
Minimum temperature on bituminous felt on adjacent flat roof with 7 in. of slag-wool insulation underneath . . . . .	251° F.
Dew collected . . . . .	70 cu. in.

The quart of water which is obtained on a night when the sky is propitious is a mere dribble compared with the 10 gallons which the same roof collects during 1/10 inch of rainfall, and it is obvious that, as an auxiliary water-supply during drought, the collection of dew in this way cannot be seriously considered. Storage for rain water is more economical to instal, more reliable and altogether more practicable.

From the experiments described above, it may also be inferred that the action of 'dew-ponds' cannot be ascribed to the ordinary deposition of dew. This corroborates the findings of E. A. Martin<sup>1</sup>, who as a result of an extensive study, decided that the ponds depend for their replenishment upon mists rather than dew and that the term 'dew-pond' is a misnomer. According to Martin, the word 'dew-pond' does not appear to have been used prior to 1813 ('The Shorter Oxford English Dictionary' gives the date 1877) and, since then, although some ponds have borne that name, others have been known as 'cloud-ponds', 'mist-ponds' or 'fog-ponds'.

<sup>1</sup> E. A. Martin, "Dew-Ponds". T. Werner Laurie, Ltd., London, 1911.

## Sylvicultural Research in Nigeria

SINCE the appointment of two sylviculturists for research in Nigeria in 1928, a remarkable amount of good work has been undertaken in connexion with the rain and moist deciduous forests in the south-western provinces. In the *Oxford Forestry Memoirs*, No. 18 (Oxford, The Clarendon Press; 1934), Mr. W. D. MacGregor, one of the sylviculturists, publishes an account of his work in a brochure entitled "Sylviculture of the Mixed Deciduous Forests of Nigeria, with Special Reference to the South-Western Provinces".

The mixed deciduous forest type in West Africa is an important concomitant of the forest flora, coming between the true deciduous and the true evergreen forest types. Botanically it includes high forest trees of both types, but differs from the deciduous forest in containing evergreen under

canopies, and from the evergreen or rain forest in containing top canopies of deciduous trees.

From the forester's point of view, the mixed deciduous forest type is nearer to the deciduous than to the rain forest type. It is in reality a climatic formation in which deciduous trees attain their optimum development. In its most humid form, the mixed deciduous merges imperceptibly into the rain forest type. It requires a rainfall averaging 50-70 inches per annum.

Of the numerous natural orders of this forest type, *Sterculiaceae*, *Leguminosae*, *Moraceae* and *Combretaceae* are the most important. The two magnificent trees *Triplochiton scleroxylon* and *Chlorophora excelsa* have the greatest range in distribution.

With the evergreen forests to the south and the deciduous forests to the north, the mixed deciduous



forests form an almost continuous belt of varying width running parallel to the coast. They are said to hold great timber wealth of large dimensions. They have not been exploited, however, to anything like the extent of the rain forests owing to their geographical position, which places them outside the zone of streams and rivers suitable for floating timber.

The object of Mr. MacGregor's memoir is to record all the experimental and research work in connexion with the sylviculture of the mixed deciduous forest type upon which he has been specially engaged; or on which other officers have obtained some experience of, for example, plantation work. In the latter work, fuel plantations have formed an important branch. Large areas of indigenous species have been planted at Akilla, Ondo Circle. At Mamu and Olokemeji teak has been successfully grown—but almost, until recently, at the expense of good local indigenous species. Latterly, however, research work in the nursery and plantation has been devoted to the study of the requirements of indigenous species with the view of replacing exotic species when possible.

It is a curious anomaly that here in the West African tropical forests, with a plethora of magnificent timber trees of which almost the only one known, during the past century at least, was mahogany, the first commencements of forest plantation work on a scientific basis should have been made with teak in several colonies to the neglect of some of the, admittedly little-known, indigenous species. The research work with the latter undertaken by Mr. MacGregor and ably depicted in this memoir proves that West Africa has timbers which will probably, in the future, be able to hold their own on any timber market in the world.

In addition to the nursery and experimental plantation work undertaken with indigenous species, sylvicultural experimental work in connexion with both artificial and natural regeneration has been commenced with considerable success.

Chapters are devoted to the description of the sylvicultural characters of a number of species, indigenous and exotic, and some excellent descriptions of seedlings. Finally, there is a report on the soils at Olokemeji by Mr. H. C. Doyne, senior agricultural chemist, and Mr. W. A. Watson, agricultural chemist, Ibadan.

Although perhaps it is too early to accept the mass of detail recorded in this important memoir as actually proved, without further check, yet Nigeria may be complimented on the methods upon which the work has been carried out.

### The Broadcasting Wave-Lengths of Europe

THE plan for allocating the wave-lengths of the broadcasting stations in Europe published in 1934, and known as the Lucerne plan, is getting more and more difficult to work. The trouble arises mainly from the fact that the full range of frequencies available for the carrier waves is 1,350 kilocycles per second, and in order to prevent serious overlapping, each station requires a width of about 10 kilocycles per sec. In order to secure agreement between the various nations concerned, it was necessary to allocate 133 channels to 170 working stations, so that some had to work at the same frequency, care being taken to give these frequencies to small stations at a great distance from one another.

Unfortunately, little attention had been given to

limiting the power of large broadcasting stations, and so there are now thirteen in Europe which work at 100 kilowatts or above, eighteen with powers not less than 50 kw. and twenty with powers not less than 20 kw. Many of these stations are transmitting through the same zone of darkness, and it follows that the spectra of the waves radiated by powerful stations in contiguous channels will overlap. The overlapping sidebands of these unwanted stations produce serious interference.

In a paper on broadcast transmission read to the Institution of Electrical Engineers on May 1 by Mr. P. P. Eckersley, it is pointed out that at the present time the designer of a receiver capable of reproducing distant as well as local programmes is forced to cut off the upper audio frequencies of modulation, and this deleteriously affects the quality of the reproduction. The ordinary commercial receiver sold to-day to the public cuts off the audio frequencies above 3,500 cycles per second.

The only way to get over this difficulty is to change radio technique. It is improbable that European nations will agree to limit either the existing power or the number of their working stations. But if it were possible to modify transmitters so that the spectra of the waves radiated contained the carrier wave and only one set of sidebands, spectrum overlap could be minimised and in some cases entirely eliminated. If a frequency band of 2,000 cycles per second could be added to the ordinary breadth, a great improvement would result. The introduction of high-fidelity broadcasting would undoubtedly stimulate the industry of radio broadcasting.

Mr. Eckersley has recently been to the United States and has inspected the apparatus developed by Wired Radio Inc. for use in connexion with their high-frequency broadcasting system. He found that several of the methods he recommended were similar to their methods, and that a very high quality of reproduction was achieved.

### University and Educational Intelligence

CAMBRIDGE.—The sixth course of Scott Lectures will be given by Prof. G. Hevesy in the Cavendish Laboratory at 4.30 p.m. on May 13, 15 and 17. The subject of the course will be "The Terrestrial and Cosmic Abundance of the Elements".

An election to the Isaac Newton Studentship will be held in the Michaelmas Term 1935. These studentships are for the furtherance of advanced study and research in astronomy and physical optics and are open to those members of the University who have obtained a degree in the University and were less than twenty-five years of age on January 1, 1935. Candidates are invited to send in their applications to the Vice-Chancellor between October 8 and 14, 1935. The emolument of the student will be £250 per annum.

EDINBURGH.—Mrs. Stewart Hall has given £15,000 for the endowment of a lectureship in the pathology of the diseases of children.

On the recommendation of the Joint Committee of the University Court and the managers of the Royal Infirmary, Dr. A. E. Barclay, lecturer in medical radiology, University of Cambridge, has been appointed lecturer in radiology in the University, on his appointment as radiologist to the Royal Infirmary from May 1, 1935.



THE International Federation of University Women held a meeting at Budapest in September last, when twenty-six national federations were represented. Among the resolutions adopted was one deprecating the "tendency, increasingly evident in the majority of countries, by new regulations to debar women from careers for which they are well qualified, whether on grounds of sex or marriage" and declaring such regulations to be "inimical to the family which is itself the foundation of society". Another deplores the contravention in certain countries of the principles that teaching history, etc., in schools should be impartial and that art, literature and science are a common human heritage and not the appanage of particular nations or races. The German Federation has passed through a difficult period, and it is hoped to reconstruct it on a basis which will eliminate discrimination on any racial, political or religious grounds. The Austrian Federation was concerned about the bad effect of recent legislation on the position of women. The Indian Federation reported a surprisingly large number of members—400. The British Federation gave scholarships last year enabling three German scholars and scientific workers who had lost their positions on account of their non-Aryan nationality or political opinions to live at Crosby Hall, London. The next conference of the International Federation is to be held in 1936 in Poland.

"FREEDOM or Indoctrination: an Enduring Dilemma of Education": a paper by Prof. Marvin L. Darsie of the University of California, contributed to *School and Society* of February 2, deals judiciously with this theme—one that is in the forefront of current educational topics of discussion in the United States. The recent development in Germany of authoritarianism in educational as in other fields has proved a powerful irritant provoking such discussion. Prof. Darsie's paper attempts an analysis of some of the complex factors associated with capitalism, scientific technology and the increasing solidarity of organised labour, in which the age-long conflict between the advocates of free intellectual inquiry and the guardians of established doctrine is to-day entangled. Starting from the position that the concepts of freedom and indoctrination have to do with the interweaving of the "two innately conditioned desires for self-expression or pre-eminence and security within the immensely complex maze of social patterns constituting a culture or civilization" he proceeds to consider the resulting problems confronting the educator. The public school teacher functions in an agency maintained by society for the direct purpose of indoctrinating the young with the established institutional patterns: but these represent nuclei of public opinion substantial at the core but with continuously fluctuating margins. It is peculiarly the function of the enlightened teacher "to keep alive this fringe of experimental thinking and at the same time to prevent its detachment from the institutional matrices which guard the stability of any organized society". In this delicate task he must beware of endorsing or promoting any propagandist movement, but his obligation to human welfare requires him to defend and preserve the fringe of free experimental inquiry. The dilemma is discussed in terms of national policies in a short article, "The Great Rift in Education", by Dr. J. F. Abel in *School Life* of December.

## Science News a Century Ago

### Loads Carried by South American Miners

On April 27, 1835, Darwin set out from Valparaíso on horseback for Coquimbo, which he reached on May 14. On May 12 he stayed at some mines, and writing of the loads carried by the miners, he said: "Captain Head has described the wonderful load which the 'Apies', truly beasts of burden, carry up from the deepest mines. I confess I thought the account exaggerated; so that I was glad to take an opportunity of weighing one of the loads, which I picked out by hazard. It required considerable exertion on my part, when standing directly over it, to lift it from the ground. The load was considered under weight when found to be 197 pounds. The apire had carried this up eighty perpendicular yards, —part of the way by a steep passage, but the greater part up notched poles, placed in a zigzag line up the shaft. According to the general regulation, the apire is not allowed to halt for breath except the mine is six hundred feet deep. . . . These men, excepting from accidents, are healthy and appear cheerful. Their bodies are not very muscular. They rarely eat meat once a week, and never oftener, and then only the hard dry charqui. Although with a knowledge that the labour was voluntary, it was nevertheless quite revolting to see the state in which they reached the mouth of the mine; their bodies bent forward, leaning with their arms on the steps, their legs bowed, their muscles quivering, the perspiration streaming from their faces over their breasts, their nostrils distended, the corners of their mouth forcibly drawn back, and the expulsion of their breath most laborious. . . . After staggering to the pile of ore, they emptied the 'carpacho', in two or three seconds recovering their breath, they wiped the sweat from their brows and apparently quite fresh descended the mine again at a quick pace. . . ."

### Bird Distribution

Much new light on the distribution of bird life outside Europe was shed at the meeting of the Zoological Society of London on May 12, 1835, with Mr. N. A. Vigors in the chair. The skin of a kiwi, *Apteryx Australis*, Shaw, sent by the Colonial Secretary for New South Wales, was exhibited, along with an account of the habits of the bird, its probing of the ground with its long bill for earthworms and its scant distribution in New Zealand, whence it had been obtained by a correspondent who had seen only two during his stay there. Colonel Sykes exhibited a series of bird skins presented to the Society from the Cape region of South Africa by Capt. Spiller, and these, stated Sykes, had enabled him to make a comparison with the collection of birds he had shot in India, and those of Europe, to draw up a list of fifteen species of bird found equally in South Africa and India, four species found in South Africa, India and Europe, and two species 'universal', providing *Strix Javanica*, Horsf. was identical with *Strix flammea*, Linn. A female hybrid pheasant, *Phasianus colchicus*, produced by a cock pheasant and greyhen (*Tetrao tetrix*) from the Merington Covers of Mr. R. A. Slaney, near Shrewsbury, was exhibited and described by Thomas C. Eyton.

### Geology of Seeland and Möen

At a meeting of the Geological Society on May 13, 1835, Lyell read a paper entitled "On the Cretaceous



and Tertiary Strata of the Danish Islands of Seeland and Møen". According to a report in the *Philosophical Magazine*, "Mr. Lyell examined, in company with Dr. Forchhammer, the cliffs of Seeland and Møen during the summer of 1834, and the following are the results at which he arrived. The two formations of which Denmark and Danish Holstein chiefly consist are chalk, and an overlying tertiary deposit. Part of the latter resembles in composition the argillaceous and sandy beds of the English crag. Another part corresponds with deposits usually called diluvial, especially those associated with the English crag, in parts of Norfolk. Large erratic blocks are also strewn over the surface of Denmark, connected with, and sometimes buried in the gravel, or 'diluvium'. In some sections on the banks of the Elbe, the yellow tertiary sands are divided regularly into thin strata and are exposed for a thickness of about 200 feet. . . . The white chalk of Denmark is characterised by the same fossils as those of the upper chalk of France and England."

#### Water from the Well of Zem-zem

At a meeting of the Royal Society on May 14, 1835, a communication from John Davidson was read giving "An Account of the Water of the Well Zem-zem, with a quantitative analysis of the same by Professor Faraday". Davidson had sent home about three quarts of the water from the well of Zem-zem near Jedda, to which the Mohomedans ascribed a sacred character and extraordinary virtues. The can containing the water had been sealed, but unfortunately it had been opened in the London Docks and the gas with which it was charged had escaped. The precipitate thrown down was found by Faraday "to consist of carbonate of protoxide of iron in the enormous proportion of 100.8 grains to the imperial pint of water. The clear liquid was neutral and contained much muriate, and a little sulphate but no carbonate; together with a little lime, potash and soda. There was also found an alkaline nitrate in considerable quantities; this Mr. Faraday conjectures to have been saltpetre, which had been added to the water by the priests".

### Societies and Academies

#### PARIS

Academy of Sciences, March 25 (*C.R.*, 200, 1077-1160). ROBERT LESPIEAU and PAUL HEITZMANN: The  $C_8H_4$  hydrocarbons arising from the action of crotyl bromide upon its magnesium derivative. Three isomers have been isolated from the product of this reaction: their probable constitution is indicated. GASTON FAYET was elected a member of the Section of Astronomy in succession to the late Benjamin Baillaud. JEAN LERAY: The topology of the abstract spaces of M. Banach. JEAN DELSARTE: The application of a general principle of development of the functions of a variable to the series of Bessel's functions. K. NIKOLSKY: The electromagnetic field of Dirac's electron. EDGAR PIERRE TAWIL: Considerations on the development of electricity by quartz. The electricity developed by the torsion of quartz is named strepoelectricity, and reasons are given for regarding this as distinct from piezoelectricity. ALBERT MILHOUD: The electromotive force produced by the outflow of steam. Study of the effects on the electromotive force of the presence

of traces of electrolytes in the drops of water in the steam jet. J. CAYREL: Remarks on the energetics of thin plates placed in the midst of a polarisable medium. ROBERT BOSSUET: The quantitative spectrographic analysis of the alkali metals. Application to caesium in mineral waters. The salts are volatilised in an oxyacetylene flame and the dilution determined at which the line 4555.3 vanishes. Figures are given for the caesium found by this method in ten French mineral springs. JEAN TERRIEN: The absorption and fluorescence of the vapours of the cuprous halides. CHARLES LAPICQUE: The distribution of light in the retinal image of a distant point. MARC ANTOINE FOËX: The application of electrical conductivity to the study of separations in fused glasses. CHARLES DUFRAISSE and MARIUS BADOCHÉ: Relations between the optical properties of the medium and the photochemical constants of tetraphenylrubene. Individual influence of the chemical nature of various solvents. The chemical nature of the solvent exerted a marked influence on the oxidation velocity. MME. PAULETTE BERTHIER: The rôle of evaporation in the phenomenon of imbibition presented by porous bodies. PIERRE DUBOIS: The decomposition of permanganic acid and of manganese peroxide. Details of the precautions necessary during the preparation of the peroxide to obtain pure  $MnO_2$ . ANDRÉ MORETTE: A new method for the preparation of pure vanadium. Metallic vanadium containing more than 99 per cent of the metal can be prepared by the action of magnesium on vanadium tetrachloride or dichloride at 700°-800° C. Y. RENÉ NAVES, GEORGES BRUS and JEAN ALLARD: Contribution to the study of the citronellol-rhodinol isomerism by means of Raman spectrography. Comparison of alcohols obtained from various sources and carefully purified. DANIEL GARDNER, MICHEL PROCOFIEF, GEORGES JUSOV and MARIA LUCIANA CASELLI: The synthesis of carvacrol. Description of a complete synthesis of carvacrol, starting with paracymene. A second method is from orthoeresol and isopropyl alcohol, by treatment with phosphorus pentoxide. MME. NELICIA MAYER: The composition of solutions of glucides after treatment with alkali. RAYMOND PAUL: Oxidation and reduction phenomena observed in the catalytic dehydration of the furylalkylcarbinols. PAUL GAUBERT: Modification of the facies of crystals of phloroglucinol by colouring matters, and the action of heat on the coloration. G. CHOUBERT: The enclosures of some lodes in the neighbourhood of Bresse (Vosges). MME. ODETTE THELLIER: Simultaneous measurements of various elements of atmospheric electricity. V. GRÉGOIRE: New data on the morphogenesis of the leaf axis in the Dicotyledons. FERNAND OBATON: The biological behaviour of *Sterigmatocystis Phœnicis* compared with that of *Sterigmatocystis nigra*. PAUL RIOU and JOACHIM DELORME: The presence of manganese in maple sugar and in cane sugar. MME. E. LE BRETON, MAURICE NICLOUX and GEORGES SCHAEFFER: The coefficient of ethyl-oxidation and basic metabolism in some homeotherm species. NICOLAS T. KORESSIOS, HENRI TILLÉ and JEAN CHASSANG: Comparative studies on certain physiological effects of cobra poison, filtered and unfiltered. The best conditions for experimenting with venoms. MARCEL GESLIN: Contribution to the study of the argon-nitrogen ratio in natural gases. Gases arising from the natural destruction of animal or vegetable organisms show a ratio of argon to nitrogen lower than that found in air. This is



attributed to the nitrogen evolved from the animal or vegetable matter. J. ANDRÉ THOMAS: The vitellin entoblast behaves *in vitro* as a merocrine gland secreting a product comparable with the vitellus. ETIENNE RABAUD and MLE. MARIE LOUISE VERRIER: The ablation of the swim bladder of the Physostome fishes. MLE. DINAH ABRAGAM: The specific curves of discharge of normal and cancerous animal tissues charged electrically. CHARLES DHÉRE and MLE. ANNE RAFFY: The infra-red radiation emitted by the fluorescence of green leaves when illuminated. J. WAJZER: The static interfacial tension as a function of the concentration of alkali in the saponification of oil. MME. ANDRÉE DRILHON: The alkaline reserve, the pH and moulting in the short tailed Crustaceans. HENRI VIOLLE: The action of sodium ricinoleate on various micro-organisms. Various strains of human and bovine tubercle bacillus, and various types of Spirochaeta, were killed by contact with weak solutions of sodium ricinoleate. At similar concentrations, various diastases were unaffected. FRANÇOIS MIGNON: Researches on the mechanism of anaphylactic sensitisation. RENÉ LERICHE and RENÉ FONTAINE: The present state of knowledge concerning periarterial sympathectomy, after 546 operations.

## BRUSSELS

Royal Academy (*Bull. Classe Sci.*, 31, No. 2, Feb. 2, 1935). E. HENRIOT: The antisymmetrical aspect of electromagnetism: torque and moment (2). Extension to case of media possessing optical rotatory power. P. BRUYLANTS: Some observations on the subject of the properties and the structure of maleo- and citraconitrile. Molecular refractivities suggest that these compounds are not true *cis* nitriles but internal dinitriles possessing a ring structure. G. BOULIGAND: Application of the contingent to obtain the criteria for identical vanishing. C. LURQUIN: On the algebra of eventual variables. H. GEIRINGER: A new method of theoretical statistics (problems in two dimensions). P. DEBYE: The rotation of the molecules in liquids. The theory of the change in the molecular polarisation and Kerr effect in passing from the gaseous to the liquid state is given in terms of a potential energy of orientation of the molecules in a liquid. YVONNE DUPONT: Th. De Donder's thermodynamic synthesis applied to the transverse Nernst and Ettinghausen effects. Bridgman's law concerning these effects is extended to the case of irreversible transformations. M. NICOLET: On the presence of argon in stellar atmospheres. The evidence is on the whole conclusive as to the presence of argon in certain stars. L. PONCELET: On turbulent movements in the stratosphere disclosed by a sounding balloon. The record of an ascent clearly shows two singularities which prove the existence of turbulence in the stratosphere. J. DE WOLF and L. VAN DE STRAETE: Maleo- and fumaronitrile. Methods of preparation and various physical properties of methyl fumarate, fumaramide, fumaronitrile and the corresponding derivatives of maleic acid. L. VAN DE STRAETE: Citracono- and mesaconitrile. Extension of work of preceding paper to these compounds. E. RUPPOL: Ultra-violet absorption spectra of fumaro-, maleo-, mesacono- and citraconitrile. The ultra-violet spectra of aqueous and methyl alcoholic solutions of the compounds described in the two preceding papers. M. GHERMANESCO: On Fredholm's third theorem (erratum).

## CRACOW

Polish Academy of Science and Letters, February 4. S. MAZURKIEWICZ and MLE. K. SZMUSZKOWICZOWNA: Quasi-analytical functions (B). M. WOLKE: A new method for detecting the neutrino. The new method for proving the presumed existence of the neutrino consists in counting the electrons projected from lead by the neutrino, either with a Wilson chamber or a Geiger-Müller counter. S. MROZOWSKI: The hyperfine structure of the mercury hydride bands. A. JABŁOŃSKI: The negative polarisation of the phosphorescence of molecules adsorbed by colouring matters. W. SZYMANOWSKI: The influence of the concentration of potassium iodide on the duration of the fluorescence of uranine solutions. MLE. A. WRZESINSKA: The variability of the fluorescence spectrum of tryptaflavine in glycerol solution. S. DOBINSKI: The influence of the electric field on the viscosity of liquids. The change of the viscosity of liquids under the influence of the electric field is due to the action of ions and diminishes or disappears when the liquids are purified. W. SWIETOSŁAWSKI and S. MIERNIK: The determination of small amounts of moisture in solid organic substances. The method is based on the lowering of the temperature of condensation of the vapour of a binary azeotrope by water. The accuracy is of the order of 0.003 per cent. W. SWIETOSŁAWSKI, M. WOJCIECHOWSKI and S. MIERNIK: The determination of moisture in standard benzoic acid. The application of the boiling point method to benzoic acid, standard 48a of the Washington Bureau of Standards, gave a moisture content of 0.0047 per cent. MLE. R. LUDWICZAK and J. SUSZKO: Studies on the saponification of the methyl group of quinidine. M. KSIAZKIEWICZ: The zone of the external Carpathian klippe in the neighbourhood of Andrychow (1). The klippe of Inwald and of Roczyn. J. TOKARSKI: Contribution to the knowledge of the hydroclastic elements of the neighbourhood of Czeremosz. S. BISKUPSKI: Chemical and microscopical analyses of the phosphorites from the kum of the mountains of Święty Krzyż. THAD. WISNIEWSKI and MLE. IR. REJMENT: The mountain element in the hepatic flora of the lacustral region of Suwalki. J. ZWIEBAUM and M. SZEJNMAN: Researches on the binuclear cells in cultures of tissues.

## LENINGRAD

Academy of Sciences (*C.R.*, 1, No. 2-3; 1935). G. LORENTZ: Functionals and operations in the spaces of numerical series. M. KELDYSH and M. LAVRENTJEV: Contribution to the theory of conformal representation. S. JANCZEWSKI: Irregular oscillating properties of the proper functions in the case of differential equations of the fourth order. P. PAVINSKI: The exchange interaction between two atomic nuclei. M. LEONTOVITCH: Contribution to the theory of molecular dispersion of light in an unevenly heated crystal. N. DOBROTIN, I. FRANK and P. CHERENKOV: Observations of the night sky luminescence by the extinction method. I. CHVOSTIKOV and A. LEBEDEV: Intensity variation of the auroral green line in the night sky. M. KATZNELSON and M. KABATCHNIK: The ester of *para*-aminobenzoic acid and lupinine. O. ZVIAGINCEV and A. FILIPPOV: (1) Occurrence of platinum in sulphurous ores. (2) Platinum content of the minerals of sulphide ores. E. SOTNIKOV and T. PALEJ: Stability of races of *Aspergillus niger* as regards the



production of acid. N. TOROPOV: Chemico-mineralogical studies of the aluminates of barium. R. BELKIN: Interaction of the external and internal factors during ontogenesis in Amphibia. (2) The influence of temperature on the metamorphosis of *Amblystoma tigrinum* produced by thyroxin. D. KOSTOFF: Studies on polyploid plants. (5) Fertile hybrids, *Triticum vulgare-monococcum*. E. HASRATIAN: Motor defensive conditioned reflexes in dogs with extirpated cortical motor areas of the cerebral hemispheres. A. LINDBERG: Influence of the length of intervals between the applications of conditioned stimuli on the energy of conditioned reflexes. S. KRAJEVOJ and F. KIRITCHENKO: New contribution to the investigation of developmental stages in wheat. V. SUKACHEV: *Brasenia purpurea*, Michx. in the early tertiary deposits of western Siberia. V. REDIKORZEV: *Apocheiridium rossicum*, sp. n. Description of a new pseudoscorpion from Russia. P. TYURIN: Contribution to the biology of the perch (*Perca fluviatilis*, L.) from Lake Chany, western Siberia.

ST. MARY'S HOSPITAL, LONDON, at 5.—Dr. Igor N. Asheshov: "Bacteriophage".\*

BRITISH SCIENCE GUILD AND ENGINEERS' STUDY GROUP ON ECONOMICS, at 5.30—(at the Institution of Civil Engineers, Great George Street, S.W.1).—Discussion on "Economic and Social Reform Programmes". Report to be presented by Lieut.-Col. J. V. Delahaye.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—Annual general meeting to be followed by talking films of eminent electrical engineers.

CHEMICAL SOCIETY, at 8.—Discussion on "The Significance of Phosphoric Esters in Biochemical Processes", to be opened by Prof. R. Robinson.

BRITISH INSTITUTE OF RADIOLOGY, at 8.—Dr. G. Shearer: "The X-Ray Microscope" (Presidential Address).

ROYAL SOCIETY OF ARTS, at 8.—Prof. A. F. Barker: "The Evolution of the Industrial System in the Far East".

Friday, May 17

GRESHAM COLLEGE, BASINGHALL STREET, E.C.2, at 6.—A. R. Hinks: "The Tercentenary of Robert Hooke".\*

### Forthcoming Events

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

Sunday, May 12

BRITISH MUSEUM (NATURAL HISTORY), at 3 and 4.30.—Capt. Guy Dollman: "Mammals".\*

Monday, May 13

UNIVERSITY COLLEGE, LONDON, at 5.—D. H. K. Lee: "The Physiological Effects of Tropical Climate" (succeeding lectures on May 20, 27 and June 3).\*

NATIONAL INSTITUTE OF INDUSTRIAL PSYCHOLOGY, at 5.30—(at the London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1).—Prof. Major Greenwood: "The Modern Importance of the Temperamental Factor and its Ancient History".\*

ARMOURERS' AND BRASIERS' COMPANY, at 7—(in the Sir John Cass Technical Institute, 31 Jewry Street, E.C.1).—Dr. H. Moore: "Internal Stresses in Metals and Alloys" (succeeding lectures May 20 and 27).\*

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Sir Halford Mackinder: "Progress of Geography in the Field and the Study during the Reign of His Majesty King George the Fifth".

Tuesday, May 14

INSTITUTE OF PHYSICS, at 3.15.—Annual General Meeting.

EUGENICS SOCIETY, at 5.15—(in the rooms of the Royal Society, Burlington House, W.1).—Prof. R. A. Fisher: "Eugenics, Academic and Practical".

GRESHAM COLLEGE, BASINGHALL STREET, E.C.2, at 6.—A. R. Hinks: "The Astronomy of the Last 25 Years" (succeeding lectures on May 15 and 16).\*

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

ROYAL PHOTOGRAPHIC SOCIETY (SCIENTIFIC AND TECHNICAL GROUP), at 7.—Prof. Moritz von Rohr: "Modern Instruments both for the Accurate Depicting and Correct Viewing of Perspectives or Photographs".

ILLUMINATING ENGINEERING SOCIETY, at 7.15.—Prof. M. Pirani: "Production of Light".

Thursday, May 16

ROYAL SOCIETY, at 4.30.—Prof. R. H. Fowler: Bakerian Lecture.

LONDON MATHEMATICAL SOCIETY, at 5—(in the rooms of the Royal Astronomical Society, Burlington House, W.1).—Prof. E. C. Titchmarsh: "The Zeta-Function of Riemann".

### Official Publications Received

#### GREAT BRITAIN AND IRELAND

River Flow Records. River Dee (Aberdeenshire): the Records of Water Level, Rainfall and Run-off for the Year 1934. By Capt. W. N. McClean. Pp. 8+5 plates. (London: River Flow Records.) 10s. 6d.

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