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## Science and Statesmanship

THE changing relations of science and industry are well illustrated in the papers and addresses presented to the Society of Chemical Industry at its recent annual meeting at Newcastle-upon-Tyne. Dr. R. H. Pickard's presidential address, which emphasised the rôle of the physicist in the textile industries, indicated the extent to which the barriers between the divisions of science are being broken down, when science is applied to the solution of industrial problems. The successful solution of industrial problems so frequently depends on co-operation of different classes of scientific workers that the programme of the Newcastle meeting might equally well have been set forth to an assembly of physicists, engineers, biologists or others concerned with industry.

This contention is sufficiently supported by the discussions which took place before various subject groups of the Society. The Chemical Engineering Group, for example, was concerned with the application to the Battersea Power Station of researches into the elimination of noxious constituents from flue gases and the treatment of resulting effluents. The Plastics Group's discussion on the relation between cellulose and phenol supplies and possible expansion in the production and applications of cellulose plastics and synthetic resins entered the economic and political fields, and underlined once more a handicap which the duty on benzole imposes on chemical industry in Great Britain as compared with its foreign competitors. A discussion arranged by the Food Group on how science can help the nation to improve its own food supply covered milk and dairy products, wheat, meat and fertilisers, and was as full of interest to the agriculturist, the geneticist, the miller or the medical officer of health as to a gathering of chemists.

These discussions in fact did not merely illustrate the contribution which science can make to industrial advance, even when we rightly regard agriculture as an industry. They equally emphasised the extent to which science has penetrated the whole range of our economic and social interests. As Dr. H. D. Kay pointed out, the improvement of the nation's food supply is now more largely a question for economic, social and educational, rather than for agricultural, science. We have, for example, the scientific knowledge to enable us to produce, efficiently and satisfactorily, all the liquid milk required at present for the

nation's limited consumption, and it would not be difficult to expand this production to meet the considerably larger requirement of at least one pint per person per day that is considered highly desirable by all informed students of nutrition. Similarly, we have most of the scientific information we require for the production of high quality butter and cheese, and by adequate intensity of farming a large part of the annual requirements could be produced at home. At this point, however, questions of policy enter. The man of science supplies the knowledge upon which wise action and policy can be based, but due consideration must be given to the other factors involved—economic and political, questions of public health, social welfare or unemployment.

The position is the same when we consider other aspects of the food supply—the application of scientific knowledge to the improvement of the quality and quantity of the wheat crop, and of the meat supply, or in the use of fertilisers or of products for the control of plant or animal pests and diseases. Questions of marketing and distribution are unescapable if the public is to receive any benefit and the producer to obtain a living, and into such fields the application of national and scientific methods has only begun to penetrate.

If the issues raised in the discussions to which we have briefly referred illustrate the way in which industrial development in its broadest and truest sense demands the co-operation of many classes of scientific workers, they illustrate equally well the extent to which the distinction between industrial, commercial and social questions is disappearing.

In situations like this, wise statesmanship is indispensable alike in industrial and social affairs, whether on an international or on a national scale. Statesmanship, as Prof. H. J. Laski suggests in a recent book ("Democracy in Crisis" : G. Allen and Unwin, Ltd., 1933), involves a knowledge of how to handle men, an ability to see the issues which need handling, a judgment upon their priority in importance, and the power and the courage to carry their proposed solutions to a successful issue. While, however, Prof. Laski is probably right also in suggesting that the fundamental issues of society are not the kind of problem the expert is accustomed to handle, that they require the power to co-ordinate rather than specialisation, and that the problems confronting the statesman are not in the last analysis problems upon which the specialisation of the expert has any peculiar relevance ; he appears, in his discussion of the position of the expert in government, to mistake the real claim and in particular the significance of such discussions as those held by the Society of Chemical Industry.

It is easy to argue that the narrowness of the experience of the expert tends to limit his power to make those broad judgments which statesmanship requires. Few, if any, scientific workers, however, could be found to contend that when a scientific worker accepts an administrative position he can continue the intense scientific specialisation which would disqualify him in this way. The very knowledge that administrative positions are largely incompatible with the personal prosecution of research is a prime reason why many scientific workers tend to evade administrative responsibility.

On the other hand, this emphasis on the limitations of the expert overshadows the equally significant limitations of the administrator who aspires to statesmanship. Few administrators have the rudimentary technical and scientific knowledge necessary to enable them to see the true issues and to form an accurate judgment upon their relative importance. Admittedly the major qualifications of the statesman and administrator are those indicated by Prof. Laski. To stress the importance of some modicum of scientific and technical knowledge in handling the problems of the modern State is, however, not to claim that such knowledge alone is sufficient. The evidence that many of our administrators lack such knowledge is only too abundant.

The fundamental problem, therefore, is that of co-ordination and of securing the service of the experts, without which, in the great society of to-day, our scale of living could not be preserved for a day. Indeed, to keep all administrative power in the hands of one small class is to court dangers equally great, even if public and industrial administration passes more and more into the hands of those dominated less by economic or financial incentives than by professional ideals and the spirit of service. The claim of the scientific worker is not for a special place as such in government, but for the recognition that administrative ability and statesmanship are not a monopoly of any vocational class, and for the admission to administrative office of those who in a scientific career have given the same proofs of administrative capacity as those following a legal, commercial or financial career.

## Sir Alfred Ewing's "Monument"

*An Engineer's Outlook.* By Sir Alfred Ewing. Pp. xxv+333. (London: Methuen and Co., Ltd., 1933.) 8*s*. 6*d*. net.

SIXTY-TWO years ago, Sir Alfred Ewing, at the age of sixteen years, became the first holder of an engineering scholarship from Dundee High School and entered the University of Edinburgh.

Born and bred in a Scottish manse in "an atmosphere of frugality but never of penury, of thrift but never of meanness, of industry without monotony, of simplicity without dullness, of refinement without affectation, of gentle culture in manners and morals" he there found it easy, he says, "to acquire the habit of sustained effort whether or no the task to be done were in itself attractive". At Edinburgh he at once came under the spell of Fleeming Jenkin, whose life was filled "with an incessant round of creative activities", and through him became an assistant to Lord Kelvin, then Sir William Thomson, "one of the few very great men whose greatness is not greater than their goodness".

At this time Thomson and Jenkin were partners in certain submarine cable enterprises, and under their guidance Sir Alfred spent his summers in the testing room of a cable factory in London and made three cable-laying voyages to South America. To these early experiences was added that of knowing Robert Louis Stevenson, the last meeting with whom, he says, was in the summer of 1878 "when Jenkin asked us both to dinner to meet Mr. Taiso Masaki, a Japanese official who had come to Edinburgh in search of a professor for the University of Tokyo and had swept me into his net".

Thus, under the most auspicious circumstances, launched upon his life's work as an engineer and educationist, Sir Alfred has spent five years in Japan, seven years in Dundee, thirteen years at Cambridge, another thirteen years under the Admiralty as director of naval education, and yet another thirteen as principal and vice-chancellor of the University of Edinburgh, a position from which he retired, full of distinction, in 1929.

First known for his refined researches on magnetism and seismology, then for his writings on thermodynamics and engineering, Sir Alfred has played many parts. In 1931 at the centenary meeting of the British Association he delivered the presidential address to Section G (Engineering) and in the following year at York, the presidential address to the Association itself, taking as his title "An Engineer's Outlook".

Now, from his retirement at Cambridge, under the same title, Sir Alfred has issued this volume of lectures and addresses, to which he has added an all too short autobiographical note. Whether or no the volume forms, as Mr. E. V. Lucas suggests, Sir Alfred's "monument", it will be read with pleasure by many who have long admired him for his work and character.

The papers and addresses for the greater part belong to the period subsequent to Sir Alfred's appointment as principal at Edinburgh, and include, beside the two addresses to the British Association, the James Forrest lecture of 1928 on "A Century of Inventions", the Hibbert lecture of 1933 on "Science and some Modern Problems", a lay sermon preached in St. Giles's Cathedral, Edinburgh, in 1930, the obituary notice of Sir Charles Parsons written for the Royal Society, and a charming sketch of the Fleeming Jenkins and Robert Louis Stevenson. But much earlier than these are the James Forrest lecture of 1899 and the Kelvin lecture of 1910, and a speech at the anniversary dinner of the Royal Society in 1895 when Sir Alfred replied to the toast of "The Medallists". On this occasion Lord Lister was in the chair and the medallists included Dr. Weierstrass, Sir John Murray and Sir William Ramsay.

The speeches and addresses are all of great interest, and though in some of the later addresses there is a tinge of the pessimism of age, there is always the same felicity of phrase, the same grace and humour and the same breadth of outlook.

Those familiar with Sir Alfred Ewing's activities who read the short autobiographical note which forms the preface to this volume will regret, however, that he had not been somewhat bolder. To write autobiography may be, as he says, "like picking one's way over marshy ground: a false step, and one may be ankle-deep in egotism"; yet who could be better equipped than he for giving us a book of reminiscences? He tells us so little of Japan, of Cambridge and of the Admiralty, and yet stored away in his memory, doubtless, are recollections, still vivid, of men, institutions and events of which the scientific and engineering worlds would gladly know more. The story of "Room 40" may have to remain untold, but surely there are plenty of others beyond official ban.

## From Palæolithic to Neolithic in Britain

*The Mesolithic Age in Britain.* By J. G. D. Clark. Pp. xxiii+223. (Cambridge : At the University Press, 1932.) 15*s*. net.

IN most departments of life, each generation is prone to regard its immediate predecessor as living in outer darkness ; but it is scarcely fair of Mr. Clark to single out an *ipse dixit* which gained few, if any, adherents as an index of ignorance concerning the later stone age twenty years ago. It is, however, unquestionable that it is only during the last ten to fifteen years that archæological discovery has provided the material which has made possible, and indeed demanded, scientific treatment of the period between the upper palæolithic and neolithic, regarded by older archæologists not so long ago as a gap, on the scale and in such detail as it receives in Mr. Clark's "The Mesolithic Age in Britain".

Almost entirely within the present century—it was in 1895 only that Piette explored Mas d'Azil—archæological research has established a number of cultures, estimated by one archæologist at seven, which now fill the former palæolithic-neolithic gap, for which, as a whole, various names are in use. Mr. Clark on logical and typological grounds elects 'mesolithic'. It covers from the end of the Pleistocene to the full intrusive neolithic of the food-producers and the long barrow. Thus, it will be seen, he eliminates 'early neolithic' and makes the whole period cover some four millennia on de Geer's chronology. This seems excessive, and Mr. Clark himself seems to regard it with some doubt ; but it accords with the facts as at present known, and agrees with the present trend of thought, which moves in the direction of reducing the neolithic to narrow dimensions in time. It does, however, make easier of acceptance the survival of mesolithic types of stone implements into the bronze age. But Mr. Clark stresses emphatically that the period is not "transitional", since the cultures are "off the line of human progress".

As regards the cultures, Britain as a peripheral area is both derivative and original. Continental types are locally developed. Thus the Azilian, now accepted as established and at an early date in north-west Britain, exhibits local differences in the characteristic harpoons and associated implements, while at Creswell, it is suggested as a hypothesis, the Upper Palæolithic itself showed a microlithic tendency before the Tardenoisian appears. Even after its arrival Tardenoisian continues to exhibit Continental influence. Thus while Early Tardenoisian is found so far apart as the Isle of Wight and the Pennines and Northumbria, and, Mr. Clark thinks, may underlie the industries of the south of England, Middle Tardenoisian influences come in from Belgium and are to be seen at their best in the Isle of Man ; while Late Tardenoisian appears in the neat geometric forms of Wangford, Scunthorpe and the Pennines. This last is absent in what Mr. Clark calls Province B, south-east Britain, where axes or picks with *tranchet* cutting-edges and mesolithic points of non-geometrical type—industries in fact comparable with Maglemosian and Campignian—appear early in the mesolithic period, and occupy substantially the same period as the evolution of the mesolithic industries of Province A which covers the rest of the country.

Mr. Clark's survey of the evidence now available is an excellent piece of work. When much has still, we hope, to be discovered, it can possess no finality ; but it will have to be taken into account in all future work on the period.

## Foraminifera of the South Atlantic

*Discovery Reports.* Issued by the Discovery Committee, Colonial Office, London, on behalf of the Government of the Dependencies of the Falkland Islands. Vol. 4. *Foraminifera.* Part 1 : *The Ice-free Area of the Falkland Islands and adjacent Seas.* By Edward Heron-Allen and Arthur Earland. Pp. 291–460+plates 6–17. (Cambridge : At the University Press, 1932.) 25*s*. net.

THE Falkland Islands area has a particular historical interest for the students of the Foraminifera, for it was in this region that d'Orbigny, the pioneer of the systematics of this group, obtained an important part of the material on which his great work was based. It is a matter for congratulation that this collection, much larger and from a wider area round the Islands than d'Orbigny's, has, a hundred years later, fallen into the capable and experienced hands of the authors of this very fine report.

It is interesting to find that as a general result of the determination of the species, they are able to confirm d'Orbigny's opinion that the foraminiferal fauna of the South Atlantic is quite distini-

from that of the Pacific coast of South America. It is true that a few Pacific species occur in the Falkland Islands area, but they "appear to have been derived from more distant parts of the Pacific".

There is some resemblance between this fauna and the fauna of the British Isles, similar to the resemblance that Miss Pratt (in 1898) found between the littoral fauna of the Falkland Islands and that of our own shores as regards the Polyzoa and some other groups, and this may be considered as a further point for the discussion on Murray's theory of 'bipolarity' which created so much interest some years ago. It is true that there are several species peculiar to the region and that others, of very wide distribution, such as the species of *Spiroloculina*, are absent, but it may seem surprising that, in such a large collection from an area so wide and so seldom visited, the number of new species, as described in this report, is not larger. This may be accounted for partly by a wisely conservative conception of the 'species' and by the great care which has evidently been taken to compare new specimens, so far as that is possible, with the original types.

We are told, for example, that Mr. Heron-Allen examined the d'Orbigny collection of Foraminifera in Paris, and was able to identify many of his specimens by comparing them with those collected and named by d'Orbigny himself. The account that is given of the present state of this collection is not the least interesting feature of the report, but it is sad to learn that so much that might have been preserved is now irretrievably lost.

The magnitude of the task which the authors have undertaken may be indicated by the statement that more than 400 species or varieties have been identified, and of these, 45 are considered to be new to science. They were obtained from the dredgings on the continental shelf within the 100 fathom line and outside it, but within the 500 fathom line, at eight stations of the *Discovery* and 49 stations of the *William Scoresby* expeditions. The fauna of the continental shelf seems to have been fairly uniform, with thirteen common species of which *Cassidulina crassa* and *Uvigerina angulosa* are the dominant forms.

In the systematic part of the report, only the names and localities of many of the old species are given but in others valuable comments on the synonomies and variations are made. In all cases there is a concise description of the new species accompanied by one or more—usually several—excellent drawings of them in the plates.

The species problem must have been extremely difficult to solve in the case of some of the genera. In the genus *Lagena* with its simple monolocular shell, no less than 82 species are recorded and some of these show a considerable variation. It is true that in some of these the species are said to have "no zoological value" but a study of the text and figures in this report supports the view that in this wide-spread, free-moving foraminifer there is a distinct differentiation into a large number of true specific groups. There were comparatively few sedentary forms in the collection but of these perhaps the most interesting is a modified and colourless variety of *Polytrema*, a genus which has not hitherto been recorded from the South Atlantic.

The report is furnished with a good index, a full list of the literature on the subject, and the numerous figures on the eleven plates are of the highest artistic and scientific quality. S. J. H.

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## Soil Science

*Soils, their Origin, Constitution and Classification: an Introduction to Pedology.* By Prof. Gilbert Wooding Robinson. Pp. xv + 390. (London: Thomas Murby and Co.; New York: D. Van Nostrand Co., 1932.) 20*s*. net.

TO those engaged in the scientific study of soils and to agricultural chemists generally, Prof. Robinson's book will need no special recommendation. Many of the recognised analytical methods for soils, for example, for mechanical analysis, organic matter and exchangeable bases, were developed by Prof. Robinson and his staff at Bangor, in the course of systematic work on the chemical basis of soil characterisation and classification. Specialists will rightly expect to find in this volume a critical account not only of such methods, but also of their bearing on field work and especially on the study of the soil profile and the process of soil formation.

The volume has, however, a much wider appeal. It is free from those elementary expositions of plant physiology, microbiology and biochemistry which often form a large part of soil textbooks intended primarily for agricultural students. The treatment is philosophical rather than technical, and it may therefore be recommended with every confidence to workers in many other branches of natural and applied science. The colloid chemist,

the ceramic chemist and the mineralogist will find a convenient summary of the modern developments from J. T. Way's original discovery of 'base exchange' materials in soils. The ecologist or the geographer will find precisely the type of material he needs in his attempts to relate vegetation or the practical exploitation of land to the intrinsic properties of the soil. The fact that this book appears in Messrs. Murby's well-known geological series will be sufficient evidence that the modern emphasis on the importance of climate and vegetation as soil-forming factors is balanced by a due consideration of geological ones, and of the part played by the soil in the weathering cycle.

A considerable portion of the book is devoted to a description of the major soil groups and soil geography, with examples chosen from a much wider range of conditions than was possible in the earlier Continental textbooks. This volume should help to secure general recognition of the value of regarding the study of soils in their natural relationships as an independent branch of natural science, for which 'pedology' appears to be the most satisfactory name.

E. M. CROWTHER.

## Thomas Hornsby

*The Observations of the Reverend Thomas Hornsby, D.D., Savilian Professor of Astronomy and Radcliffe Observer, made with the Transit Instrument and Quadrant at the Radcliffe Observatory, Oxford, in the Years 1774 to 1798.* Reduced by Dr. H. Knox-Shaw, Dr. J. Jackson and W. H. Robinson. (Published by order of the Radcliffe Trustees.) Pp. 145. (London: Oxford University Press, 1932.)

THE observations of the Rev. T. Hornsby, the first Radcliffe observer at Oxford, are among the most accurate of those made during the eighteenth century. He possessed good instruments, and obtained an astonishing number of observations between 1774 and 1803. But he left himself no time for reducing his observations, and they remained unreduced for more than a century. Mr. Stone and Dr. Rambaut made efforts in this direction. The present Radcliffe observer, Dr. Knox-Shaw, was successful in obtaining a grant for this purpose from the Government Grant Committee of the Royal Society. Sir Frank Dyson allowed Dr. Jackson, then chief assistant at Greenwich, to help in the work, and a large part of the reductions has now been completed and published.

The stages of the work are described very fully in the introduction; the greatest care was taken to eliminate systematic errors, such as diurnal terms in the clock rates, and the accuracy of the right ascensions appears to approach closely to that obtained with the best modern instruments. The declinations offered greater difficulty, being made with a quadrant, which is a less reliable instrument than a transit circle; but here also great pains have been taken to obtain the best results possible. A study of the probable error of an observation shows that those in right ascension are smaller than Bradley's, but those in declination are somewhat larger. This is ascribed to the fact that Hornsby used to observe with both instruments at the same transit; the declinations were taken in the middle of the transit, and must have been made in haste.

A diagram is given showing the mean corrections to Boss's right ascensions of stars for 1785 for each hour of R.A. These are all smaller than 0·01 sec.; comparison with Eichelberger's positions gives considerably larger residuals.

The volume contains the observed positions of the sun, the moon, Mercury, Venus, Mars, Jupiter, Saturn, Uranus. Positions from Newcomb's tables, for comparison with the observations, have been computed for the sun and Venus for the whole period (the ephemeris of Venus was computed by Mr. B. F. Bawtree); Mercury, Saturn and Uranus were compared with the tables for the years 1780 to 1784. The moon and the remaining planets have not yet been compared with tabular positions.

The observations of the sun were discussed with the view of determining equinox corrections and equator points. In the case of Mercury and Venus, a difficulty arose; when Hornsby recorded an observation of the centre, this was at first assumed to be the centre of the illuminated portion, but it appeared from the results that he was trying to observe the estimated position of the actual centre. He did not succeed in this, and an empirical correction, depending on the phase, has been applied.

The following are the mean values of observed position *minus* Newcomb's tabular position for Uranus: 1781 R.A. −0·24 sec.; Decl. + 1·2″; 1782, − 0·22 sec.; + 0·7″; 1783, − 0·18 sec.; + 0·7″; 1784, −0·17 sec.; + 0·1″. These are unexpectedly large, and show that the positions,

when fully compared with the tables, will be of value for correcting the orbit of Uranus. There were four observations in 1781, seventeen in 1782, nineteen in 1783, eight in 1784.

Dr. Jackson read a paper on Hornsby's observations of Mercury at the meeting of the Royal Astronomical Society on December 9, 1932. He showed that they indicated a rate of motion of the perihelion agreeing with the Einstein value within 1″ per century. This is an example of the valuable contribution that this volume makes to fundamental astronomy. Astronomers owe a debt of thanks both to Hornsby for his careful observations, and to those who have given many years of labour to putting them into a useful shape.

A. C. D. CROMMELIN.

## Short Reviews

*Braunsche Kathodenstrahlröhren und ihre Anwendung.* Von Dr. E. Alberti. Pp. vii+214. (Berlin: Julius Springer, 1932.) 22.20 gold marks.

THIS book will be of more use to those who already know most of the things that it contains than to the general reader or to those who contemplate taking up cathode ray oscillography. It is an uncritical and not very attractively arranged compilation from the literature of the subject, based on a useful, but far from complete, bibliography of 292 entries. The author's official position in the German Patent Office is perhaps reflected in the freedom with which he draws on patent specifications, American, British, French, German, and Swiss, for details which are not accessible elsewhere; the value of the book is substantially enhanced by the use of these sources.

The dangers of a work derived more obviously from paper sources than from intimate personal handling of the apparatus discussed are sufficiently apparent, and they are increased when the range of search is so surprisingly patchy as in the present instance. A book on cathode ray tubes and their applications which contains no reference whatever to the work of Thun in Germany, Holweck and Dauvillier in France, Appleton, Watt and Herd in Great Britain, Namba in Japan, Friis in the United States, to take random examples, is unsatisfactory; the lack of balance is not confined to omissions. The very important contribution made by von Ardenne in Berlin in his development of a much improved, sealed-off oscillograph seems to have escaped the author's attention, and Zworykin narrowly escaped exclusion, appearing only seventeen lines from the end of the book.

*Electrical Phenomena in Gases.* By Dr. Karl Kelchner Darrow. Pp. xvii+492+4 plates. (London: Baillière, Tindall and Cox, 1932.) 42*s.* net.

THE title of this volume indicates, not necessarily a wider scope than that of the classic treatise familiar to all, but the need for stressing a difference of outlook. Dr. Darrow rightly remarks on the advantages of regarding the current in, say, an arc between electrodes as but a minor feature of the hurly-burly of disrupted atoms, free electrons and positive ions which helps to determine the complex phenomena observed. His book, opening with a very clear account of ionisation and excitation, proceeds through a discussion of interception and scattering to the end of the first section, which is thus concerned primarily with "the actions and adventures of the individual atomic particles which underlie electrical phenomena in gases". The second division of the book deals with drift phenomena, and its component chapters are headed "Theory of Drift", "Data of Mobility", "Diffusion of Ions in Gases", and "Recombination and Attachment". Then, as the author genially remarks, with Chap. ix "the profounder mysteries begin" and more than two hundred pages are devoted to break-down, space-charge, plasma and sounding-electrodes, the self-sustaining glow, and the self-sustaining arc.

The book is well produced, and it is almost unnecessary to add that the presentation of the subject is admirably clear, concise and critical.

A. F.

*Jocasta's Crime: an Anthropological Study.* By Lord Raglan. Pp. xii+215. (London: Methuen and Co., Ltd., 1933.) 6*s.* net.

"JOCASTA'S CRIME", as unravelled by Lord Raglan, presents a dual problem—the interpretation of the Œdipus myth, and the explanation of the universal horror inspired by sexual unions which are regarded as incestuous. Lord Raglan examines current theories and probes their weak points. He holds, rightly, that incest cannot be considered in isolation, but must be taken in conjunction with other customs affecting the relation and union of the two sexes, such as mother-in-law avoidance, the seclusion of women at certain times, and the like, and bases upon his analysis of the whole group an ingenious derivation for the taboos which have gathered round marriage and the two sexes. An equally ingenious interpretation of the Œdipus myth is offered, in which it is suggested that it is the "book of words" of a widely distributed ritual which periodically represented the creation and embodied human sacrifice and a ceremonial union of divine bride and groom which was an infringement of the incest taboo. Hence he concludes that those who committed incest, having passed through the initial stage of a ritual, must be sacrificed, lest the effect which the rite was intended to secure, the fertility of man and crops, should be vitiated.

*History, Psychology and Culture.* By Prof. Alexander Goldenweiser. Pp. xii+475+xii. (London: Kegan Paul and Co., Ltd., 1933.) 18*s.* net.

IN this volume Prof. Goldenweiser has re-issued, in very much revised form, a number of papers and essays, which, as he says, represent his cumulative contribution over a score of years to social theory. Of these the most considerable, both as a critical review and as a piece of constructive work, is the article on totemism. The theories of Sir James Frazer, as representing the evolutionary school, and of the diffusionists, are subjected to much acute criticism from the point of view of one who has been trained in the historico-geographical and psychological methods of Prof. F. Boas. It is of interest to note that the author marks a growing tendency among social anthropologists in the United States to leave their methodological preoccupations in favour of more constructive thinking.

Two lectures, semi-popular in manner, but serious in purpose, deserve careful study. They indicate how an American anthropologist, who is in a peculiarly favourable position to estimate the gravity of racial problems, looks at the inter-racial situation as it is in the world to-day and probably will be to-morrow.

*The Birth of the Nations: from the Unity of Faith to the Democracy of Money.* By Valeriu Marcu. Translated by Eden and Cedar Paul. Pp. vii+287+12 plates. (London: George Routledge and Sons, Ltd., 1932.) 15*s.* net.

IN this volume is found a study of the influence exercised by some outstanding personalities upon the Thirty Years' War. The resulting emergence of Germany as an independent nation, and the loss of status by Spain and Austria in the comity of nations are exhibited in a succession of interesting pages. Campanella, Richelieu, Mazarin, Wallenstein, Gustavus Adolphus and others pass in pageantry before our eyes. Illuminating remarks are interspersed, such as, "Each commodity has hidden within it the sufferings of one or of many human beings"; "Man has inherited the curse of being too complicated for his own understanding"; "If you were to throw into a wine-press all the officially-announced causes of War, you would not be able to squeeze one drop of truth out". It transpires, incidentally, that the French bourgeoisie demanded a Habeas Corpus Act so long ago as 1648, but did not receive one until quite recently. P. L. M.

*The Archæology of Yorkshire.* By Frank and Harriet Wragg Elgee. (The County Archæologies.) Pp. xv+272+12 plates. (London: Methuen and Co., Ltd., 1933.) 10*s.* 6*d.* net.

YORKSHIRE, the first of the northern counties to appear in the "County Archæologies Series", is one of the most interesting county areas in the whole of England to the archæologist who is not exclusively occupied with the Palæolithic and earlier periods, for which it has little or only doubtful evidence. With this exception, it is rich in archæological material in the periods covered by the scheme of the series, while the distribution and character of its geographical features lend themselves readily to a demonstration of the relation of environment and culture. Mr. and Mrs. Elgee have made the best use of their wide and detailed knowledge of the antiquities of the county. They have selected their material with great skill and discrimination, although they have felt their task to be "filling a mere pint pot with a gallon of Tadcaster ale".

*A Short History of the World's Shipping Industry.* By C. Ernest Fayle. Pp. 320+8 plates. (London: George Allen and Unwin, Ltd., 1933.) 12*s.* 6*d.* net.

IN spite of the widespread interest in all that pertains to ships and shipping, there seem to be very few books dealing with the history of shipping as a whole. The subject is naturally a vast one, and Mr. Fayle has done well to condense it into one small volume without distorting his subject. He successfully treats the subject from the earliest ships to the problems of to-day, and while his book deals largely with the economic aspects of shipping in every age, it does not neglect the evolution of the ship itself and the development of navigation. There are useful bibliographical references for each period and eight illustrations from engravings and wood-cuts in the Macpherson Collection. In spite of its small size it is an important work.

*Robert Koch.* Von Prof. Bruno Heymann. Teil 1: *1843–1882.* (Grosse Männer: Studien zur Biologie des Genies, herausgegeben von Wilhelm Ostwald, Band 12.) Pp. v+353+6 plates. (Leipzig: Akademische Verlagsgesellschaft m.b.H., 1932.) 18 gold marks.

A FULL and detailed account, human as well as scientific, of the first forty years of a great bacteriologist. There is a number of interesting pictures and facsimiles, and the tale is carried up to the discovery of the tubercle bacillus fifty years ago. It illustrates very clearly how the progress of bacteriology has depended on the development of appropriate technique. The book is well produced and not expensive.

*Physiology of Bacteria.* By Prof. Otto Rahn. Pp. xiv+438. (Philadelphia: P. Blakiston's Son and Co., Inc., 1932.) 6 dollars.

BACTERIA flourish under such an exceptional range and variety of conditions, and their foodstuffs and modes of metabolism are so diverse that a succinct account of their physiology is of general interest. This, Prof. Rahn has well provided, more perhaps from the point of view of a chemist than of a biologist. He treats successively of the supply of energy, the conditions of growth and the mechanism of death. An appendix deals with the sizes of bacteria.

# The Genetics of Cancer*

By PROF. J. B. S. HALDANE, F.R.S.

THE statement is occasionally made, and as frequently denied, that cancer is hereditary. It is, of course, clear that environmental influences can play a leading part in determining the production of cancer.

The question is whether nature, as well as nurture, is of importance. By far the most satisfactory evidence on this point comes from a study of genetically homogeneous populations of mice. By brother-sister mating for many generations (more than fifty in certain cases) pure lines can be built up in which the individuals are all homozygous for the same genes, apart from rare cases of mutation. By crossing two pure lines we obtain a population which is also genetically uniform, but not homozygous. Their progeny, however, is not genetically uniform.

In such a population, we can study three types of cancer :

(1) due to transplantation of a tumour from another animal.

(2) due to a carcinogenic agent. These include tar, the hydrocarbons shown to be carcinogenic by Kennaway and his colleagues, certain parasitic worms, and X-rays.

(3) spontaneous tumours ; that is, tumours arising for no, at present, assignable cause.

Now the order of ease of study is the above. An inoculated tumour can be judged as a 'take' or otherwise within a month. Tar painting may produce tumours within six months ; but spontaneous tumours in many lines do not reach their maximum incidence until an age of eighteen or more months. Hence our knowledge of tumour etiology is in the above order, though the order of practical importance for medicine is clearly the reverse.

It may be said at once that there are enormous differences between different lines as regards all three types of cancer. The genetics of reaction to transplantable tumours have been very fully worked out by Little and his colleagues. The laws disclosed are precisely similar to those which govern the transplantation of normal tissue or the transfusion of blood or of leukæmic corpuscles. A tumour arising spontaneously in one member of a pure line can be transplanted into all other members of it (actually more than 99 per cent of successful 'takes' can be achieved). Further, it can be transplanted into every $F_1$ mouse one of whose parents belonged to the pure line, but if these are mated together or outcrossed, only a minority of their offspring are susceptible. This at once suggests that susceptibility is due to the possession of certain dominant genes. This theory is fully confirmed by experiment. Supposing that a line $X$ carries $n$ pairs of genes $AABBCC\ldots$. which are needed for tumour growth, and are not found in a line $Y$, then the $F_1$ will be $AaBbCc\ldots$., and 100 per cent susceptible. Of the back-cross from mating of the $F_1$ with $Y$, only $(\frac{1}{2})^n$ will carry all $n$ genes, and of the $F_2$, $(\frac{3}{4})^n$ will carry them, and thus be susceptible. In a number of cases, Cloudman[1] found that the two values of $n$ so calculated were in agreement. The number of genes ranged from 2 to about 12.

Similarly, a tumour arising spontaneously in a $F_1$ individual, between two pure lines, in general requires in its host $m$ genes contributed by one parent, and $n$ contributed by the other. In such cases the tumour will grow in all the $F_1$, in $(\frac{1}{2})^m$ of one back-cross, $(\frac{1}{2})^n$ of the other, and $(\frac{3}{4})^{m+n}$ of the $F_2$. Thus Bittner[2] found in one case $m=4$, $n=1$, while the observed value of $m+n$ was 5.

Occasionally a tumour in the course of transplantation changes its character, so that it becomes transplantable into a larger proportion of a mixed population ($F_2$ or back-cross). It is then found that one or more genes less are required for susceptibility in the host.

These facts can be explained if the host only reacts to a transplanted tumour so as to destroy it as the result of foreign antigens in that tumour, just as a recipient agglutinates the corpuscles of a donor if they carry foreign isoagglutinogens. On this hypothesis each gene is responsible for the manufacture of a particular antigen, as in the case of the red corpuscles. However, the genetical facts are quite independent of this hypothesis.

A thorough study of these phenomena is under way in Little's laboratory. The genes required for susceptibility to different tumours are being compared. Thus it was found that a number of tumours arising in the same line required the same basic gene for susceptibility, but each demanded a different assortment of extra genes. Some of these genes have been located, by means of linkage studies, in the same chromosomes as genes responsible for colour differences.

The tendency to develop cancer as the result of tarring varies greatly in different lines. Thus Lynch[3] compared two lines $A$ and $B$ which differed in their spontaneous tumour rates, $A$ having a higher incidence of spontaneous lung cancer than $B$. These tumours, however, never appeared before the age of 15 months. By tarring a large area of skin between the ages of 2 and 6 months, she induced lung tumours before the age of 13 months in 85 per cent of line $A$, and 22 per cent of line $B$. The difference was 6·3 times its standard error. On crossing $A$ and $B$ she found 79 per cent susceptibility. The back-cross to $A$ gave 81 per cent susceptibility, while that to $B$ gave 39 per cent. These figures suggest that susceptibility is

* Substance of lectures delivered at the Royal Institution on February 2 and 9, 1933.

determined, among other things, by a number of dominant genes. Other workers have obtained essentially similar results. Their importance for non-genetical workers on cancer is considerable. It is clear that in comparing the efficacy of two different carcinogenic agents, far fewer mice need be used in a pure line than in a mixed population, and it is worth noting that the variance in a mixed population is only about halved when litter mates instead of individuals taken at random are used as controls.

In the same way, Curtis, Dunning and Bullock[4] state that in the rat they have found that susceptibility to cancer, on infection with the cestode *Cysticercus*, is strongly inherited.

The problem of spontaneous cancer presents much greater difficulties. In no line can one obtain 100 per cent of deaths from cancer, because over the long period necessary, deaths from other causes cannot be prevented. But some idea of the conditions in a highly cancerous line can be obtained from the work of Murray[5]. In a particular inbred line, 1,938 females lived to be more than 7 months of age. Of these, 65 per cent died of mammary carcinoma, or were killed when severely affected with it. Above 80 per cent of deaths in females more than twelve months old were due to this cause. None survived for 23 months and probably none would have reached two years without cancer had all deaths from other causes been prevented.

In such a line we can observe the effects on spontaneous cancer of prophylactic measures. Thus of 198 females ovariotomised at 7 months, only 40 per cent died of mammary cancer, and one of these reached the age of 30 months. Still more striking is the fact that not a single operated female living beyond 22 months developed mammary cancer. It follows that in this stock the ovary plays an important part in the causation of mammary carcinoma. It is clear that a pure line (or the $F_1$ hybrids of two pure lines) furnish ideal material for the determination of factors in the environment favourable or otherwise to the development of cancer.

In contrast with such lines are others with an extremely low susceptibility to spontaneous tumours under ordinary laboratory conditions. A cross between such lines generally gives a hybrid generation with a cancer mortality nearly so high as that of the more susceptible line. Indications of linkage with colour genes have been obtained in one case.

It is important that the location of tumours is highly specific. One line has a high death-rate from mammary carcinoma in females only, and few tumours elsewhere. Another line has a heavy incidence of primary lung carcinomata in both sexes, and little mammary carcinoma. A third has few carcinomata of any kind, but sarcoma is not very rare. The genetics of spontaneous cancer will clearly be very complicated, and it is quite ludicrous to ascribe it to the activity of one gene, dominant or recessive.

Besides the work described above, a good deal has been done on stock which was not genetically homogeneous. From this work it is clear that, while a tendency to spontaneous cancer is hereditary, it is not due to a single gene, dominant or recessive, and also that a particular localisation of cancer may be hereditary. Thus Zavadskaia[6] found 13 out of 45 tumours in the occipital region in one particular line, and only 1 out of 212 in other lines. But all work with genetically heterogeneous material is unsatisfactory, because any individual may die before reaching the cancer age, and no other individual will be of just the same genetical make-up. Hence really exact work is impossible.

In the same way, human cancer tends to 'run in families' to some extent, but precise analysis is only possible where, as with retinoblastoma and some sarcomata, its victims are attacked early in life. Here there is reason to believe that a single dominant gene is mainly responsible for the cancerous diathesis, though environmental and possibly other genetic factors may be concerned as well.

A particularly clear case of the interaction of nature and nurture in cancer production is found in the case of human xeroderma pigmentosum, almost certainly a recessive character. Here the skin becomes inflamed, and ultimately cancerous, under the influence of light. We could speak with equal logical propriety of the recessive gene or the light as the 'cause' of the cancer, but as the former is rare, and the latter universal, it is more natural to regard the cancer as genetically determined.

Thus we have evidence of many different types of genetical predisposition to cancer, and although the data available on mice suggest that this predisposition is generally due to multiple dominant genes, it would certainly be incorrect to apply this theory to all human types of malignant disease.

The theory has been held by Boveri, Strong, and others, that the difference between a cancer and a normal cell is of the same character as that between the cells of two different varieties, that is to say, due to chromosomal aberration or gene mutation. This theory cannot of course be proved or disproved by genetical methods, as cancer cells do not reproduce sexually, and it is only by sexual reproduction that the geneticist can distinguish nuclear changes from plasmatic changes or virus infections.

The geneticist is concerned with the differences of 'nature' (in Galton's sense of the word) which play their part, along with environmental differences, in determining whether a given animal will or will not develop cancer. He is not particularly qualified to determine whether the difference between a normal cell and a cancer cell is analogous to that between sister gametes produced at meiosis, or to the difference which comes about at other cell divisions in the course of differentiation. The recognition of the import-

ance of genetics for the study of cancer need not lead to any decision on this point.

To sum up, we can devise conditions under which either nature or nurture will play a predominant part in determining the incidence of cancer. Neither factor can possibly be neglected in a comprehensive survey. Except in a few cases, such as retinoblastoma, our knowledge is not sufficient to warrant interference with human breeding on eugenic grounds. Nevertheless, it is probable that in the ultimate solution of the problem of human cancer, eugenical measures will play their part.

[1] Cloudman, A. M., *Amer. J. Cancer*, **16**, 568 ; 1932.
[2] Bittner, J. J., *Amer. J. Cancer*, **15**, 2202 ; 1931.
[3] Lynch, C. J., *J. Exp. Med.*, **48**, 917 ; 1927.
[4] Curtis, Dunning and Bullock, *Amer. Nat.*, **67**, 73 ; 1933.
[5] Murray, W. S., *Science*, **75**, 646 ; 1932.
[6] Zavadskaia, *J. Genetics*, **27**, 181 ; 1933.

## Gem Stones*

By PROF. W. T. GORDON

THE first essential of a gem is that it should be beautiful and attractive, but if the beauty be ephemeral the gem will not command continued popularity. Occasionally an attractive colour in a material will assume a paler tint, or vanish entirely, or even change to an opaque black shade. Or again, the surface may tarnish and all its beauty disappear. Change of colour, however, is not the only factor that may mar the glory of a beautiful substance. Lack of resistance to wear is very undesirable, particularly in transparent materials, and not all beautifully coloured minerals have the property of durability.

There is also a psychological factor that must not be omitted. Unless the material is rare it is little prized. Beauty therefore has to be accompanied by durability and rarity before popular opinion will consent to apply the term gem stone to any substance. The artistic and educated mind may resent this attitude, but *vox populi* is in this connexion *vox dei*, so far as monetary values and general acceptance of the term are concerned.

At the moment, however, beauty will be considered paramount, and there are several natural minerals that come into the category of gem stones. The methods adopted to display the maximum beauty are based on scientific principles, although these were nearly all discovered by the lapidary through experience, before they were formulated by the man of science. It is these laws and the methods adopted by the lapidary to secure their operation that will be considered here.

The natural minerals classed as gem stones may be opaque, translucent or transparent, and do not belong to any special category so far as their chemical composition is concerned : while one and the same material may occur in a great variety of colour and many degrees of transparency.

It seems probable that the earliest gems were attractively coloured substances with some degree of lustre, that property depending on the intensity of the light reflected from the surface. Were that surface smoothed and polished, the lustre would be increased and the full value of the colour developed. As large continuous areas give the finest effects, curved surfaces were worked on the materials in order that the colour and lustre might be visible from any angle. The term *cabochon* is applied to this style of cutting, and the cabochon may be deep or shallow. When deep, the top surface may be ellipsoidal (oblate or of revolution) and is often called tallow-topped ; when shallow, this term is not applied. The stone may have a flat base, a rounded base or a hollow base, and these styles are called cabochon, double cabochon, and hollow cabochon respectively. When the colour is deep and the material translucent, a hollow cabochon specimen is frequently lined with gold or silver foil on the hollow side, and the colour is much enhanced by light reflected through the stone, from the bright metal surface on the base.

Another class of gems, both opaque and translucent, exhibits a fibrous habit or has inclusions or even cavities, arranged in parallel series. If the fibres, inclusions or cavities are very delicate, and are set parallel to definite directions, light is reflected more intensely from the long edges of these, and a luminous zone or set of intersecting luminous zones is produced. Along with the natural colour of the material these bands of light produce an attractive appearance. Such stones are also cut in a rounded or oval form, and are termed cat's-eyes or star-stones according as there is one luminous band or three intersecting bands.

Thus far the only scientific principles involved have been the formation of smooth, rounded shapes that will function in the reflection of light coming from any direction ; and the larger the surface the better the effect.

The finest results of the lapidary's skill are seen, however, in the treatment of transparent gems, coloured or uncoloured, and the latter illustrate in the highest degree the skilful application of the principles of the refraction, reflection, dispersion and interference of light.

In coloured gems the beauty lies largely in that colour, whether the material be transparent or opaque ; but, in colourless stones, the beauty must be developed by the skill of the artificer. A

* Friday evening discourse delivered at the Royal Institution on May 12.

caste of colour in water-clear stones is a great blemish, for there is considerable absorption of light and consequently a loss in brilliancy. While, therefore, a distinctive colour may be tolerated or even prized, a shade of colour is always detrimental.

In Nature, many minerals occur in a glassy clear condition, with fair crystal shape. These are attractive because of the brilliant flashes from the natural facets, and doubtless caught the attention of early man ; but when, and where, it struck some individual to improve the natural faces, by polishing them to a greater extent than Nature had done, we do not know. It also seems to have been discovered at an early date that a facet perpendicular to a flaw minimised the effect of the reflection of light from the sides of that flaw, and these discoveries led to the display of the lapidary's skill in placing reflecting facets all over the surface of the gem, and thus adding to its beauty. But they did not lead at once to the development of the wonderful 'life' of the modern gem.

Now natural crystals usually occur with faces developed on one end and on the sides ; therefore, although the faces reflect a good deal of light, the moiety that is refracted into the crystal, as a result of oblique incidence on these faces, is not returned to the surface to any extent ; it passes into the matrix on which the crystal has grown. Indiscriminate setting of facets on a mineral, however, will have the effect that some of these faces will be nearly opposite others, and one could speak of a front and a back to the gem. At the front some light would be reflected, but some would also be refracted into the material, and, should this light impinge on the back facets within the angle of total reflection, it would be reflected inside the material and perhaps returned to, and emitted from, the front. Had such internally reflected light remained unchanged during its passage through the material, little notice would be given to it, but it has suffered dispersion into the prismatic colours of the rainbow, in addition to mere reflection from face to face.

But the older lapidaries covered the front of the gems with small facets to such an extent that little light actually entered the stone, and consequently the wonderful 'life' was rarely disclosed. Many of the diamonds of history were cut in this way, and they are, on the whole, duller and less interesting than they might have been. Of course, a minimum amount of material was used up during the processes of cutting and polishing by this method.

Probably the earliest step towards the modern ideal in cutting was taken by Lodewyk van Berguem about 1476. A descendant of his, writing in 1669, claimed that his ancestor had invented the process of *cutting* diamonds ; but this is evidently erroneous, for there are records of a guild of diamond cutters in Burenberg so early as 1375. Van Berguem discovered that absolute symmetry in the arrangement of facets on a gem improved the general effect, and the *pendeloque* style of cutting is usually attributed to him. To-day we think this style rather dull, but it is certainly more attractive than the styles of the Oriental lapidary with their multitude of small facets arranged with scarcely any regard for symmetry.

Towards the middle of the sixteenth century another forward step was made and the *rose*-cut devised. Here a number of triangular facets are placed on the surface of the gem. The facets are usually triangular and equilateral in shape, but unless the stone is rather thick the 'life' of the gem is not really marked. All these methods of cutting were more concerned with economising material and hiding flaws than developing the full beauty of the gem.

Another century passed before Cardinal Mazarin suggested that the prismatic effects ('life') should be sought, rather than mere bright flashes from the surface faces, and he had certain diamonds re-cut by the lapidaries in order to secure such effects. The improvement was most marked and diamonds cut in this way were called 'mazarins' in honour of the discoverer. In this style of cutting the top facets were made rather larger than before, and the back faces arranged at fairly steep angles, and the absolute symmetry introduced by Van Berguem was retained. As a matter of fact, the natural octahedral faces of the crystal of diamond were made the basis of the shape, which was therefore rather square. Extra facets were made along the edges of the large natural faces of the crystals and so the gems were termed double-cut.

Peruzzi added still further to the number of facets, especially round the centre or girdle of the gem, and these were said to be triple-cut. The effects were striking and the style was known as the *brilliant*-cut. Compared with modern brilliants these were dull, though much brighter than the older styles. They were still too thick, and doubtless it was the desire to economise the material that prevented the attainment of the ideal beauty of the diamond. By reducing the angle between the black facets and the plane of the girdle—and incidentally losing more material—and altering the angle of the corner facets on these older styles of brilliants, a better effect was obtained. In the process the stone becomes rounder in shape, and, to-day, the best type of brilliant is the round form.

Tolkowski has shown recently, from theoretical considerations, that the angle of the back facets should be 48° 52′. This would secure the greatest brilliance *and* 'life'. But a slight loss of brilliance is accompanied by added 'life', and, when the angle is 40° 45′, the best all-round effect is attained. It is true that a great deal of material is lost in the process, and about 52 per cent of the original weight of material may be ground away. The older lapidaries simply dared not lose so much material, or their patrons would probably have accused them of pilfering.

Recently fashion has been experimenting with straight line effects, and many diamonds have been re-cut in corresponding ways. The beauty is not the best attainable, but the effects are not so dull as in the older squarish styles, for no attempt is made deliberately to economise material. The style adopted is called the *step-* or *trap-*cut, a type very appropriate to coloured gems but not really inappropriate to uncoloured material. In fabricating individual specimens of diamond, there is a constant compromise between fashion, loss of material and perfection of effect; and, while the round brilliant is the best compromise between effect and loss of material, the dictates of fashion cannot be neglected.

On account of the high angle of total reflection in diamond, the return of almost all the refracted light by total reflection from the back can be secured by cutting a small number of facets on the back. The light so returned is also dispersed. But other clear gems have lower angles of total reflection, and consequently several series of facets must be placed on the back to secure the return to the front of an adequate amount of light. The facets must also be arranged at several different angles. Near the girdle the facets are steep and nearer the base they are set at flatter angles. As a consequence the facets are smaller.

In the *zircon-*cut (used in the case of the zircon gems) the style adopted is a close approximation to the brilliant, but there is an extra set of small faces alternating with the main back facets, and set round the central facet at the back. In other white gems several extra series must be introduced into the back to secure the maximum return of light by total reflection. The dispersion of light has also to be remembered, but the degree of dispersion is, in most cases, so slight, as compared with that in the diamond, that this property is rarely considered. Brightness rather than 'life' is sought, and the cutting is arranged accordingly. The shape then is controlled by the original shape of the specimen and the formation of a bright sparkling gem with so little loss as possible. Consequently the shape on the back is terraced, each step a little flatter than the one above, and the style is termed *step-* or *trap-*cut (from the Scandinavian *trappa*, a step).

Among coloured gems there are three classes, those with one unvaried tint, those with pleochroism, and those that are coloured by the interference of light reflected from inclusions, or from thin films of different refractivity, in the interior.

In the first category the shape is arranged to permit the maximum of light to enter and to be emitted after total reflection from the back. To secure these two effects the facets on the front are made so large as possible, and those on the back arranged in tiers. The trap-cut is frequently used both on the front and on the back, especially to-day when straight-line effects are the fashion; but the front is often brilliant-cut, and the back either trap-cut or zircon-cut.

Should the colouring material be streaky the front is made parallel, or nearly parallel, to the streaks of pigment, and thus a uniform tint is imparted to the whole. If the colour be in patches the best effect is secured if the coloured patch is arranged near the centre of the back for, in that case, most of the refracted light will pass through the coloured patch either before or after, suffering total reflection at the back facets, and so a uniform colour will again be imparted to the light emergent at the front.

The colour in pleochroic minerals varies with direction, but one colour is more pleasing than any other, and the lapidary strives to retain that tint in the finished gem. The front is cut either trap or brilliant style, and set so that the central facet is perpendicular to the direction of best colour. The back is trap-cut, but it is elongated so that the facets across the direction of the least desirable colour are small and steep, and consequently return very little light to the front. The facets that cross the direction of good colour are made large, and at low angles, so as to reflect so much light as possible to the front. Sometimes a modified zircon-cut is used on the back with those facets across the direction of undesirable colour set at a steeper angle than the others. In this last case the whole gem has an elongated or cushion shape.

When the colour of the gem is due to the interference of light reflected from internal structures—inclusions or films of material of slightly varying chemical composition, and consequently with varying degrees of refraction of light—there is no necessity to place facets on the stone at various angles. The treatment is therefore similar to that of the opaque coloured stones, and large rounded surfaces are produced. In general, however, the surfaces are rather flat; bright flashes from these surfaces are not desired, the internal effects being those most wanted. The internal lights are best seen on flattish surfaces with rounded edges. Opal, sunstone, moonstone, labradorite are all of this type, and are translucent rather than opaque in character.

It must be conceded, therefore, that the fabrication of mineral species suitable for gem stones is a highly skilled operation, if the finest possible effects are to be obtained. The treatment, moreover, varies with different categories of mineral. Definite scientific laws must be obeyed, though the laws themselves have been arrived at empirically, and formulated, not in mathematical symbols, but by observation of the effects as the work proceeds. The work is initiated by the experience of the artificer of similar materials; lack of experience, so much as lack of skill, may render the final result unsatisfactory.

As the artist obeying certain laws, and by the skilful arrangement of his colours, may produce a beautiful picture, so the skilled lapidary, obeying the laws of optics, may transform a mere mass of mineral into a dazzling or a richly coloured gem.

## The British Association at Leicester

THE full programme of the British Association meeting to be held at Leicester on September 6–13, will be shortly in the hands of members. It shows no less promise of interest than usual, whether interest be judged from the point of view of the scientific worker or of the public. Certainly topics of wide current importance are not neglected by the Association in these days; no less certainly the "general interest in science and its applications" which the Association, by its own claim, "seeks to promote", is increasing, if slowly.

In his inaugural address the president, Sir Frederick Gowland Hopkins, president of the Royal Society, will discuss some chemical aspects of life. Dr. J. Gray's address to Section D (Zoology), on the mechanical view of life, cannot but provide a notable complement to that of Sir Frederick Hopkins. Among other sectional addresses of the widest appeal, examples are Sir Gilbert Walker's to Section A (Mathematical and Physical Sciences), on seasonal weather and its prediction; Prof. J. H. Jones's to Section F (Economics) on the gold standard, and Mr. J. L. Holland's to Section L (Education) on the development of the national system of education.

The various sections of the Association are, by tradition, autonomous under their respective committees, and it is not many years since it was urged in these columns that the Association should take steps to co-ordinate its sectional work. Co-ordination, in recent years, has been fostered, mainly through the institution, at the instance of the late general treasurer, Dr. E. H. Griffiths, of the joint meetings of organising sectional committees held in January. At the same time, there has been a strong movement toward the arrangement of sectional programmes under prescribed broad headings. Several sections now formulate the whole or almost the whole of their programmes on this principle. Thus it comes about that at Leicester, Section L (Education) is to hear groups of communications and discussions on training for business and administration, the cultural value of science in adult education, and other such large topics; Section M (Agriculture) will similarly deal with milk production and distribution in relation to nutrition and disease, with land drainage, and with sociological aspects of agriculture; and there are plenty of other examples.

Some of the sections, notably on the biological side (as is natural) adhere more nearly to the type of programme in which the majority of speakers deal with minutiæ in their own special fields; but such sections do not nowadays overlook their wider contacts, and this year we find Section D (Zoology), I (Physiology) and K (Botany) staging a joint discussion on genetics. The sphere of Section A (Mathematical and Physical Sciences) is so extensive that it must find room for both types of communication; among much that might be cited there is space here to refer only to the discussion on atomic transmutation, to be opened by Lord Rutherford, and that on the expanding universe to be opened by Sir Arthur Eddington.

The traditional type of evening discourse, with experiments, has found its way back into recent programmes, and this year Prof. J. F. Thorpe is to speak upon, and demonstrate the work of, the Safety in Mines Research Board, the Secretary for Mines being expected to be present. As for the other evening discourse, the social implications of the advance of science were brought to the notice of the Association last year in no uncertain terms, and this year Sir Josiah Stamp is to address the members under a properly provocative title, "Must Science ruin Economic Progress?" The preliminary programme of the Department of Industrial Co-operation of Section F (Economics) well illustrates the interest of the Association in economic, industrial and social problems. The opening discussion of the Department on September 7 deals with "Organisation as a Technical Problem." Dr. E. F. Armstrong will occupy the chair and Major L. Urwick will open the discussion. The programme of visits to industrial establishments includes a representative number of important firms such as the Dunlop Rubber Co. and Messrs. Boots Ltd., Nottingham.

The new practice instituted last year, of compiling and issuing in advance a scientific survey of the place of meeting and its neighbourhood, on a definite plan, in lieu of the former unsystematised local handbooks, will be continued this year, and, it is to be hoped, in future. The scientific survey of Leicester and district, compiled under the editorship of Dr. Bryan, vice-principal of University College, Leicester, indicates the wide interests for which Leicester is a centre, and further evidence of this appears in the extensive series of general and sectional excursions which has been arranged. A geological excursion to the Lower Palæozoic Rocks of the Welsh borderland has been arranged to take place before the meeting, terminating at Leicester on September 6.

The only word of regret to be spoken at this moment is that the intimations of attendance received from visiting members are as yet substantially sub-normal in number. Any falling off in their support must react unfavourably upon the Association's grants in aid of research. The Association may be the more grateful to its energetic local committee in Leicester for the efforts the members are making, through a special sub-committee, to assure an ample local membership. To attract such local support is one of the first objects of the Association, and one which its permanent organisation is least able to achieve unaided.

# News and Views

## Sir Thomas Muir, C.M.G., F.R.S.

HEARTY congratulations will be extended by many friends in Great Britain to Sir Thomas Muir, the distinguished mathematician, long resident in Cape Colony, who enters on his ninetieth year on August 25. Born at Stonebyres, Lanark, he was educated at Wishaw School, and he graduated at the University of Glasgow. In 1871, Muir became assistant professor of mathematics there; afterwards, for a while, he held a teaching post in Glasgow High School. Opportunity for public service in Cape Colony came in 1892, when he was made superintendent-general of education, retaining office until 1915, and at its termination receiving the honour of knighthood, having previously (1901) been made C.M.G. Muir was elected a fellow of the Royal Society in 1900. Earlier, the Royal Society of Edinburgh had awarded him its Keith gold medal for researches into the theory of determinants and allied studies, allotting the medal again in 1897 for further work in the same field, and once more in 1916 to signalise the completion of a series of memoirs, all having been issued by the Scottish Society. On the occasion of the first visit of the British Association to South Africa in 1905, also on its subsequent visit in 1929, much active assistance was rendered by Muir towards the success of these gatherings. President, in 1910, of the South African Association for the Advancement of Science—an institution then but seven years old—Sir Thomas delivered an address on "The State's Duty to Science". The following pregnant sentence may be recalled: "All that the most enlightened State can do will never be fully effective without a continuance of that zeal and devotion on the part of the private worker which has been so conspicuous in the past history of science."

## Mummy Wheat

IT seems impossible to shake the popular belief that grains of wheat may be interred in ancient tombs for thousands of years and are then capable of germination and of producing a crop. In the *Times* of August 4 there is a description, with an illustration, of a so-called 'mummy' wheat grown from an ear found in a tomb at Mohenjo Daro in Sind. Upon inquiry at an address given in the *Times* we were supplied with a statement by Sir Malcolm Hailey relating to the S.P.G. Mission Agricultural School, Umedpur, which succeeded in reproducing the alleged ancient grains, and one from Mrs. Crosthwaite, widow of the late Canon Crosthwaite, who started the School. In both statements it is announced that seed from the wheat is on sale at one shilling an ounce, on behalf of the Mission Farm at Umedpur, and we understand that there is a large demand for it. There is no doubt whatever that the story of this so-called mummy wheat from an Indian tomb is based, at the best, on a misunderstanding. In the first paragraph of Mrs. Crosthwaite's memorandum it is stated that "Mr. H. C. Dutta . . . was given an ear of wheat that was taken out of a tomb during excavations in Sind". The probability is that the ear was a recent one and that either the donor fabricated the story, or someone had placed the ear in the tomb and the donor found it and gave it to Mr. Dutta in good faith. All our knowledge of longevity in seeds, and all experiments on the subject, go to show that the maximum period for any known seed is probably somewhere round about 300–400 years, and that wheat cannot remain dormant for more than 25 years. On several occasions authentic wheat from Egyptian tombs has been examined and in each case the tissues have been so disintegrated that germination was quite impossible. The statement that there is no wheat known to-day with a branched spike, such as was illustrated in the *Times*, and is being sold, is incorrect.

## Industrial Co-operation

THE Department of Industrial Co-operation of Section F (Economic Science and Statistics) of the British Association which was inaugurated at the centenary meeting of the Association in 1931, has issued a classified list of papers, discussions, visits to works, etc., in the programme of the forthcoming Leicester meeting. The papers are of special interest to business men and others concerned with various branches of scientific research bearing directly or indirectly upon industrial administration and management. The comprehensiveness and balance of this programme are a tribute to the efforts of the Industrial Co-ordination Committee of the Association on which not only Section F, but also Section G (Engineering), I (Physiology), J (Psychology), and L (Education) are represented, as well as to the vigour with which the new Department is being developed. The principal discussions arranged by the Department itself are devoted to organisation as a technical problem, to the rôle of accountancy in scientific management, the essential data for the organisation of economic distribution, and the psycho-physiological requirements of modern factory equipment, including particular instances of applied physiology and psychology. These discussions and numerous other papers promise to make the programme of the Department fully as interesting to the scientific worker and industrialist as those of which the account in "Business and Science" received such a wide circulation, and they well illustrate the value of the contribution which the new Department is destined to render in the co-ordination of scientific effort in the management and organisation of industry.

## Verulamium and Colchester

RESUMPTION of the work of excavation on the pre-Roman and Roman sites at St. Albans and Colchester has already been marked by noteworthy results, more especially on the latter site. The first reports from Verulamium, which record *inter alia* the

discovery of a mosaic floor of a previously unknown type, are accompanied by the welcome announcement that the Corporation of St. Albans has decided that the site shall be a permanent exhibition of the excavation, and parts of the structures discovered have been prepared for inspection accordingly, while the Office of Works is maintaining the South Tower with its ditches as an example of the system of defences of the second Roman city. At Colchester, where the Excavation Committee is at work on land adjoining Sheepen Farm, has been found a grave group, concluded to be that of a wealthy Romano-British lady and dated at the middle of the second century A.D., which has afforded some remarkable examples of Romano-British artistry and technique. According to the report which appeared in the *Times* of August 14, the grave group, which was enclosed in a large globular amphora, included a two-handled cinerary urn, a square metal mirror, a bronze brooch, another brooch with an unusual decoration of bone or ivory knobs, and a casket containing beads, pins, rings and other small objects. Most notable, however, among the contents of the amphora was a vase of Castor ware, with a lid, about three inches high, with a decorative design of a man fighting a lion and hounds chasing stags. The whole is executed in the technique of applied clay paste known as barbotine, which is known to have sprung up in the second century A.D. This is not only the finest, but also the earliest dated example of this form of Romano-British art. A large deposit of glass vessels has also been found. It may be that the excavators are on the track of a local factory of the large amount of glass which has been found at Colchester; but up to the present no sign of a kiln has appeared.

### Reductions of Scientific Staffs in the United States

A RECENT drastic reduction by the United States Federal Government of 27·3 per cent in the funds appropriated by Congress for the Bureau of Mines involves the dismissal or placing on indefinite furlough of 25–30 per cent of the present staff including about 70 members of its scientific or technical personnel. The health division of the Bureau is being abolished and the officers assigned to it from the public health service are being returned to the Service. The helium division is being merged with the petroleum and natural gas division, and all the field offices and stations of the Bureau are affected to varying degrees. Little relief will accrue to Federal scientific research funds from the recent assignments of public works funds. The latter are aimed at putting unemployed labour to work and not at restoring to fruitful research activities the large number of scientific workers who have suffered under the economy 'axe'. The 4¼ million dollars allotted to scientific bureaux from the public works funds are largely to be expended on reconditioning buildings in which the laboratory work has been severely restricted. The situation is all the more serious because of the extent to which the continued depression has diminished the income and resources from foundations or endowments available for scientific and creative educational work.

### Business Administration

THE close of the second teaching year in the Department of Business Administration at the London School of Economics marks the successful completion of a further stage in training for business management and the beginning of a new and important development in the recruiting of trained men to industry and commerce. The Department has faced two main problems: on one hand, the framing of courses which would give training suitably specialised in business subjects and at the same time develop the discipline and judgment required for handling practical problems; on the other hand, to attract students of the right type and quality in sufficient numbers. Satisfactory progress has been made in dealing with the first problem. The specialised business subjects which form the Department's main course comprise marketing, production, finance, statistics, accounting and personnel management as instruments of executive control. The Department has broken the greatest amount of new ground in the fields of marketing, retail management and sales management, where the teaching is based on investigations of current practice and where it is hoped to extend these systematic investigations to cover other major fields of business activity. Special efforts are made to keep the teaching in close touch with practice through discussions opened by business men, visits to factories, shops and offices, and the use in the marketing courses of the case method.

DURING the past two years nearly forty students have been trained by the Department of Business Administration, half in the specialised business course, and half in the preliminary evening course. Most of the students were university graduates, and nearly all were between 22 and 28 years of age. About half of these students were seconded for training by associated firms and at the end of each session there was a keen demand for the non-seconded students from firms wishing to recruit trained men. A further step to secure an adequate supply of suitable students has now been taken by the Department and it is expected that in future students will be drawn mainly from the universities rather than by seconding from industrial firms. Eight or ten firms associated with the Department are offering definite positions to men selected by them and trained by the Department. Candidates must possess a university degree and high personal qualifications and must themselves defray the cost of the Department's specialised business course. On the completion of their training they will be assured of definite posts at salaries arranged in advance, and this university scheme thus offers the right man a new and notable opportunity. It should further assist towards the gradual raising of the general level of business administration.

### The Engineer and Public Affairs

AT a joint meeting of Engineering and Economic Societies, recently held in Chicago, Dean Dexter S. Kimball of Cornell University College of Engineering

said that if the engineer is to be an important figure in public affairs he must acquire a broader technique than that which he usually possesses, and must inform himself concerning a wide range of subjects of which ordinarily he knows little. Furthermore, he must acquire a wide knowledge of economic history, and be able to trace the effect of economic changes over long periods of time. The engineer who aspires to solve modern economic problems must expect to do an unusual amount of studying before he can replace older economic theories with others which are suited to our day and methods. Perhaps no field of knowledge presents such a bewildering array of theories which purport to tie together groups of phenomena more or less vaguely connected. If the engineer can apply his analytical methods to those vague relations and develop the basic facts through his more intimate knowledge of industry, he could indeed perform a most useful service. In so doing, however, the engineer should avoid dogmatic statements. In his own field he may be quite dogmatic at times but in the field of general economics he must be more careful. This is particularly true of mathematical deductions as to future trends. Economic variables frequently change with new discoveries and changed conditions and it is very unwise therefore to interpolate any curve involving economic variables.

### Tropical Land Tenure

IN a valuable survey entitled "Studies in Tropical Land Tenure" (Government Printing Office, Port-of-Spain, Trinidad. Price 2*s*.), Dr. H. Martin Leake shows that the most striking feature of the systems of land tenure found in the different tropical components of the British Empire is their extraordinary diversity despite the fact that, in all cases, their wealth is primarily and dominantly agricultural. A land tenure system, he points out, must be judged by two standards: (1) an economic standard—its capacity to supply that export trade which is an essential to progress, and (2) a sociological standard—its capacity to afford opportunities to the component sections of the community to develop their innate capacities. Only in the last generation has the welfare and progress of the indigenous population come to be accepted as the primary consideration to which all others must give precedence. The practical policy by which it is hoped to attain this desideratum is the maintenance of the indigenous system of administration so far as it is acceptable as a moral code. The evolution from an indigenous land system to a peasant system producing for export necessitates the aggregation of the small farming units, so that they become subject to a unified control as regards production for export. Dr. Leake recommends a system of vertical co-operation between the peasant, the productive organisation and the State such as has been successfully adopted in the Gezira district of the Sudan and among the sugar growers of Fiji.

### First Appearance of Snapdragon Disease in England

THE appearance of a new plant disease in England is rightly treated as a serious matter, and the unexpected appearance of the rust fungus, *Puccinia Antirrhini*, on the cultivated snapdragon in several districts in the south of England this summer, will be viewed with alarm by many growers. Although the antirrhinum is a European plant, hitherto no rust fungus has been recorded on it in that Continent, the British Isles included, but curiously enough the disease has become a menace in the United States, where the snapdragon was introduced from Europe a long time ago. The same rust also occurs in Canada and Bermuda, but has not as yet been recorded elsewhere. The source of the outbreaks in England this year are unknown, but the hot weather has probably favoured their development. The disease is easily recognised by the dark brown or snuff-coloured pustules on the leaves and stems and all affected plants (and healthy ones in proximity to them) should be immediately burnt if the pest is to be prevented from obtaining a permanent foothold. In the event of an outbreak of rust having occurred, no antirrhinums should be allowed to carry over the winter, or there will be a danger of a recurrence of the trouble in the following summer. The disease is not thought to be seed-borne.

### Range of Variation in the Leopard

THOSE interested in the study of variation, in regard to the size and coloration displayed by animals having a wide geographical distribution, will be glad to learn that a pair of Indian leopards, from Hyderabad, has just been added to the collection in the Gardens of the Zoological Society of London. The range of the leopard is greater than that of any other of the larger carnivores, since it inhabits the whole of Asia, and is found almost throughout Africa; and everywhere it shows a tendency to split up into groups, such as, were they isolated for a sufficiently long period, would give rise to distinct species. The Indian leopard, for example, may range in length between five to so much as eight feet; while the tail may measure from a half to three-quarters of the length of the body. In the Persian leopard the length of the hair, and the bushiness of the tail approaches the snow-leopard, a nearly related species. The Manchurian leopard is still more distinct. The African leopard shows an even greater range of variation in these particulars, and we have yet to find an explanation of the curious fact that individuals from East Africa have large 'rosettes' like those of Persian and Indian leopards, while those from West Africa are characterised by the small size and great number of their spots which nowhere form the rings or 'rosettes' of the typical leopard. The same is true of the Albany district of South Africa. We have this much as a basis for further study; that such as are found in open country have a light golden-tawny ground colour, while those from damp, tropical forests are darker. The smallest of all the tribe are leopards from Somaliland, where, it may be noted, lions are also smaller. They have, indeed, been described as pigmy-leopards. That these differences are associated in some subtle way with the nature of their haunts and habits seems a

justifiable inference. But how, or precisely why, they occur is a matter which demands a more intensive study than it has yet received.

### Mexican Archæological Exhibits at Chicago

AN extensive selection of the remarkable series of relics found in the tombs of Monte Alban in the state of Oaxaca, Mexico, is being shown at the Century of Progress Exposition, Chicago. It includes ornaments in gold, jade, pearl, and other precious, or semi-precious, material. The exhibit is in charge of Señor Alfonso Caso, the excavator and director of the expedition by which the tombs were first discovered. One of the most remarkable exhibits, recently described in a communication from Science Service, Washington, is a human skull covered with a mosaic of small flat pieces of turquoise and fitted with eyes of pearl shell and a nose of flint. The skull is a representation of the god Tezcatlipoca, the god of the sky and Nature. Only one other skull treated in this way is known. This is now in the British Museum. The exhibits also include a number of objects which are considered to point to a knowledge in ancient Mexico of the art of the turner. A chalice of rock-crystal and several pairs of large spool-shaped ear-pendants, of the same material, are so accurate in outline as to suggest that they could have been cut in this hard material only with a mechanical aid such as the lathe.

### North American Archæology

MUSEUM handbooks not infrequently appeal to a wider public than that to which the collections are accessible. Especially is this evident when, as in a guide to exhibits illustrating the archæology of North America recently issued by the Field Museum of Natural History, Chicago, the subject is treated on broad lines, rather than the exhibits described in detail. In Hall B of the Field Museum series of exhibits have been arranged to illustrate the archæology of each of the cultural areas, into which anthropologists have divided the continent, with the exception of the Plains area, from which material is scant, and the south-western States which are represented in another hall. The author of the guide, Mr. P. B. Martin, an assistant curator of the Museum, has given his attention mainly to summarising on broad lines the principal conclusions of American archæological studies, as they now stand, in relation to the crucial problems of the early history of man and his culture on the American continent. Thus in addition to a description of artefacts in stone, copper, bone and shell and the pottery, as well as the methods of their manufacture, he discusses the origin of the Indian, the antiquity of man in America, the culture of the mound-builders, and the classification of culture areas. It is interesting to note that in the formation of these collections, the aim of their assemblage and arrangement has been, not the exhibition of specimens remarkable for their rarity or exceptional character, but the illustration of essential features in each type of culture. As an introduction to the broad facts of American archæology this handbook has much to commend it.

### Modern Whaling in the Antarctic

CAPT. HAROLD KEITH SALVESEN'S lecture on modern whaling in the antarctic, given before the Royal Society of Arts on February 15, is now printed in the *Journal* of that Society, vol. 81, 1933. Nobody is better qualified to give information on this subject, for his family has been closely connected with whaling since the introduction of the modern whaling gun which completely revolutionised the industry. Exactly twenty-one years ago, his father lectured to the same Society on modern whaling, and since then many changes have taken place, rather of degree than of kind, with one important exception, the adoption of ice-fishing, and the present lecture deals almost entirely with ice-fishing. In 1930–31, the antarctic production was forty-seven times that of the combined total of the rest of the world, the increase in the production being due exclusively to the ice-fishing of 41 floating factories and 201 catches. It is satisfactory to know that this ice-fishing caused a great reduction in tropical fishing and also in the South Georgia area, where the percentage of immature whales is very high, the animals in the ice regions being fat and full of oil. Capt. Salvesen is emphatic in his opinion that there is no need to fear the extinction through whaling of any species of whale in the antarctic, although there is much to fear from over fishing unless there are proper and sufficient restrictions. Future agreements continuing to regulate the number of whales killed and especially to enforce the least amount of waste should do much to minimise the dangers of over-fishing.

### Ice-cooled homes

ACCORDING to *Science Service* of July 7, research chemists of the University of Illinois under the direction of Prof. Dana Burks have made progress in reducing the cost of manufacturing ice. If the air in small houses is to be kept cool and free from humidity, ice or a mechanical refrigerator must be used. Both methods are in common use and both have advantages. If ice is to be widely used for air-cooling, it will be necessary to sell it in fairly large quantities at not more than about 15 shillings a ton. Prof. Burks has been successful in showing how the distillation process sometimes used can be made unnecessary. Owing to the presence of salts, one-third of the ice-manufacturing plants in the United States have to distil the water they use. A special ice can is employed which allows air to pass across the surface of the ice crystals as they grow. This agitation prevents the salts from concentrating and a clear, strong ice block is produced. The method has been tested with all kinds of synthetic waters without distillation, with satisfactory results. The time required for freezing the ice has also been shortened from 47 to 24 hours. This was effected by using special small cans and by lowering the temperature of the brine used in the freezing. The report on the experiments says that a saving of about thirty per cent in the cost of manufacture can be effected in this way. It has been demonstrated that it is possible to make

clear solid cakes of ice from any of the natural waters found in the United States, without first distilling them.

### Fuel and Oil used at High Speeds

THERE is now a great demand for special fuels and lubricants to meet the needs of engines for fast transportation. Science Service, Washington, D.C., has issued an interesting report of an address by Dr. Gustav Egloff, director of research of the Universal Oil Products Co., on this subject. He said that the lubricating oils made from petroleum a few years ago would decompose and vanish if used in modern engines, leaving the metal parts to fuse together in hopeless ruin. The strain put upon the lubricant at 70 miles per hour is far greater than at the 35-mile rate of ten years ago. In the case of aeroplanes, the difficulty of keeping a strong film of oil between the moving metal parts at 200 miles an hour is enormous. Lubricating oils are now refined by distillation under vacuum or by using solvents which dissolve the desirable parts from the undesirable. Paraffin wax is separated from lubricating oils at refrigeration temperatures so low as −60° F., or inhibitors are used to prevent its crystalline formation. Gasoline is no longer produced from crude oil by distillation, but is manufactured scientifically from parts of the crude oil.

### An Inquiry into Cancer of the Skin

IN a recently issued report, Dr. Gretta M. Thomas records the results of an inquiry undertaken at the instance of the Yorkshire Council of the British Empire Cancer Campaign under the direction of the Faculty of the General Infirmary at Leeds (Reps. on Pub. Health and Med. Subjects, No. 70. H.M. Stationery Office. Price 2*s*. 0*d*. net). One of the objectives of the inquiry was an attempt to ascertain whether environmental conditions associated with occupation or industry, other than those already recognised, are conducive to skin cancer; but no definite indications on this point were elicited. Many instances of the supervention of skin cancer upon a previously existing non-malignant lesion, such as lupus, were met with, and second cancers of the skin were found occasionally to occur in those who had suffered from the first growth at least six years previously. No facts were met with in explanation of the difference in incidence of lip cancer in the two sexes, which is considerably higher in males.

### Sterilisation of the Unfit

IT is announced that the Departmental Committee on Sterilisation has now finished hearing evidence but it is still awaiting the completion of certain returns which local authorities have been asked to furnish. The Committee has now adjourned for a short time, but will meet again in September to settle the report, which it is hoped to complete by the end of October. A preliminary draft of the report is in course of preparation, but it has not yet been considered by the Committee, and statements purporting to forecast the Committee's recommendations are wholly unfounded.

## Announcements

WE regret to announce the following deaths :—Mr. W. J. Lewis Abbott, known for his contributions to the prehistory of England, and collection of flint implements, aged eighty years; Dr. M. O. Malte, chief botanist in the National Herbarium, Victoria Memorial Museum, Ottawa, Canada, and principal research botanist of the Federal Government, known for his work on the flora of Canada, aged fifty-three years; Mr. Edward Roberts, I.S.O., secretary of the Tide Committee of the British Association in 1868–75, a pioneer in the practical development of tidal prediction, on August 4, aged eighty-seven years; Mr. H. F. Tagg, for nearly forty years keeper of the museum at the Royal Botanic Garden, Edinburgh, on August 9.

THE summer number of the *Fight Against Disease*, the quarterly journal of the Research Defence Society, contains among other matter the annual report of the Committee and report of the annual general meeting, and the seventh Stephen Paget memorial lecture, which was delivered by Maj.-Gen. Sir Leonard Rogers (see NATURE of July 8, p. 57).

THE Ministry of Health has issued a circular (No. 1345. H.M. Stationery Office. Price 2*d*. net) containing the descriptions, with reproductions, of the certificates, labels, marks and stamps which will be recognised from September 1 as official certificates for the purposes of the Public Health (Imported Food) Regulations, 1925, and the Public Health (Imported Food) Amendment Regulations, 1933.

WE have received the first number of a new quarterly journal, entitled *Le Travail Humain*, edited by MM. J.-M. Lahy, H. Laugier, and R. Bonnardel, and published by the Conservatoire National des Arts et Métiers (292, Rue Saint-Martin, Paris III$^{e}$). It deals with physiology, psychology, biometry, and hygiene in relation to industry, and contains original articles and a summary of current literature. The annual subscription price (foreign) is 130 fr.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned :—An assistant lecturer in mathematics at the Imperial College of Science and Technology, South Kensington, S.W.7—The Secretary (Aug. 25). An inspector for the purposes of the Diseases of Animals Acts, 1894–1927—The Secretary, Ministry of Agriculture and Fisheries, 10, Whitehall Place, London, S.W.1 (Aug. 28). A principal of the Farm Institute, Sparsholt, near Winchester—The Agricultural Organiser, 82, High Street, Winchester (Aug. 28). A lecturer in zoology at McGill University, Montreal—The Secretary (Sept. 9). An inspector of explosives to the Home Office—The Private Secretary, Home Office, Whitehall, S.W.1 (Sept. 15). A conservator of the Museum and a director of research at the Royal College of Surgeons of England—The Secretary (Oct. 7).

## Letters to the Editor

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, nor to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

### Locusts in Sunlight

WHEN tropical lizards, which by night are cool and torpid, absorb the rays of the sun, they become as warm and active as a warm-blooded animal. The cages at the Gardens of the Zoological Society provided for such animals used to be heated with hot water pipes to about 80° F. This did not suffice to make the animals active enough to feed and so they died off during the winter. One of us (L. H.) suggested the introduction of incandescent lamps, and the animals now bask under such lamps, eat their food and keep healthy. The provision of such lamps has proved of value not only for reptiles, but also for tropical birds, giraffes, monkeys, etc.

Insects are also influenced by absorbing the rays of the sun. In the case of locusts, the gregarious hoppers become pigmented black, while the solitary remain pale green or buff. If a young gregarious locust is put by itself it goes pale, while young solitary locusts crowded together become black.

During the night, hoppers are in a state of torpor; in the morning, under the influence of the first rays of the sun, the first movements of the hoppers become apparent. "The first to move are those that are under the direct rays of the sun, and they shift their position on the plants to get the fullest advantage of it. The higher the sun rises above the horizon the more active the hoppers become. When in the evening the sun begins to sink the movements of bands of hoppers stop gradually."[1] Sometimes the bands stop in the middle of the day, the hoppers seeking shelter from the sun under plants, clods and stones, and orientating themselves so as to catch least of the rays for fear of being over-heated. When a band is well on the move, it does not stop if it encounters suitable food, but a drop in temperature automatically results in a stop. The influence of temperature on a swarm actually in flight does not seem to be so great, many cases of flight at night being known, but a sudden change in the weather, particularly rain, usually stops the flight, and the swarm settles down temporarily. In 1924, P. A. Buxton[2] measured the body temperature of two colour forms of the Palestine grasshopper, and found that in the chocolate black form the temperature was 4·5° C. higher than that of the buff, and this when both forms were tied to frames and exposed to the sun over a dish of sand. These animals were no doubt heated both by the sun rays and by the rays from the sand, which was at more than 40° C. The temperature of the body of the black grasshopper rose to about 42° C.

We have carried out observations on gregarious and solitary hoppers kindly supplied to us by Mr. B. P. Uvarov from the breeding cages of the Entomological Institute. We used a pair of thermo-electric junctions, each made of fine copper and iron wire, one wire being threaded down a glass capillary tube, and the other attached outside this; the two wires being soldered together at the opening of the capillary tube. A temperature scale was made by recording the reading of the galvanometer when one junction was placed in water at a known temperature higher than in the case of the other. One junction was then inserted under the pronotrum (the chitinous cover behind the head) of a black locust, and the other under the pronotrum of a pale green or buff one. In the case of each locust a thread confined the legs and wings and fastened the body of the animal to the side of the capillary glass tube. The animals were then suspended in air, the other end of the glass being fixed to a lump of plasticine, in a room free from sensible draughts. The backs of the two locusts were then exposed similarly to a carbon arc lamp, a quartz water screen 4·2 cm. thick being interposed to cut off long infra-red rays, and make the arc's rays nearer to those of the sun. With the arc taking 6 amperes, and the locusts 12½ cm. from it, the black locust showed a temperature higher than the green by about 3·5° C.

The junctions were interchanged and the observation repeated on several pairs of locusts with like results. On a sunny, clear day, pairs of locusts were similarly exposed in a room beneath an open skylight so that the sun rays fell directly upon their backs; here again the black locust became about 3° C. warmer than the green.

LEONARD HILL.
H. J. TAYLOR.

London Clinic,
Ranelagh Road,
London, S.W.1.
July 17.

[1] Uvarov, B. P., "Locusts and Grasshoppers". Imp. Bureau of Entomology, 1928.
[2] Buxton, P. A., *Proc. Roy. Soc.*, B., **96**, 123–131.

### Cumulus Clouds, Convection Currents and Gliding

IN the note in NATURE of July 22, p. 130, where the achievement of Mr. G. E. Collins in soaring for 27 minutes in an atmosphere free from clouds is recorded, it is stated that there "were no cumulus clouds to produce the normal up currents beneath them". The use of the word "produce" invites criticism. The word "indicate" could have been passed without comment.

Until recently, it was generally supposed that cumulus clouds were buoyant owing to their temperature exceeding that of the surrounding air. It was assumed that the air at the bottom of the cloud was at least as warm as other air at the same level, whilst the lapse of temperature inside the cloud was less than that outside. The observations of W. Kopp[1] have proved that such ideas are ill-founded and that the air inside a cumulus cloud is cooler than that outside at the same level. The first evidence for this generalisation was found in a comparison between the temperatures estimated by the use of kite balloons and by the use of aeroplanes. It frequently happens that the temperature recorded by the observer in an aeroplane is the higher, and Kopp came to the conclusion that this is because the pilot of the aeroplane avoids the clouds and finds the temperature in the air between the clouds. Direct observation in aeroplanes taken through the clouds has provided confirmation. In fine-weather cumulus at any rate, there is a deficiency of temperature inside the cloud; the deficiency is of the order of 2° C.

Kopp has adopted the theory that the cloud is buoyant in spite of its low temperature and that it

contains a large amount of water vapour, sufficient to imply supersaturation amounting perhaps to 300 per cent[2]. His observations may be explained more readily by supposing that, whilst the cloud is actually heavier than the surrounding air, support is provided by the lightness of the column of ascending air below the cloud. This column may extend upwards from the ground. The ascending current is fed by air which has been warmed near the ground and has received moisture by evaporation. As the air rises it cools, and before the condensation level is reached, the rising air may be a little colder than other air at the same level. The cool air is lifted up to form the cloud, but the average density of the whole column, including the cloud at the top of it, is less than the corresponding average for the surrounding air. When there is a suitable wind, the cumulus clouds form in rows and the countryside is covered with alternate blocks of warmer and cooler air.

If this is the correct explanation of Kopp's observations, then the glider is served by convection currents, when he keeps below a cumulus cloud. The cumulus clouds *indicate* the normal up currents beneath them.

So far as I know, comparative observations of temperature and humidity just below the level of the clouds are not available. I hope that such observations will be provided by the friends of gliding.

I have not noticed any observations of Kopp's referring to the lower parts of cumulo-nimbus or other rain-producing cloud. It would be a shock to meteorologists to learn that such clouds were not inherently buoyant.

F. J. W. WHIPPLE.

Kew Observatory,
Richmond, Surrey.
July 24.

[1] *Beiträge z. Physik freien Atmosphäre*, **14**, 169; 1930.
[2] Kopp quotes in one instance 600 per cent (*ibid.*, **16**, Plate 9; 1930). The difficulty in reconciling this theory with physical principles has been stressed by Johannsen (*ibid.*, **18**, 165; 1932) and by Findeisen (*ibid.*, **20**, 157; 1933).

## Disappearance of *Zostera marina*

DURING the past three years a very serious reduction in the growth of *Zostera marina* has taken place on the Atlantic coast of North America. Practically the whole coast-line from New Brunswick to North Carolina is affected and in some areas the reduction amounts to its total disappearance. A mimeographed paper by Dr. Harrison F. Lewis, of the Department of the Interior, Canada, gives an account of the situation up to the autumn of 1932, and a further report by Mr. Clarence Cottam (dated June 1933) prepared for "The Plant Disease Reporter" of the U.S. Department of Agriculture, has now been received. The cause of the destruction is not known, but the attack is spoken of as an epidemic ("epiphytotic").

The first records as to Europe concern France, Dr. Lewis quoting letters received from French botanists. Since then a note by E. Fischer Piette, Roger Heim and Robert Lami has been published[1], recording the total destruction of *Zostera* in various localities near Roscoff during the winter season of 1931–32, and its general diminution along the whole Atlantic coast of France and Holland. The Mediterranean beds, as also those on the Pacific coast of North America, appear to be unaffected.

In England, reports have been received of the almost complete disappearance of *Zostera* at the old Swannery at Abbotsbury, and Dr. E. J. Allen, director of the Marine Biological Laboratory at Plymouth, states that signs of disease in several localities in Devon were noticed early in 1932 and that this summer many beds are entirely bare and the roots dead, though a few stray plants exist here and there. The Thames estuary is also affected.

The French authors regard the destruction of *Zostera* as being due to the action of a pathogenic bacterium, but American and Canadian observers have not been successful in finding a causative organism.

Previous periods of diminution of *Zostera* are known to have occurred and the latest American report refers to statements by fishermen and sportsmen showing that several such periods have taken place within living memory, but whether these have been local or widespread is difficult to ascertain. There is general agreement, however, that no period of scarcity and wholesale disappearance, in any way comparable with the present one, can be recalled.

The effects of the destruction of *Zostera* fields are of far-reaching consequences. The plant is used for various economic purposes (between 2,000 and 3,000 tons, for example, are reported to be shipped annually from Nova Scotia to a single firm in Boston). The seeds and rhizomes form the staple food of various geese, ducks and other birds and in the United States the birds are reported to be suffering severely. At Abbotsbury, and in the Yealm, near Plymouth, unless the swans are artificially fed, they forsake the swanneries. The marine fauna also suffers when such extensive cover is removed. In addition, the destruction of the chief sand- and mud-binder of estuaries and bays may lead to a considerable alteration in topography and physiography by the removal of mud- and sand-banks and their silting up elsewhere.

The problem of the *Zostera* epidemic is, therefore, apart from its great scientific interest, of considerable economic importance. Any records or observations on the phenomenon will be welcomed for the preparation of a report, in conjunction with the Ministry of Agriculture and Fisheries, on the situation as regards the British Isles.

A. D. COTTON
(Keeper of the Herbarium and Library).

Royal Botanic Gardens,
Kew, Surrey.
Aug. 1.

[1] *C. R.*, **195**, 1420–1422; 1932.

## Ecology of a Swamp in the American Tropics

ON a recent expedition to the Island of Haiti, a fresh-water swamp, Trou Caïman, lying well within the tropics (lat. 18° 39′ N., long. 72° 9′ W.), was examined in order to compare it with the tropical ærocratistic swamps reported by Carter and Beadle[1] and Beadle[2].

The swamp is about 6·5 km. long by about 2.5 km. wide. It lies at the north edge of the low Plaine du Cul-de-Sac, approximately 26 m. above sea-level. It is about 23 km. from Port-au-Prince, and within 1 km. of Thomazeau. The greatest depth of water observed was about 2 m. The water, which is remarkably transparent, is underlain with a small depth

of organic mud, which in turn rests on an alluvial soil consisting very largely of calcium carbonate.

The Plaine du Cul-de-Sac is rather arid, and the existence of the swamp depends largely on the inflow of a number of springs, appearing from under the edge of a bed of Pleistocene coral limestone, on or near its northern shore. Water may also be added by the River Blanche from the south side of the valley.

The swamp vegetation is fairly varied, but rushes (reaching a height of 3–4 m. above the water-level) and sedges greatly predominate. Most of the bottom is densely carpeted with *Chara* and *Utricularia*. There is practically no growth of surface-covering plants.

Data from Woodring, Brown and Burbank[3], show that the temperature is remarkably equable. The average mean for the warmest three months (June–August) is 28·5° C. at Port-au-Prince. For the coldest three (December–February) it is 25·7°, or only 2·8° cooler. The yearly mean is about 27° (figures for seven and a half years). All these temperatures are greater than those of the Paraguayan Chaco, and considerably greater than those of the African swamp regions.

The rainfall, which is very variable at Thomazeau, over 13 years averaged: April–September, 569·5 mm.; October–March, 292·9 mm.; year, 862·4 mm. The level of the swamp does not vary markedly with the change of season, but rises and falls to a great degree over periods of several years, sometimes becoming nearly dry. At the time of my visit it was close to its maximum level. Observations were first made on a small open space between clumps of rushes. Later in the day a deeper and better-shaded pool was investigated:

Station 1, Feb. 15, 1933, 9.30 a.m.
Direct sunlight. Depth of water 35 cm. Air temperature (shade) 31·6°C.

| | mgm. oxygen per litre | Phosphorus | *p*H | Temperature |
|---|---|---|---|---|
| 1 cm. under surface | 8·5 | trace | 7·2 | 28·2° C. |
| 1 cm. above bottom | 5·0 | trace | 7·2 | 28·0° C. |

Station 2, Feb. 15, 1933, 1.30 p.m.
In shade. Depth of water 75 cm. Air temperature (shade) 35° C.

| | mgm. oxygen per litre | Phosphorus | *p*H | Temperature |
|---|---|---|---|---|
| 1 cm. under surface | 4·0 | trace | 7·2 | 29·25° C. |
| 1 cm. above bottom | 2·5 | trace | 7·1 | 28·0° C. |

In the middle of the open stretches of water, in the centre of the swamp, the surface temperature at 3.30 p.m. was 34·9° and the *p*H was 7·4. Fish were numerous, even along the bottom.

The plankton, both plant and animal, though comparatively poor in numbers at the time, was relatively rich in species. Diatoms, desmids, Volvocales, and filamentous green and blue-green Algæ were taken; as were Protozoa, rotifers (more than twenty species), *Cladocera*, copepods, ostracods, amphipods, and numerous dipteran and ephemerid larvæ.

The presence of adequate oxygen is shown both by analysis and by the varied fauna. The scarcity of phosphorus suggests that the productivity is largely limited by the inorganic food supply. My observations were made at the end of the dry season, and there has been practically no rain or surface drainage for about three months, so that the inorganic nutrient salts had probably approached their minimum.

Although this swamp is closer to the equator than the swamps of the Chaco, is much nearer sea-level than the African swamps, and is in a warmer climate than either of these localities, it is quite obvious that it is entirely unlike them in character. A possible explanation is that the substrate of calcium carbonate tends to minimise the effects of the production of carbon dioxide and hydrogen sulphide associated with organic decay, and also makes for unusually clear water which permits photosynthesis even to the bottom.

R. M. BOND.

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Yale University,
New Haven.

[1] Carter and Beadle, *J. Linnean Soc.* Zool., **37**, 205–258.
[2] Beadle, *J. Linnean Soc.* Zool., **38**, 135–156.
[3] Woodring, Brown and Burbank, "Geology of the Republic of Haiti". Republic of Haiti, Dept. of Public Works, Port-au-Prince, 1924.

## Monetary Standards

IN NATURE of July 22 there was an interesting letter by Prof. H. E. Armstrong on this subject. It might be pointed out that standards of weight or length can be agreed upon because they will not vary with the changing of world conditions, but the quality of value or desirability to mankind cannot be standardised; yet it is this quality which a money standard attempts to fix. The value of one commodity in the terms of some other, such as gold, must always vary in relation to the supply.

Gold may have a certain temporary qualification as a money standard but setting it up gives to gold a false value at once. Unless it is intended to encourage speculation, it seems illogical to call the honesty of banks into question when they adjust their paper promises to a changed 'desirability value' of gold.

Even the energy required to produce a commodity is not fixed, so that an energy standard is also unsatisfactory as a gauge of value.

If fixed, international, monetary ratios are really necessary, then surely they could only be set up on a basis of supply and demand by a form of permanent board which would correct such ratios periodically. Money would then become in fact, what it is in theory, nothing more than a convenient medium for exchanging goods or services, having, like a standard of weight, no intrinsic or marketable value of its own.

W. S. GALL.

Corigliano-Calabro,
Prov. Cosenza.
Italy.
Aug. 4.

## Albinism in the Common Frog

ALBINISM in the common grass frog is a very rare phenomenon and as no mention is made of it in most works on albinism, its occurrence in four parts of England seems worth recording. The specimens I have seen recently came from Somersetshire, Wiltshire, Oxfordshire and Lancashire.

(1) In 1931 a boy at Yeovil School found about twenty albino tadpoles of the common frog (*Rana temporaria*) and took them to the biology master, Mr. G. Mumford, for identification. Mr. Mumford

was successful in rearing four of the tadpoles through the metamorphosis, and sent three of the young frogs to the Zoological Society of London. Two specimens were preserved and are still in the possession of the Society. Mr. Mumford kept the fourth specimen for some time, but it escaped and nothing further was seen of it. The pond from which the albino tadpoles came was searched in 1932 and 1933, but neither frogs nor tadpoles exhibiting albinism were discovered.

(2) In March 1933 an adult female albino frog (*Rana temporaria*) was sent to this department by an old student living at Trowbridge, Wilts. This frog, which is still alive, is of a dirty yellow colour, devoid of all pigment or markings in the skin, and possesses the characteristic pink eyes of the albino. When the female arrived in March it was obviously full of eggs. It was mated with a freshly caught active male, and during the night of March 16 produced two large masses of eggs, of a glistening whiteness, absolutely devoid of pigment, but normal in size and shape. Unfortunately, the eggs proved infertile. The male was killed after separation from the female; it contained active spermatozoa, and there was nothing to indicate that the discharge of sperms had not taken place during the mating. As several hours had elapsed since deposition of the eggs, artificial insemination was a forlorn hope, though it was attempted. After egg-laying the female became very thin and flabby, but soon recovered, and is now feeding, though never very active.

(3) In May I received a letter from Dr. Burgess Barnett, Curator of Reptiles and Amphibia at the Zoological Society's Gardens, informing me that a boy living near Woodcote, Oxfordshire, had reported finding some pure white spawn, which developed into pigmented tadpoles. The boy took some of these tadpoles to Dr. Barnett and also gave me five specimens, three of which have now metamorphosed into normally marked frogs. I think there is no doubt, from the boy's description, that the spawn he found was albino spawn, though he searched unsuccessfully for an albino adult.

(4) Mr. H. W. Parker, of the Natural History Museum, reports that a male albino *Rana temporaria* is preserved in the collection. The specimen came from Warrington, Lancashire, in 1921, but is only a semi-albino, as the eyes are pigmented.

I have not succeeded in finding any records in the literature concerning albinism in the common frog. Mr. Maxwell Savage, to whom I appealed on the matter, writes that he knows of two cases described by Fischer Sigwart[1]. These two cases are of albino tadpoles which turned dark during development, and correspond to the Woodcote tadpoles.

It seems clear from the above that albino spawn arising as a product of an albino female and a pigmented male acquires pigment during development owing to the pigment factor present in the sperm, and the adults so formed will possess the recessive factor of albinism. The Yeovil albino tadpoles did not develop pigment and metamorphosed into albino frogs, and had therefore, so far as one can infer, either inherited albinism from both parents, or from parents in whom the albino factor was latent.

NELLIE B. EALES.

University of Reading.
July 3.

[1] *Vierteljahrsschrift der Naturforschenden Gesellschaft*, Zürich, **42**, 238–313; 1897.

## Nitrogen and Plant Nutrition

THE writer of the very interesting article on this subject in NATURE of July 8, p. 49, makes an only too common mistake regarding the fate of nitrogen in bacterial metabolism. His statement that bacteria which hoard nitrogen are opposed to those that fix it, is misleading. All bacteria hoard nitrogen in the sense that they require it for metabolism. No bacteria are known to store it except in combination with carbon and hydrogen. When these elements are lacking in the medium nitrogen cannot be assimilated or stored. Bacterial proteins are not richer in nitrogen than those of animals and plants the nitrogen factor of all of which is about 6·5.

In the absence of carbohydrates, bacteria derive their energy by the breakdown of proteins and liberation of ammonia, and in this respect they are essential partners with the nitrogen fixers, since by breaking down the nitrogen fixed, they render it in a form available to the plant. Any nitrogen which they assimilate is also in its turn ammonified when no external source of energy is available. Hence we see the significance of the C/N ratio in soil fertility.

Further, those much-maligned denitrifying bacteria which liberate free nitrogen only do so in the absence of oxygen, and it is another common fallacy to suppose the earth would be more fertile were they all annihilated. Alternatively the nitrifying bacteria might be exterminated, so that there would be no nitrates to reduce. This would satisfy Prof. Comber[1] who, for other reasons, regards them as amongst the farmer's worst enemies.

According to Stickland[2], nitrate reduction by *B. coli* requires a diminution of not less than 96 per cent in the oxygen tension. It also requires an oxidisable substrate. In other words, loss of nitrogen is an indication of oxygen shortage and does not occur without a corresponding oxidation of organic matter. Since plant tissues also contain the nitrate-reducing enzyme it is very probable that the roots of plants under anaerobic conditions utilise nitrate as a source of oxygen and liberate free nitrogen in the process. Definite experimental evidence of this is difficult to obtain, but it is well known that plants grown in water-cultures grow better when the nitrogen is supplied as nitrate, though nitrogen as ammonia is more readily assimilated. No definite evidence of denitrification in arable soils has been obtained, but a loss of nitrogen under crops growing in lysimeter tanks has been recorded by various workers and could not be accounted for by leaching (Dehérain, Warington, Leather, Lyon and Bizzell).

Denitrification is known to occur in percolating sewage filters and in the activated sludge process under conditions of greater aeration than is possible by any system of soil cultivation. In this case, denitrification serves a useful purpose in promoting the oxidation of the organic matter of the sewage. It is possible that denitrification may also play a similar part in the respiration of plant roots which must of necessity flourish only in the undisturbed region of the soil below the zone of cultivation.

The solubility of oxygen in water at 15° C. is less than one part per 100,000 by weight whilst the solubility of nitrate is many thousand times as much. Soil cultivation aims at maintaining the aeration of the soil water to provide the oxygen essential to root respiration and bacterial oxidation, but no reserves of oxygen can be accumulated in the soil

water except as nitrates. The very word 'manure' means cultivation which promotes both the production of available nitrogen and its accumulation as nitrates.

Nitrogen has, therefore, not only a nutritive function in bacterial and plant metabolism, but probably also that of an oxygen carrier in biological oxidation and in plant respiration.

N. W. BARRITT.

Department of Microbiology,
Rothamsted.

[1] Comber, N. (1930), *The Fertilizer and Feeding Stuff Journal*, **25**, 419.
[2] Stickland, L. H., *Biochem. J.*, **25**, 1543; 1931.

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THE relevant statements made by Sir Frederick Keeble in his lecture to the Royal Institution, of which the article referred to by Mr. Barritt was a summary, were as follows: "Soil bacteria other than those which break down organic nitrogen by gradual stages into ammonia may set the nitrogen free again and in the interplay of these ammonia-forming and nitrogen-liberating bacteria are to be discovered the secrets of soil fertility and infertility. . . . Life must therefore depend on the resultant of these opposing forces, the nitrogen-fixers and the nitrogen liberators and hoarders."

If we take the words "the resultant of these opposing forces" in the dynamic sense, there does not seem to be much call for criticism, for the ingestion of nitrogenous compounds by bacteria must for the time being remove them from the sphere of action of the plant. In the long run, of course, the hoarding is not opposed to the fixing, for the nitrogen becomes available.

THE WRITER OF THE ARTICLE.

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## Synthesis of *d*- and *l*-Ascorbic Acid (Vitamin C)

IN a preliminary communication[1] we reported that by treatment of osones with hydrocyanic acid, succeeded by hydrolysis, we obtained products which possessed the strong reducing power of ascorbic acid. Starting from *d*-xyloson we were able to isolate a small amount of the reducing substance as the crystallised acetone derivative. From the melting point, analysis and iodine-titration, we considered the substance to be the acetone derivative of *d*-ascorbic acid.

Meanwhile we have improved the synthetic method in such a way that the free acids are obtained as pure crystals from both *d*- and *l*-xylosone. The products have the following constants:

*d*-Form. m.p. 187–189° (cor. decomp.) $[\alpha]_D^{23} = -48°$ ($c = 1$ in methanol)

Found C = 41·06 per cent, H = 4·72 per cent. Alkali-equiv. 176·2, Iodine-equiv. 87·4

Calcul. C = 40·89 per cent, H = 4·58 per cent. Alkali-equiv. 176·1, Iodine-equiv. 88·0

*l*-Form. m.p. 186–189° (cor. decomp.) $[\alpha]_D^{23} = +48°$ ($c = 0·85$ in methanol)

Found C = 41·05 per cent, H = 4·77 per cent. Alkali-equiv. 175·5, Iodine-equiv. 87·1

For the natural ascorbic acid Vargha gives $[\alpha]_D^{20} = +50°$ ($c = 1$ in absolute methanol)[2]

A sample of natural ascorbic acid, for which we thank Prof. Szent-Györgyi, showed a melting point 187°–189° (cor. decomp.). A mixture with the synthetic *l*-form melts unaltered at 187°–189°, while with the *d*-form a strong depression is shown. When equal amounts of the *l*- and *d*-form are crystallised together, they give crystals of melting point 168°–169° (cor.) and $\alpha_D = 0°$.

There can, therefore, be practically no doubt that the synthetic *l*-form is identical with natural ascorbic acid. Experimental details and the results of physiological tests will be published later in the *Helv. chim. Acta*.

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Eidg. Techn. Hochschule,
Zürich.
July 11.

[1] *Helv. chim. acta*, **16**, 561; 1933.
[2] NATURE, **130**, 847, Dec. 3, 1932.

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## Reducing Property of Aqueous Humour

EXPERIMENTS on the significance of the aqueous humour in the lens's metabolism, which I have been carrying out during the past few years[1], have shown that the power of the aqueous humour of cattle and of the rabbit to reduce methylene blue does not depend upon the presence of an enzyme, but essentially upon a reducing substance which is present in the trichloracetic acid filtrate and can be titrated with iodine. The trichloracetic acid filtrate, as well as the aqueous humour in which the protein has been deactivated by heating, obtained from 1 c.c. of aqueous humour, unites with approximately 1 c.c. of a $N/500$ iodine solution.

These reducing substances are sensitive to oxygen in an alkaline medium, whereas in an acid milieu and in the presence of oxygen they retain their power to reduce iodine. The reduction of methylene blue by aqueous humour can be accelerated by increasing the alkalinity and by the addition of sodium cyanide (NaCN). These reducing substances create an electrical potential in the aqueous humour which is measurable, well defined, easily reproduced, and the intensity of which depends upon the concentration of the aqueous humour; it is determined, therefore, by the concentration of the reducing substances.

SH-containing substances, such as glutathione and thionein, are not demonstrable in aqueous humour.

The nature of the oxygen sensitivity, the power to reduce iodine, the creation of a well-defined and reproducible oxidation-reduction potential the intensity of which depends upon the concentration of the reducing phase, the acceleration of the methylene blue reduction by means of NaCN and alkalis, the fact that SH-containing substances are not present in appreciable amounts in aqueous humour, induces me to believe, in conformity with recent results obtained by Tillmans, Szent-Györgyi, v. Euler and others, that the above-mentioned reducing substances of the aqueous humour should probably be considered as vitamin C. This has led me to further, as yet, unfinished experiments.

L. J. Harris's recent communication[2] stating that he has found large amounts of vitamin C in aqueous humour, is of the utmost importance, for we ought now, in the light of the reducing substances which I have found and characterised, to denote them as vitamin C.

The vitamin C of the aqueous humour stands in a close relationship to the metabolism of the lens. It is traceable by iodine titration only in minimal

amounts in the aqueous humour of the rabbit's eye after the lens has been removed. Therefore the vitamin C of the aqueous humour arises from the lens's metabolism. Since, according to what we already know, we have to regard the aqueous humour as an ultra-filtrate of the serum, and since no iodine reducing substances are present in the trichloracetic acid filtrate of the serum, these cannot be present in the original aqueous humour. The lens either secretes the vitamin C into the aqueous humour, or it reduces some component of the aqueous humour already present.

The vitamin C of the aqueous humour must be brought in relationship with the genesis of cataract. Within four hours after oral administration of naphthalene in doses sufficient to cause cataract, the capacity of the aqueous humour to reduce iodine disappears. I also found that the capacity of the aqueous humour-trichloracetic acid filtrate to combine with iodine is considerably diminished in the case of cattle afflicted with cataract. The regenerated aqueous humour contains essentially less iodine reducing substances than the normal one. Medical practice shows that one can 'ripen' a young cataract by puncturing the aqueous humour. This seems to substantiate the above.

The aqueous humour, in regard to its vitamin C content, occupies a unique position, for the trichloracetic acid filtrate of the vitreous humour can reduce only 0·5 c.c. of a *N*/500 iodine solution and that of the liquor only 0·1 c.c. per c.c.

H. K. MÜLLER.

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Basel.
July 13.

[1] Discussed at the meeting of the German Ophthalmological Society in 1932, by the Basel Society for Research, and at the 1933 meeting of the Swiss Physiologists in Basel.
[2] NATURE, **132**, 27, July 1, 1933.

## Vertical Distribution of Ozone in the Atmosphere

PREVIOUS estimates of the height of the ozone in the atmosphere, including our own measurements at Arosa[1], agreed in giving the centre of gravity of the ozone layer at about 40–50 km. above sea-level. These estimates were based on measurements of the intensity of the spectrum of direct sunlight as the sun was rising or setting, and—as we were careful to point out—it was necessary in deducing the height to assume that there was no regular diurnal variation in the amount of ozone through the day.

Recently it has been found possible to deduce, not only the centre of gravity of the ozone layer, but also the general character of the vertical distribution of the ozone in the atmosphere. This new method is based on observations of the spectrum of the light received from the clear blue zenith sky as the sun is rising or setting. The results of the new method are much more reliable than those of the former method, and measurements on different days give values for the average height of the ozone which agree within a few kilometres. The average height at Arosa now appears to be about 20 km., which is much below the former estimates.

The recent measurements also confirm the results obtained by an entirely different method by Götz and Ladenburg[2] and by Buisson[3] that there is an appreciable amount of ozone in the lower layers; though the main amount seems to be situated between 15 km. and 50 km. and to be distributed in a manner similar to that deduced theoretically by Chapman. So far as we can tell at present, the changes in the total amount of ozone which are associated with changes in the meteorological conditions seem to take place mainly in the upper region.

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Arosa, Switzerland.

G. M. B. DOBSON.
A. R. MEETHAM.

Boar's Hill, Oxford.

[1] Götz and Dobson, *Proc. Roy Soc.*, A, **120**, 252; 1928; **125**, 292; 1929.
[2] Götz and Ladenburg, *Naturwiss.*, **19**, 373; 1931.
[3] Buisson, Janssevan and Rouard, *Revue d'Optique*, **12**; 1933.

## Salazinic Acid and the Constituents of the Lichen, *Lobaria pulmonaria*

IN the May number of the *Berichte*, p. 689, Asahina and Asano put forward a constitutional formula for salazinic acid. In the June number, p. 893, the formula is altered so as to bring it more into agreement with experimental results. With the latest formula of these workers there is an admitted difficulty in explaining the production of 3·5 dioxy–*p*–toluic acid from hyposalazinol on fusion with potash. We have been engaged on the constitution of salazinic acid for some time past, and while we confirm the empirical formula of Asahina and Asano and we had independently prepared some of the derivatives mentioned by these workers, we find a difficulty in accepting the constitutional formula submitted, as we have observed that salazinic acid on methylation with silver oxide and methyl iodide gives rise to two products, one a trimethyl derivative of salazinic acid $C_{18}H_{12}O_{10}(CH_2)_3$, and the other a pentamethyl derivative of a hydrated salazinic acid $C_{18}H_{14}O_{11}(CH_2)_5$. A full account of our experiments will appear elsewhere.

In the July number of the *Berichte*, p. 943, Asahina and co-workers state that specimens of the European species of *Sticta pulmonaria* that have been examined do not contain gyrophoric acid. On the other hand, the lichen from mid-Japan contains gyrophoric and salazinic acids and that from South Sakhalin contains gyrophoric acid and an acid having the empirical formula $C_{23}H_{34}O_5$.

In an investigation of the constitution of stictaic acid we used as our raw material the lung lichen, *Sticta pulmonaria* (*Lobaria pulmonaria*, Hoffm.) gathered in the Powerscourt Demesne, Co. Wicklow, and find that no gyrophoric acid is present but it contains two constituents. One of these is a pentahydric alcohol (m.p. 102° C.; acetate m.p. 74°–75° C.) which we believe to be arabitol, and is interesting as the first recorded instance of the isolation of an alcohol of this type from a lichen. The second constituent is an acid which we had thought to be stictaic acid but which does not appear to be the stictaic acid of Asahina. The acid gives analytical figures (C 57·9; H 3·77; $OCH_3$ 7·6) which agree with the formula $C_{18}H_{14}O_9$ rather than $C_{19}H_{14}O_9$. This acid with acetic anhydride and sulphuric acid gives an acetate m.p. 239° C. (C 55·4, H 4·16) which is also different from that obtained by Asahina from his stictaic acid.

THOS. J. NOLAN.
J. KEANE.

Chemical Department,
University College,
Dublin. July 12.

## Modified Field Equations with a Finite Radius of the Electron

THE attempts to combine Maxwell's equations with the quantum theory (Pauli, Heisenberg, Dirac) have not succeeded. One can see that the failure does not lie on the side of the quantum theory, but on the side of the field equations, which do not account for the existence of a radius of the electron (or its finite energy=mass).

I have developed a new method of the quantisation of the electromagnetic field in such a way that the four independent variables (time-space) are treated absolutely symmetrically and the principle of relativity is trivially fulfilled. From very general principles of quantum theory (superposition of states, linearity of the equations for the amplitudes of probability) one can deduce how Maxwell's equations have to be modified. In the classical theory, they are equivalent to the statement that the Lagrangian is given by $L=\frac{1}{2}(H^2-E^2)$; in the new theory, this expression is replaced by a linear function of the field components, the coefficients of which are non-commutative quantities of a type similar to those in Dirac's theory of the electron. In the limit, where the classical theory should hold, the new Lagrangian does not go over into the above given expression, but into

$$L=\frac{1}{a^2}\sqrt{1+a^2(H^2-E^2)}$$

where $a$ is a constant of the dimensions $r_0^2/e$ ($e$= charge, $r_0$=radius of the electron), and only in the limit $a\to 0$ does this tend to

$$\frac{1}{a^2}+\tfrac{1}{2}(H^2-E^2).$$

The simplest case of a central-symmetrical field independent of time ($H=0$, $E=-\text{grad}\ \varphi(r)$) gives for $\varphi$ the differential equation

$$\frac{d}{dr}\left(\frac{r^2\frac{d\varphi}{dr}}{\sqrt{1-a^2\left(\frac{d\varphi}{dr}\right)^2}}\right)=0,$$

with the solution

$$\varphi=e/r_0\cdot\int_{r/r_0}^{\infty}\frac{d\xi}{\sqrt{1+\xi^4}},$$

where $e$ is a constant of integration and $r_0$ is a length chosen so that $a=r_0^2/e$. For $r\gg r_0$, one has Coulomb's law, $\varphi\to e/r$, but for small values of $r/r_0$ the new potential is finite and tends to $1{\cdot}85\ e/r_0$.

The form of the general expression for $L$ ensures the relativistic invariance. Thus there is no difficulty in calculating the properties of a moving electron on the basis of the classical theory. But the importance of the new Lagrangian $L$ seems to lie in the possibility of a systematic quantisation of the field.

M. BORN.

University of Göttingen.
July 20.

## The Uncertainty Principle

THE familiar application of this principle is to a particle, such as an electron, and from it we learn that errors, $\Delta q$ in the positional co-ordinate and $\Delta p$ in the momentum, must occur such that:

$$\Delta q\ \Delta p\sim h.$$

This principle is bound up with the ideas in the wave theory of matter and is accepted as part of that theory, in which it is embedded. It is interesting to note, especially in view of a possible generalisation of the principle to systems more complex than a particle, that a little boldness of statement might have led substantially to it in the earlier days of the quantum theory. The work of Planck and Sommerfeld led to the recognition of a cell-like structure in phase space. Thus on a diagram representing the co-ordinate, $q$, along one axis and the momentum, $p$, on the other, the whole area was divided into small rectangles $\Delta q\ \Delta p$ of area $h$. One might have postulated that elementary areas of smaller size in this diagram had no physical significance or that points within the area could not be distinguished from one another. The statement of this postulate would thus be:

$$\Delta q\ \Delta p\not< h,$$

which is only another form of the uncertainty relation.

This is the method of approach adopted in the discovery of the principle of minimum proper time and it would have been difficult to accept it without the background of the wave theory.

The interest here is that the generalisation of the idea gives a principle of indeterminacy for systems of $n$ degrees of freedom, namely:

$$\Delta q_1\ldots\Delta q_n\ \Delta p_1\ldots\Delta p_n\not< h^n,$$

for the phase space now becomes composed of cells of 'volume' $h^n$.

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July 28.

## Curious Atmospheric Refraction Effects

WHILE in a rowing-boat on the ocean during a sultry afternoon this summer I observed a very peculiar series of refraction phenomena that seem worth describing. A thunderstorm was brewing in the north-east far enough away so that the thunder was just audible. There was no sunshine. The wind had dropped and the sea was gently undulating. A small steamer was passing westward some three miles distant. When I first saw her she was almost hull down (apparently). In a few minutes she loomed up so that the forecastle was high, although the midship section was normal. A little later the cabins disappeared entirely and all one could see was an unbroken line of black hull, the funnel and the masts. Next she again appeared hull down, only to emerge with complete hull and upperworks. Then once more she seemed to sink so that her deck was awash. These changes took place as one gazed at the boat and were most startling. The hull seemed slightly longer at the time when only the deck showed but this may have been imagination on the part of the observer.

I attribute the effects to irregular currents of cool air from the approaching storm gently flowing over the water. A number of years ago I witnessed a similar case, in which a receding steamer seemed to sink to her upper deck at three miles, to emerge safely within the next mile. I wonder if anyone else has noticed such freak refraction as the first case cited?

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## Research Items

**Inhabitants of Inland Salt Waters.** The animal associations of salt inland waters are peculiar in that there several animals can tolerate salt water although they apparently cannot live in the sea. H. Singh Pruthi found in the succession of pools which, in all but the wet season, form the 'stream' of Khewra Gorge in the Punjab, salinities varying from 0·12 per cent to so much as 17·0 per cent, or about five times that of sea water. Flat worms and leeches did not survive beyond the least saline stage (0·12–2); Mollusca, Amphibia and fishes dropped out in the succeeding range (5–15); Crustacea at 30–35; and only insects survived in the waters of greater salinity. Buxton was of opinion that in water as salty as, or more salty than, the sea only Diptera (families Ephydridæ, Culicidæ and Chironomidæ) and a Trichopteron could survive, but in addition to the dipterous families mentioned above, Pruthi found Tabanid larvæ, as well as representatives of several families of Coleoptera, may-fly larvæ and Rhynchota, all living in waters of much higher salinity than that of the sea. At salinities of 120–170, Thysanura, Dermaptera, Coleoptera and Diptera were all represented. The author regards the absence of such forms in the sea as probably due, not to unfavourable salinities or the force of waves or tidal currents, but to the low calcium content of sea-water, a thesis which he is endeavouring to prove experimentally (*Records Indian Mus.*, 35, 1933, p. 87).

**Hydrology of Lake Tanganyika.** Since its discovery some sixty years ago, the Lukuga outlet of Lake Tanganyika has presented some interesting problems. In 1874 Cameron found the channel swampy but entirely blocked. Two years later Stanley found a slight flow which by 1879 had become a strong river. Since then the flow has continued, but in some years has been only a few centimetres in depth. In Geological Survey Bulletin No. 5 (Tanganyika Territory), Mr. C. Gillman, in a study of the hydrology of Lake Tanganyika, discusses the reasons for these fluctuations and concludes that they are periodic phenomena due to an intermittent rise and fall of the lake level. He points to a discharge of a comparable nature by the Shire from Lake Nyassa. Crustal movements in the fault valley may have an effect but this has not been determined. On the other hand, variations in rainfall in a belt of transition between a humid and dry climate would undoubtedly cause fluctuations in the lake level. Observations are not available for a long period, but Mr. Gillman traces periodic fluctuations of level of the order of 13–15 metres and short period fluctuations of 2·5–3 metres. During low levels, the Lukuga outlet is filled by debris consolidated by swamp growth, which remains strong enough to serve as a dam until the water reaches its top and overflows. Then the barrier is quickly destroyed down to the rocksill and cannot form again until a low-level period is reached.

**Edible Molluscs of Manila.** Florencio Talavera and Leopoldo A. Faustino have described and figured a large quantity of edible Mollusca, both univalve and bivalve, from Manila (*Phil. J. Sci.*, 50, No. 1, Jan., 1933). Most of them were actually purchased in various Manila markets or from street vendors, practically all of them being sold in their shells. It is an interesting collection, and shows a surprising number of edible forms from the large oysters, clams and gastropods such as the well-known *Cerithium telescopium*, *Strombus canarium* and *Melongena pugilina*, to such tiny shells as *Donax radians* and the variable *Umbonium vestiarium*, the last eaten as periwinkles are often eaten, only with a thorn to pick out the animal instead of a pin! Amongst these edible molluscs, we find the brachiopod *Lingula unguis*, the 'bálay' or 'tongue clam'. This occurs in large numbers living in vertical burrows in shallow waters. Its burrowing methods are very interesting for it may dig on its side, using the stiff hairs to plough into the sand while forcing the body forward; it may penetrate the ground by means of the peduncle in the manner of a worm, dragging the body down as it cleaves the sand; or, it may bury itself head first, a method usually exhibited by an individual with the peduncle broken close to the body. It is extensively used as food, especially by the people living near the grounds, and considerable quantities are brought into the public markets, the stalk being generally eaten fresh or pickled in vinegar.

**Respiratory Activities in the Soil.** The production of carbon dioxide by the soil, which is closely related to the various oxidative changes taking place in the organic matter and hence represents an approximate index of the processes of humification and transformation of the humus, is governed by a number of factors. In a note communicated to the Reale Istituto Lombardo di Scienze e Lettere in December last and published in parts 19–20 of vol. 65 of the *Rendiconti*, Antoniani, Arnaudi and Nicolini record experimental results which indicate a correlation between this formation of carbon dioxide and the number of micro-organisms present in the soil. Such correlation is manifested only with soils of identical geological character and similar content in organic matter which have been cultivated in the same manner. The number of micro-organisms appears to be related to the physical nature of the soil, the numbers being greater in soils comparatively rich in organic matter.

**Cytology of Cotton.** Some advances are being recorded in the correlation of cytological and genetical results in cotton, where various cases of duplicate genes are now known. Dr. Skovsted (*Ann. Bot.*, 47, 227) has made a study of mitosis and meiosis in the diploid *Gossypium arboreum* and in a triploid rogue which appeared from diploid parents in the genetic experiments of the Cotton Research Station, Trinidad. The latter was sterile. The chromosomes of cotton are very small and two of the 13 pairs in the diploid have satellites. In meiosis there is not a continuous spireme, but the leptotene threads corresponding to whole chromosomes pair laterally and also in some cases end-to-end. Occasional non-disjunction occurs in the heterotypic mitosis. In the pachytene stage of the triploid, univalent and trivalent as well as bivalent threads are seen, and end-to-end conjugation of strands also occurs. Although no evidence of secondary pairing of chromosomes in metaphase was obtained, yet it is concluded from genetical and other data that 13 must be a secondary polyploid number. It is suggested that perhaps a tetraploid Asiatic cotton can be obtained from the triploid mutant. An

island of tetraploid tissue with 52 chromosomes was found in the root of a plant of *G. arboreum*, and it may therefore be worth while looking for possible tetraploid mutations in commercial fields of Asiatic cotton.

Classification of Climates. The climates of the earth form the subject of a paper and a map by Dr. C. W. Thornthwaite in the July number of the *Geographical Review*. The paper discusses the basis of an attempt to find a classification of climates more satisfactory than that of Köppen, which was based on the distribution of various types of vegetation. The new attempt is like Köppen's in that it attempts to determine the critical climatic limits significant in the distribution of vegetation, but it differs in making use of two new climatic concepts, precipitation effectiveness and temperature efficiency. Tropical rain forest is assumed to have the most favourable climate for plant growth, that is to say, precipitation effectiveness and temperature efficiency are at their maxima. Diminution of either element causes a slowing of plant growth until a minimum is reached where growth ceases. Five humidity types are recognised corresponding respectively with rain forest, forest, grassland, steppe and desert. These are given numerical values and symbols. Similarly, six temperature efficiency types are noted and given numerical values and symbols. Lastly, four types of seasonal distribution of moisture are defined and given symbols. The factors of climates that control vegetation have thus five, six and four aspects respectively, giving 120 possible combinations. Certain of these, however, do not occur, several being impossible. So in practice there are actually 32 climatic types. These are shown on a coloured map of the world.

Soil Erosion in Africa. The serious reduction in productivity in Africa by soil erosion was discussed by Mr. A. M. Campion in a lecture to the Royal Geographical Society on May 8. The history of the native races of Africa shows a continuous movement from one area to another, and many of these migrations have been the outcome of reduced productivity on the abandoned area. After mentioning certain conditions of structure and climate which favour soil erosion but are not amenable to human intervention, Mr. Campion went on to point out that man has also played a most destructive part in various areas. Destruction of forests has loosened the soil, and perhaps decreased the fall of rain, but certainly increased the effect of the rain in washing away soil. Overgrazing by stock has been equally harmful. Trees and shrubs are destroyed, and grasses uprooted. Water channels are caused by the trampling of hoofs along broadening paths. The control of cattle diseases causes increase of stock and further depletion of fertility. Burning of grass may encourage new growth, but is apt to destroy young shoots and seeds and discourage the formation of humus. Mr. Campion discussed possible remedial measures, among which he stressed the necessity of the entire abandonment of exhausted areas for a period and a check on the number of animals grazed in a given area.

The Witwatersrand System. The *Proceedings of the Geological Society of South Africa* for 1933 contains a stimulating presidential address by Dr. L. T. Nel with special reference to the occurrence of the Witwatersrand System outside the Rand itself, that is, in the Heidelberg, Greylingstad–Vaal River, Parys–Vredefort and Klerksdorp–Ventersdorp areas. It is pointed out that although changes in material, structure and thickness of individual rock units occur, yet each of the five major subdivisions can be recognised in all the areas. The predominance of argillaceous rocks in the lower part suggests deposition in deep or quiet waters. The steady upward increase of sand indicates the approach to shallow water or even terrestrial conditions. Changes in thickness and coarseness of grain and the alignment of conglomerate lenses show that the flow of sediments came mainly from the north-west. Comparatively cold climatic conditions are indicated by the presence of tillite, the occurrence of fresh felspar and the absence of limestones. Volcanic rocks occur at the base of the system in the areas of Parys–Vredefort (basic amygdaloids) and Klerksdorp–Ventersdorp (less basic amygdaloids and quartz-porphyry). Higher up in the succession lavas of acid types have been found in certain other areas. Gold is widespread in the Witwatersrand System, but the conditions for concentration were rarely so favourable as in the Main Reef Group, and mining ventures in the outlying areas have not been able to develop to the same extent as on the Rand.

Meteor Spectra. The spectroscopic investigation of meteors has not yet been carried very far. Until recently, only 24 meteor spectra had been photographed, eleven of these photographs being obtained in 1932. Dr. P. M. Millmann of Harvard (*Popular Astronomy*, 41, 299; 1933) describes a very simple apparatus for this work, consisting of an ordinary camera with an accurately cut prism mounted in front of the lens. Systematic investigations are also being carried out by Dr. J. D. Williams of the Steward Observatory, University of Arizona. Three regions of the spectrum appear to call for special attention: 3800 A.–4000 A., 5100 A.–5300 A. and 5800 A.–6000 A. Very fast photographic negative materials are required and among the recommended plates are the Barnet Super Press, which covers the first two regions, and a hypersensitive panchromatic plate made specially for meteor work by the Research Department of Ilford, Ltd.

Thermo-Electric Power of Hydrogenated Metals. Recent investigations on the occlusion of hydrogen in metals have led to the hypothesis that such gas is not only occluded in a state of solution, but also, like a dissolved electrolyte, is ionised. It is assumed that the absorbed hydrogen is in the form of protons diffused uniformly throughout the whole mass, and that electrons are present in equal number, so that the metal is electrically neutral. The possibility of the existence of a thermo-electric force between the hydrogenated and the non-hydrogenated metal is confirmed by the results of experiments described by Franzini and Gazzaniga in the *Rendiconti dell' Istituto Lombardo di Scienze e Lettere* (Parts 1–5, 1933). For thermo-couples formed by a metal in conjunction with the same metal saturated with hydrogen, the E.M.F. developed for a temperature-difference of 1° between two junctions amounts, in multiples of $10^{-7}$ volt, to: iron, 0·705; platinum, 0·223; nickel, 1·08; palladium, 174·5, the electronic current passing from the hydrogenated to the non-hydrogenated metal through the warmer junction. The proportions of hydrogen required to

saturate the different metals vary widely, but, even when the E.M.F. is referred to 1 volume of hydrogen absorbed by 1 volume of the metal, the value for palladium is still considerably the highest.

Thermal Data for Organic Compounds. Since 1929 G. S. Parks and H. M. Huffman and collaborators have published in the *Journal of the American Chemical Society* an important series of papers on thermal data for hydrocarbons, some aliphatic alcohols and acids, from which the entropies and free energies have been calculated. In the July issue of that journal, Parks, Huffman and Barmore describe measurements with more diverse types of substances, including urea, glycine, phenol, aniline, benzoic acid and sucrose. The heat capacities at various temperatures were determined and from them the entropies and free energies calculated by means of Nernst's theorem (third law of thermodynamics). Besides providing valuable experimental data for the study of organic chemical reactions, the results provide a check on the validity of Nernst's theorem, since they show that, in the case of urea, the free energy found is practically the same as that calculated from the equilibrium constant in the reaction $CO_2+2NH_3=H_2O+CON_2H_4$ found by Lewis and Burrows. In the series of papers some useful empirical values for the changes of entropy accompanying various structural modifications have been developed and shown to be in good agreement with experiment, and this is again found, except in the case of sucrose, where inadequacy of data and the rather hypothetical character of the ring formula proposed by Haworth may partly account for the discrepancy.

Atomic Weight of Lead from Katanga Pitchblende. Baxter and Alter (*J. Amer. Chem. Soc.*, July) have determined the atomic weight of lead from an East African pitchblende, for which several similar determinations by previous investigators are available, varying from 206·046 (Morogoro pitchblende; Hönigschmid and St. Horowitz) to 206·20 (Katanga pitchblende; Richards and Putzeys). The Katanga ore is nearly free from thorium, and the lead content should be nearly pure uranium lead. The interesting result was found that the atomic weight of the lead from the black portion of the pitchblende, insoluble in dilute hydrochloric acid, is definitely higher, 205·996, than that in the softer yellow vein material present in the ore, readily soluble in dilute hydrochloric acid, which gave Pb = 205·970. It is possible that the yellow material is more recent in date than the black. Infiltration, or leaching, or varying rates of decay of different isotopes of uranium are possible causes for the difference. Another determination of the atomic weight of lead from Bedford cyrtolite gave the value 205·94, and the method has been carefully checked by a redetermination of the atomic weight of ordinary lead. If Katanga lead contains chiefly the isotopes 206 and 207 in the proportions found by Aston (NATURE, 129, 649; 1932) the low value 205·90–205·92 results for the isotope $Pb^{206}$.

## Astronomical Topics

White Spot on Saturn. This spot (see NATURE of August 12, p. 248) was discovered almost simultaneously by Herr Weber at Berlin-Steglitz and by Mr. W. T. Hay at Norbury; the time being August 3 at $22^h30^m$ U.T. It was independently found, $1\frac{1}{4}$ days later, by Messrs. Hellweg and Willis at Washington. The latter gave its diameter as being one-tenth of Saturn's. Probably this estimate was too small, but there is evidence that the spot increased rapidly in length; accordant determinations at Juvisy and Bournemouth on the evening of August 6 showed that it took 49·2 minutes to cross the central meridian, making its diameter one-quarter of Saturn's; while on the early morning of August 9 the Rev. T. E. R. Phillips made its length nearly 27,000 miles, which is more than one-third of Saturn's equatorial diameter. The expansion is explicable if the matter forming the spot came from different levels of Saturn, at considerable depths below the surface; at these depths the rotational speed would be slower than at the surface, which would cause the matter to lag behind the surface matter.

Preliminary estimates of the time of rotation, using the centre of the spot, give values a fraction of a minute below $10^h16^m$. If the preceding edge of the spot had been used, a slightly shorter time would be found. Prof. Asaph Hall and others observed a similar spot in 1876, which also increased in length, but probably less rapidly than the present spot. A. Hall derived the rotation period $10^h14^m23{\cdot}8$ from that spot.

Accuracy of Eclipse Predictions. Dr. L. J. Comrie recently gave some formulæ for deducing the limiting curves of visibility, and the other curves that are now printed in the eclipse maps in the different Nautical Almanacs (*Mon. Not. Roy. Astro. Soc.*, Jan.). Dr. James Robertson, Superintendent of the American Ephemeris, has a paper in the May number of the same journal in which he states that formulæ of a similar character to those deduced by Dr. Comrie have been used in the American Ephemeris for about twenty-five years. The resulting errors are only of the order of a few hundredths of a minute, whereas the approximate formulæ of Chauvenet may be some 3′ in error. Dr. Comrie, in a note, expresses his pleasure at finding that accurate formulæ have been used for so many years, but he considers that some note about the change of method should have been made at an earlier date; this apparently was not done. He also notes that his formulæ are better suited for work with calculating machines than the American ones.

A Variable Star of Short Period. Dr. van Gent has lately been taking photographs of the cluster Omega Centauri with the 26-in. photographic refractor of the southern station of Yale Observatory, which is at Johannesburg. In addition to the variables already known in the cluster, Mr. Kooreman has found that the star numbered 65 by Bailey has the shortest period of any known variable; the material at present to hand is insufficient to decide between the two following values: 1/15·9430 day and 1/16·9455 day. The first value is somewhat more probable. The uncertainty in the period has little effect on the deduced light-curve. The range is 0·47 magnitude, the increase in light is more rapid than the decrease, and the maximum is much sharper than the minimum. The star is 645″ from the centre of the cluster, but this distance is not great enough to throw much doubt on its physical connexion with the cluster.

The above details are from a recent article by Prof. E. Hertzsprung (*Bull. Astro. Instit. Netherlands*, 7, No. 247).

## The Eighth National Radio Exhibition

IT is doubtful whether the Radio Exhibition at Olympia is the best occasion for learning what scientific progress is being made in that particular area of the radio field which is concerned with the reception of broadcast programmes. The exhibition, as exhibition, is admirable, attractive and deservedly popular. But there is no 'radio' to be heard in it.

It might be captious to suggest that 'the show' is really an audio exhibition, but the limiting of demonstration to reproduction of music and speech distributed at audio (not at radio) frequency does prevent a complete subjective appraisal of the radio receivers shown, since more than half—and a vital half—of the receiver is not in use. Objective appraisal, by the method which the scientific worker regards as normal in other fields, is also impossible, for the reason that on no one of the stands carrying receivers were overall performance curves to be found on the opening day, and on only one stand were such curves found on the second day of the exhibition.

An inquiry into the reasons for this almost universal reliance on subjective selection—even when the absence of facilities for such selection is left out of account—is too extensive for development here, but it demands attention. It must be admitted that existing knowledge is inadequate for completely objective testing ; it must be inquired what steps are being taken, and by whom, to bridge these gaps in knowledge.

What does emerge most clearly from the study of the new season's receivers, and from their audio frequency performance, is that the industry has, almost without exception, decided to follow one of two divergent paths which offer themselves to the designer. One path leads towards the most faithful attainable reproduction of music from the 'local' broadcasting station, the other towards reproduction of programmes from stations at such distances that fading phenomena, interference between emissions of comparable field intensity, and interference from natural and artificial sources of electrical disturbance assume dominant importance. The two paths do not diverge rapidly in their early stages, but the ultimate goals are definitely irreconcilable.

The most marked feature of the audible demonstrations is a very notable and gratifying improvement in the average level of acoustic fidelity. The very general introduction of the moving-coil speaker, even in inexpensive sets, and of dual speakers of the moving-coil type in the medium and highly priced sets, are milestones common to both paths. The range of frequencies over which the response curve of the speaker system may be taken as flat on the average, neglecting its very complex fine structure, has been greatly extended. Yet it must be said that no single set which was heard would have deluded an even moderately tolerant musician that he was in the concert room itself. This is said not by way of derogation from the praise due for the very notable progress made, but to indicate the magnitude of the outstanding scientific and technical problems. The final æsthetic aim of broadcasting is not necessarily 'photographic representation', but it is just as necessary that the broadcast receiver should give close acoustic fidelity, as it was necessary that Cezanne and his followers should be as competent draughtsmen as their predecessors.

How far the trend of design has travelled along the alternative path is shown by the very general provision of 'automatic volume control'. The very great facility for shaping the frequency-acceptance curve which is afforded by the frequency-conversion principle, embodied in the superheterodyne receiver, has brought such an increase of receivers of this type that this may well be labelled the superheterodyne year. Within the limits set by the international allocation of frequency channels, the superheterodyne set can probably be made to give an overall response curve of the same degree of fidelity as the 'straight' set, with greater facility for its displacement to accept either of the alternative 'local' programmes. The old difficulties of high background noise level have been almost completely surmounted, and so the superheterodyne set is not specifically off the path of high quality local reception.

The automatic volume control, a device of high technical ingenuity and surprising practical simplicity for reducing the effects of fading, is, however, in a different category. It aims solely at mitigating some of the worst imperfections of emissions which are already foredoomed to æsthetic imperfection. That it makes a great contribution to the very real pleasures of 'distant listening' is indubitable ; that it leads away from the path of highest quality reception is equally indubitable.

Television apparatus at the show brings no surprises, and no great novelties. There is, indeed, a complete cathode-ray television receiver, but it is designed for the present medium-wave thirty-line emissions, for which a cathode-ray receiver is neither necessary nor well-suited. The only other modern television receivers shown were both of the mirror-drum type, and both utilised the Kerr effect for light-modulation. Perhaps the one greatest unheralded novelty in the whole exhibition, however, derived its main significance from television requirements. This was the cathode-ray oscillograph with a fluorescent screen of nine-inch diameter, which was exhibited in the now familiar sealed-off form, requiring accelerating voltages of the same order as the voltages necessary in the mechanical television receivers already noticed, and thus quite suitable for domestic use.

Next to this particular 'vacuum tube' the exhibits of highest scientific interest are, probably, other vacuum tubes, such as those which facilitate the application of automatic volume control, the double-diode-triodes, those which improve high-frequency amplification, the screened pentodes, and those which have brought the performance of the dry-battery driven set to a much higher level, the valves designed for 'class B' and 'quiescent push-pull' amplification.

Special notice must be given to the exceptionally interesting exhibit by the Post Office, which very properly reminds the visitor that 'radio' and 'broadcasting' are not synonymous. The central feature of the exhibit recalls the fact, already implicit in what has been said above, that the problem of the interference which electrical apparatus—domestic and industrial plant, traction and communication plant, illumination devices and the like—produce in the reception of broadcast programmes is the most important single obstacle to high-quality reception in the great centres of population.

One last remark is suggested by the omissions from the exhibition. It is to be hoped that the Post Office, the British Broadcasting Corporation, and the Radio Manufacturers Association, will not forget that the situation in respect of the highest-quality broadcasting is not yet hopeless.

The very qualities which may render the ultra-short wave-bands suitable for television working are the qualities required for very high-quality musical reproduction. Channels should be reserved for services of this character before the existing state of congestion in the medium-wave bands has established itself in these still open bands.

## The Welsh Plant Breeding Station, Aberystwyth

IN response to numerous requests, the Welsh Plant Breeding Station, Aberystwyth, has issued a booklet, price 3*s*., entitled "An Account of the Organisation and Work of the Station from its Foundation in April 1919 to July 1933". The publication describes in an eminently readable form the general principles governing the work of the Station and the lines upon which it is organised and functions. Though not intended to be a precise guide to the experiments, it should prove invaluable to visitors and others desirous of a real insight into the general aims underlying the work, the methods employed and the difficulties encountered.

From the outset, the policy has been to concentrate all researches on one main problem, namely, grassland improvement, though this question is necessarily studied from a number of aspects the chief of which are plant breeding of herbage crops and trials relative to their seed production, the improvement and management of ordinary farm grasslands and hill grazings, while plant breeding with oats and wheat and investigations into plant diseases form necessary complements to the central problem.

The breeding of the more important herbage plants, as perennial rye grass, white clover and cocksfoot, however, is the pivot upon which the work turns as it is by such characters as leafiness, persistence and flowering habit, factors found to be associated with clearly defined types, that the agricultural value of the herbage is determined. The safeguarding of truly authenticated stocks, and the best means for their distribution, are further problems awaiting solution, and the co-operation of the seed trade, farmers' societies and individual farmers has already been enlisted in the latter cause.

In this connexion a plea is put forward for the foundation of something in the nature of a British or Imperial Seed Production Co., which would be a properly conceived and controlled organisation, acceptable alike to the seed trade and the farmer, and competent to produce the right kind of seeds, sufficiently cheaply and adequately authenticated. The far-reaching nature of the term 'management' is fully brought out. The importance of the choice of the seeds mixture, the use of rotational grazing, and the significance of differences in yield, productivity, carrying capacity and nutritive value of the various types of herbage are discussed in the light of experimental evidence.

The necessity for ploughing old pastures prior to re-sowing has entailed a study of the oat plant, as this makes an excellent first crop after grass. Breeding experiments have been carried out with the view of finding strains particularly suited to these poor conditions; hardiness and good standing ability being the chief requisites.

The work on rough and hill grazings is of particular interest considering the necessity for making the best use of all available grassland at the present time. Climate has not been found to be such a limiting factor to the improvement of hill pastures as had previously been thought, and after a preliminary cultivation by means of a scratching or ploughing operation, a sowing combined with a manurial dressing has proved of immense value. Wild white clover (preferably assisted by inoculation) is the most important species to include in a seeds mixture for this purpose and, among the grasses, Yorkshire fog and sweet vernal grass have given particularly promising results.

The extent to which the work of the Station has been helped by the neighbouring county agricultural organisers, landowners and farmers is evidence of the real practical value of the investigations being carried on. The publication of this booklet cannot fail to increase and widen the interest taken in grassland management as a whole, and in the methods by which our knowledge of the subject is being extended at Aberystwyth in particular.

## The Cape Observatory

*SCIENCE PROGRESS* for July contains an interesting article on the Cape Observatory by Dr. H. Spencer Jones.

Rev. F. Fallows was the first director and commenced work in 1821. He worked under great difficulties, the site being inhospitable, the instruments badly made, the assistance allowed to him hopelessly inadequate; he died in 1831 at the early age of forty-two years. It may be remarked that the amenities of the site have now been greatly improved, the bare rock having been covered with a good depth of soil, trees planted to shelter the instruments from wind, and a good water-supply laid on.

Henderson was director for only one year, but did good work in that time; *inter alia* he detected the large parallax of $\alpha$ Centauri.

Maclear was director in 1834–1870. In his early days there he enjoyed the companionship of Sir J. Herschel, who established an observatory at Feldhausen in order to extend his father's survey to the southern heavens. Maclear made an immense number of observations, but their reduction was delayed owing to insufficient staff. It was completed after his retirement by his successor, E. J. Stone. He in turn was succeeded by Sir David Gill in 1879. The great comet of 1882 was the accidental occasion of detecting the value of photography for determining the position of stars. This led both to the formation of the Cape Photographic Durchmusterung and to the great Astrographic Catalogue of the entire heavens.

The Cape Zone has been rephotographed under Dr. Spencer Jones, and comparisons of the earlier

and later plates will shortly yield proper motions of about 40,000 stars. The average time-interval between early and recent plates is 25 years.

Gill made a determination of the solar parallax from observations of Iris, Victoria and Sappho: the resulting value 8·804″ was nearly identical with that deduced by Hinks from the Eros-opposition of 1901. The Cape Observatory took a larger share than any other in the observations of Eros in 1931: it is expected that the resulting value of the parallax will be accepted as definitive for a long period. The McClean 24-in. equatorial was presented to the Cape Observatory in 1900 and was used for stellar spectroscopy until 1926, the last spectrograms taken with it being of Nova Pictoris. They sufficed to prove a rapid expansion in the outer layers of the star, while the effective temperature remained nearly constant.

The 24-in. is now being used for stellar parallax work, 500 parallaxes having already been determined with it.

The article is accompanied by reproductions of artistic pencil drawings: one, a general view of the Observatory and the surrounding mountains; the other, the dome of the 7-in. heliometer.

## University and Educational Intelligence

CAMBRIDGE.—Dr. M. Born has been appointed University lecturer in the Faculty of Mathematics.

The Frank Smart studentship in botany will be vacant on October 1. Any graduate of the University is eligible for the studentship provided that not more than fourteen terms have elapsed after his first term of residence. The successful candidate must devote himself to research in botany under the direction of the professor of botany. The value of the studentship is £200 per annum and names of candidates must be submitted to Prof. A. C. Seward at the Botany School on or before October 2.

LONDON.—Prof. H. W. Florey, Joseph Hunter professor of pathology in the University of Sheffield, whose appointment to the Sir William Dunn chair of pathology tenable at Guy's Hospital Medical School was announced by the University of London on July 27, is unable to accept the appointment.

The following degrees have recently been awarded: D.Sc. in zoology to Benjamin Dawes (recognised teacher at King's College) for six works on the development of the vertebral column in mammals and on the food requirements in the plaice; D.Sc. (Engineering) to Robert O. Boswall (King's College) for seven works on lubrication; D.Sc. (Engineering) to Edward Hughes (private study) for published work on (1) heating of electrical machines, (2) testing of magnetic materials, (3) effect of harmonics on power-factor improvement, (4) testing of ceiling fans.

THE fact that the School Certificate has, since its inception some fourteen years ago, assumed a predominating influence over secondary education in Great Britain, has been stressed several times in these columns. As stated in NATURE of February 18, p. 218, all secondary and public schools have come under its influence; instead of following the curriculum, it determines what lines the curriculum shall adopt; and, worst of all, in very many cases, it is a matriculation qualification. In other words, the School Certificate examinations, instead of assessing the educational standing of a pupil at the age of about sixteen years, is too frequently used to decide his qualifications for entrance to a University. In the summer of 1931, nearly 67,000 candidates sat for the School Certificate examination. Considering the small percentage of that number who had any obvious desire at all to carry on their academic studies and read for a University degree, the character of the School Certificate examination for the rank and file seems quite unsuitable. It is clearly not what it should be; that is, a school leaving certificate assessing the qualifications of pupils for the edification of not so much the University authorities as for business, commercial and professional bodies who require the services of such pupils. It is with satisfaction, therefore, that we read in "Education in 1932" being the report of the Board of Education published in June of this year (H.M. Stationery Office, 3*s*. 6*d*. net) that the Secondary Schools Examinations Council agrees with the investigators of the School Certificate Examinations in their recommendation that the School Certificate examination should no longer be accepted by the Universities as an alternative to their own matriculation examinations; and that it should not be permissible for a pupil to take an external matriculation examination unless he is a genuine candidate for admission to a University. This is one step towards establishing the School Certificate and the matriculation as two separate examinations, each with its necessary but distinctly different function to perform.

THE recently issued annual report of University College, London, includes an account of a notable expansion rendered possible by the acquisition of a large area to the south of its present site. This fulfilment of a long-cherished aspiration of the College authorities was achieved in co-operation with the Carnegie United Kingdom Trustees, by whom a part of the area is to be used for the purposes of the National Central Library and the Library Association. A prominent feature of this expansion is the rehousing of the Department of Zoology, now to be reorganised, with adequate equipment as a Department of Zoology and Comparative Anatomy on a scale of national importance. Student enrolments of the session 1931–32 show a decrease in the number of evening students due to the London County Council's discontinuance of awards of free places in the evening schools of geography, history and phonetics in favour of a new system of grants to individual students. The number of vacation students also decreased owing to phonetics and librarianship vacation courses not being held. The number of other students, 2,705, is almost the same as in the preceding year, 2,709. Postgraduate and research students numbered 465, an increase of 17. A table giving the geographical distribution of students shows that 57 per cent were from homes within thirty miles from the College, 24 per cent from elsewhere in the British Isles, 10 per cent from the rest of the Empire and 9 per cent from other parts of the world. Those from India numbered 151, from Germany 40, from the United States 39, from Australia and New Zealand 34, from South Africa 23, from Scandinavia 23, from France 21 and from Switzerland 21. Appended to the report are reprints of speeches at the summer assembly and a list of 637 original publications from the various departments of the College.

## Calendar of Nature Topics

### August 20—Blackgame Shooting Begins

The 'heath-fowl' or black grouse (*Lyrurus tetrix*) in Great Britain has been granted annually eight days longer respite from the guns than its relative the 'muir-fowl' or red grouse (*Lagopus scoticus*), since the Game Act of 1773 ; although the early statutes made no discrimination between them. In both cases the open season ends on December 10. Even with this additional protection, the fortunes of black game have not kept pace with those of grouse, for whereas the latter flourishes, the former seems to be subject to a steady decline. In many places numbers have been gradually falling off ; in some places which they once frequented black game have disappeared.

The years of greatest abundance lay between the 'sixties and 'seventies of last century, and another good period began about 1909, but since then the falling off has been all but general in Scotland and England, as well as in several other European countries. The cause of the decrease is likely therefore to be a widespread, and not a local, phenomenon. It has been attributed to a series of bad seasons which interfered with the hatching and rearing of the young, and by reducing the resistance of the old birds laid them open to disease. But changes in the face of the country may also have played a part : drainage has banished locally some of the food-plants favoured by black game, and lack of young plantations may have reduced the number of suitable nesting places ; though this should now have been remedied by the extensive planting carried out by the Forestry Commissioners, who, however, are themselves said to be responsible for a certain reduction in numbers of a bird which notoriously destroys the leading shoots of young pines.

### Increasing Birds

The open season in August, at a time when the bird population of the countryside is more evident through the breaking up of the nesting habits, recalls the increasing number of species that are gradually extending their range as nesters in the British Isles. In *British Birds* of August, 1932, T. H. Harrison and P. A. D. Hollom described by census the increase that is still going on of the great crested grebe (*Colymbus cristatus*) throughout Europe from Norway southwards to France. The increase of the black-necked grebe (*P. nigricollis*) seems also one of recent years. It was first recorded as breeding in Wales in 1904 (*Zoologist*, p. 417 ; 1904) ; in Ireland in 1915 (*British Birds*, 9, 125), in the Forth area of Scotland in 1929 (*Scottish Naturalist*, p. 105 ; 1930). In 1918 and 1919 the species nested at Tring (*Trans. Herts. Nat. Hist. Soc.*) and afterwards C. V. Stoney and G. R. Humphreys found a colony of some 250 pairs in western Ireland and another breeding colony was found in Yorkshire. The tufted duck (*Nyroca fuligula*) and the pochard (*Nyroca v. ferina ferina*) now nest commonly on inland meres and the gadwall and pintail (*Anas strepera* and *Dafila acuta*) nest in many new localities in Norfolk. Shelducks (*Tadorna*) and woodcock (*Scolopax rusticola*) seem also more numerous nesters, and Eric Hardy found both species nesting on the very edge of Liverpool this year, while the woodcock now nests near Cambridge (*Report Cambridge Bird Club*, 1932). Yet nesting woodcock seemed once very numerous as nesters, for Ogilvie recorded "in 1871 in Eastern Sussex alone over 150 nests were found". The causes of these fluctuations are not altogether understood, but one certainly is the influence of the Wild Birds Protection Acts.

### Departure of Summer Visitors

Towards the end of July there begins an erratic movement of a few species of birds which arrived in Great Britain for the nesting season, but by the latter half of August the migration has begun in force, with a general southward trend which carries many species beyond the limits of Great Britain. As a rule the first emigrants are insect-eating species, especially of the group of waders, followed last of all by the fruit and seed-eaters. Curiously enough the order of flight is the reverse of that adopted during the spring immigration, for now the young birds generally leave first and are followed some time later by the older birds. A notable exception is the cuckoo, of which the parent birds set out alone, beginning about August 16, leaving the young for a month longer in the care of the foster-parents. Among the earliest emigrants is the swift, the last dates upon which the species has been seen varying between July 31 and August 27 according to Gilbert White, August 5 according to Markwick, July 29–August 23 according to Blomefield, whose average for eight years was August 8, and August 18 according to a twelve years' average of the records of the Phenological Committee of the Royal Meteorological Society.

### Daylight and Migration

The general association between the length of the day and the migration of birds is so patent that many attempts have been made to explain it. Some have gone so far as to suggest that certain of the light rays act directly upon the birds, so that, as the Swedish scald Runeberg put it, they bear the motto *Lux mea dux*. But as a rule the opinion has been that the influence of light upon migration is indirect. In 1907 Sir Edward Sharpey-Schafer suggested in NATURE of December 19, p. 159, that the shortening of the day, by reducing the time available for feeding (even when food was fairly plentiful), necessitated the movement of birds to regions where at one or another time of year there will be sufficient daylight to procure it, although he admitted that light was only one of the factors in determining food-sufficiency. The experiments of Prof. Rowan suggest that the daylight stimulus works in a different direction ; that daylight has a close relationship with the activity of a bird, that activity speeds up the rhythmic cycle of the gonads, and that this in its turn activates the stimulus which releases the migration instinct.

But the connexion between migratory flight and light seems to be more direct than this notion suggests, for Dr. Rudolf Drost has shown that on Heligoland not only are the times of passage of the dunlin and the knot significantly associated throughout the year with the time of sunset, but also that the times of departure of blackbirds in the spring are related to the hour of sunset and apparently also to the periods of waxing moonlight (Proc. Seventh Intern. Ornith. Congress, Amsterdam, 1931, p. 340). Apparently light may, directly or indirectly, call more than one response from the migratory bird.

## Societies and Academies

### PARIS

Academy of Sciences, July 3 (*C.R.*, 197, 1–100). GABRIEL BERTRAND and MME. S. DELAUNEY-AUVRAY: The favourable action of lead in reductions with sodium amalgam. Contrary to the usually accepted view, the introduction of small proportions of lead (1–2 per thousand) is not prejudicial to the hydrogenating action of the amalgam, but, on the contrary, may make the reduction more rapid and more complete. EMILE MARCHAL was elected *Correspondant* for the Section of Rural Economy in succession to the late B. Bang, and EDOUARD CHATTON *Correspondant* for the Section of Anatomy and Zoology. C. POPOVICI: The integration of systems of functional equations. C. E. WINN: The number of zeros of a class of analytical functions in a sector. R. SALEM: Correction of a printer's error in a note by R. Salem (*C.R.*, 196, 1951). JULIUS WOLFF: The integral of Stieltjes representing a holomorph function with real positive part. C. KURATOWSKI: The topological theorems of the theory of functions of real variables. F. LEJA: A constant related to each closed plane ensemble and its application. PAUL BOISSEAU: A new method of resolving equations. W. MARGOULIS: An aerodynamic blower for trials of models at high speeds. EMILE SEVIN: The spontaneous absorption of radiations and the deviation of the spectral lines of nebulæ. JACQUES MÉTADIER: The theory of Brownian movement and the method of operators. H. PARODI: An application of the Doppler-Fizeau principle to electric machines. S. PIÑA DE RUBIES: The arc spectrum of neodymium in air at normal pressure between the wavelengths 2400 and 3100 A. AUREL JONESCU: The absorption spectrum of sulphur dioxide in the ultraviolet. I. I. AGARBICEANU: The spectral width of the absorption lines of $I_2$. PIERRE VIÈLES: The polarimetric study of active dilactylamide. G. ATHANASIU: The photoelectric effect of crystals of argentite, proustite and pyrargyrite. T. MOUNAJED: The conductivity of hydrochloric acid in anhydrous ether. In anhydrous solution, the equivalent conductivity of the solution with increasing concentration of the acid at first decreased, giving a minimum at normal concentration. On long standing the conductivity increased, due probably to the formation of water and ethyl chloride. PAUL SOLEILLET: The influence of the magnetic field on the fluorescence of a jet of cadmium atoms. The Lande factor $g$ relating to the state $2^3P_1$. G. MANO: The slowing down of the α-rays in hydrogen. Comparing the experimental results with those based on the theory of wave mechanics, a close agreement is shown. E. RINCK: Solidification diagrams of alloys formed with two alkali metals. The sodium-potassium alloys. The diagrams show the existence of an unstable compound $Na_2K_0$ and a eutectic with 66 per cent potassium atoms. F. BOURION and E. ROUYER: The cryoscopic determination of the total hydration of the ions of ammonium chloride. H. FORESTIER and MLLE. M. HAURY: The influence of the magnetic field on the corrosion of iron by the salts of the noble metals. J. P. MATHIEU: The compounds of tartaric acid and nickel. R. RAT: The decomposition of the arsenites by heat. PIERRE BOUDNIKOFF: Contribution to the study of the reduction of sodium sulphate to sulphur. The conditions of reduction with carbon, carbon monoxide and hydrogen have been studied. A. BOUCHONNET, M. TROMBE and G. PETITPAS: The nitration of celluloses to the maximum. The conditions necessary for the preparation of a stable trinitrocellulose (14·14 per cent nitrogen) are given. A. BARBOT: The products named polyundecylenic acids. J. PRAT: The chlorhydrates and perchlorates of *p*-aminophenylarsinic acid. LESPIEAU and WIEMANN: The synthesis of the primary dimethyline of a linear pentite. P. DELAUNEY: The properties of the β 5-chloro, 5-bromo, and 5-iodosalicyl-d-glucosides. PAUL GAUBERT: The hemihydrate of calcium sulphate and its products of dehydration. JACQUES DE LAPPARENT: Greek emeries and bauxites. ANTONIN LANQUINE: The direction of the Lias-Jurassic ensemble and its Triassic substratum in the neighbourhood of Méounes and Garéoult (Var). L. TUWIM: Measurements of the cosmic radiation with the aid of a new kind of tube counter. LEFÈVRE: The structure of the theca in the Peridinites. ROBERT LAMI: Marine algæ of the southern region of the coasts of Portugal. R. GAUTHERET: Cultures of meristems of roots of *Zea Mays*. MLLE. H. F. M. PETTER: The nucleal reaction of Feulgen in some lower plants. M. CHADEFAUD: Vital colorations in the algæ. A. GRUVEL: The abundance of *Branchiostoma lanceolatum* in the Suez Canal. PIERRE DRACH: The growth of the abdomen in the Brachyoura. The case of *Portunus puber*. BORIS EPHRUSSI: The lethal factor in short tailed mice. A. MEUNIER: The presence of maltose in the fresh tubercles of *Lathyrus tuberosus*.

### GENEVA

Society of Physics and Natural History, May 18. W. SCHOPFER: Biometric observations on the inflorescence of *Primula veris*. The study of *Primula veris* from the point of view of the biometry of the umbels shows that the curve is trinodal: apexes on 3, 5, 8 to 10 very different stations furnish analogous curves, whatever may be the stage of the development during which the countings are made. W. SCHOPFER: The study of a case of unilateral stimulation and of a case of inhibition in a micro-organism. A poor culture of *Phycomyces* giving only a weak development is strongly accelerated by an injection (*Penicillium*); this fungus liberates a substance accelerating the development which takes the place of a known accessory factor of growth. *Phycomyces* produces a substance inhibiting the germination of the spores. E. CHERBULIEZ and IDA TRUSFUS: A new method for the determination of the amino acids and peptones of blood serum. Triacetohydrindene hydrate gives a blue coloration with all the amino acids and polypeptides which, under defined conditions, is proportional to the molecular concentration of these substances. Starting with 1 c.c. or even 0·5 c.c. of the blood serum, in which the proteins and albumoses are precipitated by ammonium sulphate, a solution is obtained in which the molecular concentration of the amino acids and polypeptides remaining in solution may be determined rapidly and easily by means of this colour reaction. E. CHERBULIEZ: The variation of the composition of casein and its importance in cheese manufacture. Casein from the cow is a mixture of at least four constituents, the proportions of which are not constant. The coagulating action of the rennet is due to a constituent named α II. A casein poor in α II will give a milk reacting badly with rennet even if all the other conditions are favourable to the coagulation with rennet. In

milk from a given cow, with milk coagulating badly, it has been found that the casein is poor in this constituent compared with the casein from a normal milk. Hence the variability of the composition of the casein is an important biological factor, especially for cheese-making, and a factor which had hitherto not been considered.

June 1. F. CHODAT: Genetics of the strawberry. The heredity of sex. The author proves that the segregation of sex in the second generation of hybrids realised between the horticultural variety Moutôt (*Fragaria grandiflora*) with perfect flower and the Dufour variety with imperfect flower, is in agreement with the theory which brings in the idea of realising genes. Crossing these hybrids with *F. virginiana* furnishes, in agreement with the theory, a first generation of plants showing normal androecium and gynœcium in which the number of carpels is reduced to about half. E. FRIEDHEIM: A system of biological reversible oxido-reduction. The pigment of *Arion Rufus*. The author indicates a method for the extraction of the pigment of the red slug, *Arion Rufus*. Electrometric titration shows that the pigment forms with its leuco derivative a reversible oxido-reduction system with approximately the same standard potential as pyocyanin and hallachrome, other reversible natural pigments. P. WENGER, C. CIMERMAN and M. GORNI: Study of the precipitation of iron as the basic acetate. The authors have determined the optimum *p*H for the precipitation of iron as the basic acetate. This *p*H is 4·2 and may be reached at once by adding a determined quantity of sodium acetate or a 10 per cent solution, when the solution is slightly acid.

## ROME

Royal National Academy of the Lincei, March 5. G. ARMELLINI and G. ANDRISSI: Solar radiation in 1929 and 1930. The results of daily observations with a pyroheliometer are given. G. ABETTI: Height of the chromosphere in 1932, and the course of the solar cycle. At Arcetri, observations on 95 days during 1932 gave the mean height of the chromosphere as 10·22″, which represents an increase of 0·38″ over 1931. At Madrid, 22 observations gave the mean 9·85″ which, possibly owing to the small number of measurements, is 0·29″ less than the value for 1931. The height was greatest at the poles and least at the equator, the commencement of a new cycle being probable. L. PALAZZO: Corrections of values previously given for the secular variation of the magnetic component *H* at Piedmont. The mean variation of *H* during the period 1887–1929 should be + 282y and not + 290y as given earlier. L. LOMBARDI: Adoption of the absolute system of electrical units. E. FERMI and B. ROSSI: Action of the earth's magnetic field on penetrating radiation. The effect of the earth's magnetic field at various latitudes and at various heights is discussed, on the hypothesis that penetrating radiation is due primarily to the effect of electric corpuscles (electrons or protons) arriving from cosmic space and distributed from celestial bodies isotropically and uniformly. P. VINASSA DE REGNY: Age of the marble-like limestones of Monte Pisano. G. BARBA: Differential systems having algebraic integrals. S. CHERUBINO: Certain properties of pseudo-ordinary transformations. T. BOGGIO: Riemann's homograph relative to a curved space. A new, simplified method for introducing Riemann's homograph brings out, almost without calculation, its fundamental properties. RUY LOUIS GOMES: Further notes on linear operators. S. GOLAB: A property of harmonic functions in Riemannian spaces. M. GHERMANESCO: Equations to finite differences. G. RACAH: Determination of the number of independent isotropic tensors of range *n*. A. FERRARI and C. COLLA: Chemical and crystallographic investigations on ammonium, potassium, rubidium, cæsium, and thallium cobaltinitrites. These cobaltinitrites form anhydrous monometric crystals of the formula $R_3[Co(NO_2)_6]$; the unit cell which contains four molecules, has the side $a = 10{\cdot}81$, 10·44, 10·73, 11·15 and 10·72 A. respectively, the corresponding densities being 2·00, 2·64, 3·18, 3·51 and 5·10. G. SCAGLIARINI and F. GENTILE: Decomposition products of potassium sulphonitroprusside. In aqueous solution, this compound gradually decomposes, yielding potassium nitrite and ferrocyanide, sulphur, ferrous and ferric oxides, and gases consisting mainly of nitrogen and nitric oxide. A mechanism is suggested to explain the formation of these products. NICOLA ALBERTO BARBIERI: Insecticidal action of tabacol. Treatment of tabacine, the toxic alkaloid of tobacco, with dilute alkali yields liquid tabacinic acid, a reducing sugar, and a basic principle, tabacol. Either as vapour or as 1–2 per cent solution, tabacol rapidly kills insects without damaging the plants or other material with which it comes into contact. ROMILDE FARAGGIANA: First investigations on the histogenesis of the islets of Langerhans in the pancreas of Amphibia.

## VIENNA

Academy of Sciences, May 4. FRANZ PATAT: Photochemical decomposition of methyl and ethyl alcohols. Unlike most polyatomic molecules, methyl and ethyl alcohols show continuous absorption with no trace of fine structure. Consequently these alcohols should undergo photo-decomposition into OH and $CH_3$ (or $C_2H_5$). Actually, however, for the region $\lambda = 2000$ A. to about 1850 A., the gaseous products not liquefiable by liquid air comprise, in the case of methyl alcohol, about 80 per cent of hydrogen and 20 per cent of carbon monoxide. Decomposition of this alcohol into hydrogen and formaldehyde is thus indicated. ANTON KAILAN and NAFTALY HERZ FRIEDMANN: Velocities of esterification of alcohols in formic acid (2). LEOPOLD SCHMID and LUDWIG HASCHEK: Colouring matter of the yellow dahlia. This dahlia contains, besides apigenin, a second colouring matter, dahlia II, of the same empirical formula, $C_{15}H_{10}O_5$. In presence of pyridine, acetic anhydride converts this into acetylapigenin. FRITZ ASINGER and GUNTHER LOCK: (i) Influence of substituents on the velocity of hydrolysis of benzylidene chloride. All the chloro- and nitro-derivatives of benzylidene chloride examined are hydrolysed more slowly, and the methyl derivatives more rapidly, than benzylidene chloride itself. The position of the substituents appears to have less influence in this direction than their number and nature. (ii) 3 : 5–Dichlorobenzaldehyde. This compound, previously unknown, may be prepared from 3 : 5–dichlorotoluene, by way of the benzylidene chloride. WALTER SLONEK: Excitation of neutron emission from beryllium and boron by α-rays. Excitation curves of the neutron emission, determined by means of a Geiger counter, are described. For beryllium, there are probably eight discrete excitation energies for the region of the polonium α-rays. With boron

the excitation appears to progress steadily. JOSEF SCHINTLMEISTER: Disintegration of atoms with emission of neutrons. Investigations of lead, magnesium, copper and nickel for neutron emission on irradiation with polonium α-particles by the tube electrometer give results which, in general, confirm the observations of Kirsch and Trattner by the Wilson method. Magnesium has the greatest effect, and copper and lead considerably less. Nickel showed a very low value, possibly owing to the use of palladium as substratum. FRANZ MEINRAD KUEN: Oxidation of organic compounds at the surface of fuller's earth. Of a number of adsorption media investigated by Warburg's apparatus, fuller's earth showed the greatest efficiency in the transference of oxygen to organic compounds. Digestion of this earth with hydrochloric acid reduces the iron-content (5·08 per cent) by only 0·33 per cent, and the treated earth, although still strongly adsorbent, is unable to effect the transference of oxygen. Thus, the bulk of the iron is catalytically inactive. FRANZ WERNER: Results of a zoological expedition to the islands of the Ægean Sea. (1) Reptiles and amphibia. LORENZ MÜLLER and OTTO WETTSTEIN: Amphibia and reptiles of Lebanon. A remarkable race of salamander, sub-sp. *orientalis*, Wolt. is described and detailed descriptions are given also of *Lacerta major Wolterstorffi*, Mert., *L. fraasi*, Lehrs., *L. laevis*, Gray, *L. danfordi kulzeri*, L. Müller, and *Vipera bornmuelleri*, Wern. ODOMAR GUGENBERGER: The Cardita strata of Launsdorf (Carinthia). Gastropods, scaphiopods, conularids, and cephalopods. HUGO BONDY and KARL POPPER: A mass spectrometer with direction- and velocity-focusing. By combination of a radial electric with a homogeneous, transverse, magnetic field, this instrument, based on a theory of Bartky and Dempster (1929), allows of the focusing of direction and velocity at the same position.

May 11. MAX TOPERCZER: Radiation measurements at Innsbruck. EKKEHARD SCHMID: Investigations on evaporation meters.

## Official Publications Received

### GREAT BRITAIN AND IRELAND

Journal of the Royal Microscopical Society. Series 3, Vol. 53, Part 2, June. Pp. xvi+109–201. (London: Royal Microscopical Society.) 10*s.* net.

Experimental and Research Station, Nursery and Market Garden Industries' Development Society, Ltd., Turner's Hill, Cheshunt, Herts. Eighteenth Annual Report, 1932. Pp. 72. (Cheshunt.)

The Hannah Dairy Research Institute. Annual Report for the Year ending 31st March 1933. Pp. 20. (Kirkill.)

Report of the Progress of the Ordnance Survey for the Financial Year, 1st April 1932 to 31st March 1933. Pp. 14+11 plates. (London: H.M. Stationery Office.) 3*s.* 6*d.* net.

Proceedings of the Cambridge Philosophical Society. Vol. 29, Part 3. Pp. 319–439+1 plate. (Cambridge: At the University Press.) 7*s.* 6*d.* net.

Memorandum on British Trade Mark Law. By the Joint Trade Marks Committee. Pp. ii+17. (London: Association of British Chemical Manufacturers.) 1*s.*

Transactions of the Royal Society of Edinburgh. Vol. 57, Part 3, No. 26: Notes on the Kidston Collection of Fossil Plant Slides, No. 2: The Anatomy of the Axis of *Bothrodendron mundum* Williamson Sp. By Mary G. Calder. Pp. 665–673+1 plate. (Edinburgh: Robert Grant and Son; London: Williams and Norgate, Ltd.) 1*s.* 6*d.*

Committee on Bird Sanctuaries in Royal Parks (England). Report for 1932. Pp. 21. (London: H.M. Stationery Office.) 6*d.* net.

Technical College, Bradford. Diploma and Special Day Courses, Session 1933–1934. Pp. 245+19 plates. (Bradford.)

Air Ministry: Aeronautical Research Committee: Reports and Memoranda. No. 1507 (Strut. 98): Distortions of Stripped Aeroplane Wings under Torsional Loading. By D. Williams. Pp. 23+1 plate. 1*s.* 3*d.* net. No. 1530 (T.3335): Possible Increase in Level Speed of High Speed Aircraft caused by a Diving Start. By H. M. Garner and R. K. Cushing. Pp. 4+6 plates. 4*d.* net. No. 1531 (T.3305): Vortex System behind a Sphere moving through Viscous Fluid. By Dr. H. F. Winny. Pp. 14+10 plates. 1*s.* net. (London: H.M. Stationery Office.)

Institute for Research in Agricultural Engineering: University of Oxford. The Use of Electric Heating Cables for Hot-Beds. By C. A. Cameron Brown. Pp. 47. (Oxford.) 1*s.*

The Journal of the Chemical Society. July. Pp. iii+741–920. (London: Chemical Society.)

Experimental Researches and Reports published by the Department of Glass Technology, The University, Sheffield. Vol. 15, 1932. Pp. iii+240+2 plates. (Sheffield.) 7*s.* 6*d.*

University of Bristol. The Annual Report of the Agricultural and Horticultural Research Station (The National Fruit and Cider Institute), Long Ashton, Bristol, 1932. Pp. 260+10 plates. (Bristol.)

### OTHER COUNTRIES

The Memoirs of the Imperial Marine Observatory, Kobe, Japan. Vol. 5, No. 3, May. Pp. 105–266. (Kobe.)

The Science Reports of the Tôhoku Imperial University, Sendai, Japan. First Series (Mathematics, Physics, Chemistry), Vol. 22, No. 2, May. Pp. 201–392. (Tokyo and Sendai: Maruzen Co., Ltd.)

Studies in Tropical Land Tenure. By Dr. H. Martin Leake. Pp. 56. (Trinidad, B.W.I.: Imperial College of Tropical Agriculture.) 2*s.*

University of Adelaide. Official Opening of the Johnson Chemical Laboratories, June 12, by the Hon. Mr. Justice Angas Parsons. Pp. 22. (Adelaide.)

The Mathematics Student. Edited by A. Narasinga Rao. Vol. 1, No. 1, March. Pp. 40. (Madras: Indian Mathematical Society.) 1.8 rupees.

The Peninsula of Yucatan: Medical, Biological, Meteorological and Sociological Studies. By Prof. George Cheever Shattuck. (Publication No. 431.) Pp. xvii+576+68 plates. (Washington, D.C.: Carnegie Institution.)

Punjab Irrigation Research Institute. Research Publication, Vol. 2, No. 2: Studies on Sub-Soil Hydraulics; Investigation of Observational Methods for Models. By Harbans Lal Uppal and J. P. Gunn. Pp. 24+11 plates. (Lahore: Government Printing Office.) 1.2 rupees; 1*s.* 9*d.*

The Egyptian University: Faculty of Science. Report for the Session 1931–32. Pp. ii+43. (Cairo.)

Proceedings of the American Philosophical Society. Vol. 72, No. 2. Pp. 57–100. (Philadelphia.)

Records of the Survey of India. Vol. 23: Report on Sind Rectangulation, 1926–1930. By Lieut.-Col. A. H. Gwyn. Pp. v+50. (Dehra Dun.) 1.8 rupees; 2*s.* 6*d.*

Survey of India. Geodetic Report, Vol. 8, from 1st October 1931 to 30th September 1932. Pp. xvii+118. (Dehra Dun.) 3 rupees; 5*s.* 3*d.*

U.S. Department of the Interior: Geological Survey. Professional Paper 175-A: Miocene Foraminifera of the Coastal Plain of the Eastern United States. By Joseph Augustine Cushman and Edgar D. Cahill. (Shorter Contributions to General Geology, 1932–33.) Pp. 50+13 plates. (Washington, D.C.: Government Printing Office.) 15 cents.

U.S. Department of Agriculture. Technical Bulletin No. 363: The Parasites of the Sugarcane Borer in Argentina and Peru, and their Introduction into the United States. By H. A. Jaynes. Pp. 27. (Washington, D.C.: Government Printing Office.) 5 cents.

The University of Colorado Studies. Vol. 20, No. 4, June. Pp. 267–315. (Boulder, Colo.)

Records of Oceanographic Works in Japan. Compiled by the Committee on Pacific Oceanography. Vol. 5, No. 2, June. Pp. iii+99–254. (Tokyo: National Research Council of Japan.)

Proceedings of the Academy of Natural Sciences of Philadelphia, Vol. 85. Dermaptera and Orthoptera of the De Schauensee South African Expedition, Part 1. By James A. G. Rehn. Pp. 39–66+1 plate. Zoological Results of the Matto Grasso Expedition to Brazil in 1931. 2: Mollusca. By Henry A. Pilsbry. Pp. 67–76+plate 2. A Revision of Synthyris and Besseya. By Francis W. Pennell. Pp. 77–106. Notes on the Miocene of Southern New Jersey. By Henry A. Pilsbry and Anne Harbison. Pp. 107–120+plates 3–5. Santo Domingan Land Mollusks collected by Daniel C. Pease, 1932, and by A. A. Olsson, 1916. By Henry A. Pilsbry. Pp. 121 162+plates 6–11. (Philadelphia.)

Survey of India. Map Publication and Office Work, from 1st April 1931 to 31st March 1932. Pp. vii+22+5 plates. (Calcutta: Survey of India.) 1 rupee; 1*s.* 9*d.*

Jahresbericht der Hamburger Sternwarte in Bergedorf für das Jahr 1932. Pp. 27+1 plate. (Bergedorf.)

Commonwealth of Australia: Council for Scientific and Industrial Research. Pamphlet No. 38: The Occurrence of *Anaplasma marginale* Theiler 1910 in Northern Queensland. By Dr. J. Legg. Pp. 31. Pamphlet No. 39: The Grasslands of Australia and some of their Problems; a Report upon the Dairy Pastures. By William Davies. Pp. 36. (Melbourne: Government Printer.)

The Half-Yearly Journal of the Mysore University. Vol. 6, No. 1, January 1932. Pp. 121. (Bangalore: Bangalore Press.) 2 rupees.

Boletín del Instituto Internactional Americano de Protección a la Infancia. Tome 7, No. 1, Julio. Pp. 134+26 plates. (Montevideo.)

Sveriges Geologiska Undersökning. Ser. Aa, No. 171: Beskrivning till kartbladet Kappelshamn. Av Henr. Munthe, J. Ernhold Hede och G. Lundquist. Pp. 129+1 plate. 4.00 kr. Ser. Aa, No. 175: Beskrivning till kartbladet nya Kopparberget. Av N. H. Magnusson och G. Lundquist. Pp. 91+1 plate. 4.00 kr. (Stockholm: P. A. Norstedt and Söner.)

Memoirs of the Faculty of Science and Agriculture, Taihoku Imperial University. Vol. 5, No. 8, June. Mathematics, No. 5: Über Fläche und Kurven, III.; Beiträge zur Geometrie der Kreise und Kugeln, V.; Beiträge zur Geometrie der Kreise und Kugeln, VI. Von Sôji Matsumura. Pp. 287–367. (Taihoku.)

Pubblicazioni del R. Osservatorio Astronomico di Torino (Pino Torinese). No. 12: Osservazioni e studio della variazione di luce di "R. Scuti" (1912–1932.) Per Giovanni Battista Lacchini. Pp. 22. No. 16. Y Delphini nota intorno alla variazione luminosa. Per Giovanni Battista Lacchini. Pp. 15. (Pino Torinese.)

Conseil Permanent International pour l'Exploration de la Mer. No. 13: Faune ichthyologique de l'Atlantique nord. Publiée sous la direction de Prof. Joubin. 24 plates. (Copenhague: Andr. Fred. Høst et fils.) 4.00 kr.