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## Inland Water Survey

ELSEWHERE in the present issue of NATURE Prof. W. S. Boulton gives an account of the discussion at the recent British Association meeting at Aberdeen on the subject of underground water supply. The investigation of underground water resources is intimately connected with, and indeed, as Prof. Boulton specifically points out, forms an essential part of, a complete inland water survey, which was the subject of a second report presented at the same meeting by a Research Committee of the Association appointed two years ago to consider the matter. It is, we think, opportune to make some observations on the present position of a movement which has been growing in importance and intensity for a number of years past, and on which we have commented from time to time.

Fully three months have elapsed since on July 17, the Minister of Health, on behalf of the Prime Minister, then absent abroad, received a deputation from the British Association and the Institution of Civil Engineers, which laid before him the considered recommendation of both bodies that an inland water survey, conducted on unbiased lines and in a thoroughly scientific manner, was urgently necessary in the national interest, as a means of ascertaining definitely and unmistakably the actual water resources available, and further, as an essential preliminary to any consideration of the allocation of supplies throughout the country on a sound and judicious basis. Sir Hilton Young listened to the deputation and promised that their representations should receive the most careful consideration of the Government.

While admitting that due consideration involves time and that the holiday season has intervened, yet it is with a sense of disappointment that we have to add that so far no action has been taken. The prolonged delay is the more remarkable in view of the fact that there have been several opportunities of making some appropriate public allusion to the subject and these opportunities seem to have been studiously ignored. On October 9 Sir Hilton Young addressed a conference of water authorities at the Council House, Birmingham, summoned to consider the formation of a Regional Advisory Water Committee for the counties of Staffordshire, Warwickshire and Worcestershire. While he expatiated on the lessons of the drought and said that "it was of the highest importance that all authorities should survey the position in

the light of their new experience and prepare to meet needs over a long period of years", he added nothing about the preliminary and more pressing duty of inaugurating a technical survey to determine in an accurate and reliable way the resources which water supply authorities would have at their disposal. To be fair, we must admit that he did say that "the line of advance was to improve control of supplies by improving knowledge of them", but without any explanation or enlargement, this expression remains cryptic and indefinite. Sir Hilton had a further opportunity of making a clear pronouncement on the subject on October 18, when he addressed at Manchester a conference of about a hundred and fifty representatives of water authorities in Cheshire, Lancashire and Derbyshire, but again no indication was given of the Government's intentions.

There is reason to fear, as pointed out in a leading article in NATURE of August 4, that the question is being complicated by interdepartmental jealousies. The Government, in the face of the strong and cogent reasons advanced by the British Association and the Institution of Civil Engineers, is apparently prepared to concede the necessity for a survey and to consider the best means of carrying it into effect, but, on the other hand, there are indications that difficulty is being found in deciding which of two important departments should be entrusted with charge of the work. The Ministry of Health, for reasons which, if correctly conjectured, do not carry great weight or redound very much to the credit of the civil service, would appear to be reluctant to admit priority for the claims of the Department of Scientific and Industrial Research, which, in the view of all who are acquainted with the technicalities of a survey, is the most appropriate and indeed the only competent official body at present in existence to supervise operations of this kind. It would serve to relieve the situation in some degree if the Ministry of Health could be brought to realise that the kind of survey contemplated by the British Association and the Institution of Civil Engineers is strictly a technical procedure which need, and in fact would, in no way encroach on the province of the Ministry in regard to matters affecting the supervision of public water undertakings.

Other matters, unfortunately, have arisen to cause cross-currents of thought and differences of opinion. The allocation and method of distribution of water supplies to the best advantage of the public have lately been the subject of much controversy and argument. Mr. Alan Chorlton, in a recent presidential address to the Institution of Mechanical Engineers, has put forward a suggestion for the creation of a water 'grid', on the lines of the electricity grid which has been adopted in dealing with communal supplies of electricity. Mr. Thos. Levy, the vice-chairman of the House of Commons Committee on Water Supply, has communicated to the Press his proposal for the establishment of a Statutory Central Water Authority, "charged with the responsibility of providing a supply of pure water wherever needed". Mr. Clemesha Smith, water engineer of Wakefield, has advocated the formation of a body of water commissioners, acting in conjunction with a series of regional committees, exercising administrative jurisdiction over the whole country and empowered to raise funds and to deal with all questions of water supply. These and a number of other schemes, however laudable and attractive in many of their aspects, are, we urge, not ripe for consideration at the present juncture. They only serve to confuse the issue and to cause delay. The primary essential is a survey. The cookery book direction about the preparation of jugged hare is apt and to the point: "First catch your hare!" Until a survey has been instituted and in a large measure completed, it cannot be known with any degree of certainty and reliability to what extent supplies are actually available for distribution.

The public is, in fact, inclined to have rather hazy ideas about the availability of water supplies, and the recent restrictions of consumption imposed in consequence of the drought have occasioned some unpleasant surprise and even perplexity. Prof. Boulton, in his article in this number, remarks that during recent months, "letters and special articles have appeared in the public Press, which have given the impression that we have underground in Great Britain an inexhaustible supply of potable water, and that it is only necessary to bore down to a sufficient depth almost anywhere to get all the supplies we need", and he deplores, in connexion with the obscure and debatable practice of water divining, "the great waste of private and public money" to which it has given rise and which still continues. This haziness of perception is, in fact, characteristic of the attitude of the public towards water supply sources as a whole, about which they never trouble to inquire, so long as there is sufficient to meet their demands, some of which, it cannot but be felt, border on wastefulness. It is only

when restrictions come into force and when supplies fail altogether, as they have done recently in various parts of the country, that a correct appreciation of the position is brought home to the national consciousness.

At present, under the system of water appropriation which prevails, the country is very much in the position of a tradesman who is completely ignorant of his balance at the bank and who, when in need of cash for any purpose, dips his hand into the nearest till in his establishment and is content if he finds therein sufficient to meet his immediate requirements. Such a state of affairs is incompatible with a sound business policy. It is essential that the nation should possess an exact inventory of its water, as of its other resources, and that it should realise how far these can be made to cover all present and future demands for supplies, whether for domestic, industrial or other purposes. So far back as 1921, a Board of Trade Committee heard evidence which proved "*beyond all doubt* [the italics are ours] the urgent necessity in the national interest of some control of all water, both underground and surface". Before control can be exercised, it is essential that definite knowledge should be obtained of the resources to be controlled. Hence the primary and fundamental necessity for a complete technical survey. This is so obvious that an apology is almost necessary for reiterating it.

Indeed, we should hesitate to labour the subject as we have done, were we not acutely aware of the difficulties which arise from public misconception on one hand and of official inertia on the other. To some extent the public has come to realise in the course of recent experiences that water, while constituting one of the most important requisites of life, is not to be had merely for the asking. It is not available in unlimited quantity, and supplies may be unduly depleted and even exhausted, if not efficiently conserved and administered. Official prejudice and reluctance to accept external advice, however competent, is a more difficult matter to deal with. Thirteen years have been allowed to pass since the publication of the urgent recommendation of the Board of Trade Committee which we have quoted above. The additional emphasis supplied by the finding of the British Association Committee, with the whole-hearted concurrence of the Institution of Civil Engineers, has been laid before the Government, as also it has received in the early part of the year the Report of the Committee on Scottish Health Services, which affirms, with equal conviction, "that a technical survey of the water resources and supplies of Scotland should be undertaken *at once*" (again the italics are ours). Still there is no indication of an official decision, let alone of the inauguration of effective measures for its realisation. In contrast to the vigorous activity and enterprise which characterise the present age, Government departments continue to move

"With the slow motion of a summer's cloud"[1].

Unfortunately, as experience proves only too surely, such dilatoriness in national affairs is attended by the risk of unpleasant consequences, and we again consider it our duty to urge the necessity for prompt action and, equally emphatically, action on the right lines. We respectfully commend to the notice of the Government the general feeling of expectancy in scientific and engineering circles which finds expression in the following resolution passed jointly by four sections (Mathematical and Physical Sciences, Geography, Engineering and Geology) at the Aberdeen meeting and referred by the General Committee to the Council: "that the British Association await with great interest the result of the careful consideration which the Government promised to give the matter, and trust that it will be favourable to the establishment of an organised survey of the water resources of the country on a scientific basis".

[1] Wordsworth: "Hart-leap Well".

## Sexual Physiology as Applied to Practice

(1) *Recent Advances in Sex and Reproductive Physiology.* By Dr. J. M. Robson. (Recent Advances Series.) Pp. x+249. (London: J. and A. Churchill, 1934.) 12*s.* 6*d.*

(2) *Clinical Contraception.* By Gladys M. Cox. Pp. ix+173+5 plates. (London: William Heinemann (Medical Books), Ltd., 1933.) 7*s.* 6*d.* net.

(1) DR. ROBSON'S book is designed chiefly to meet the needs of those clinicians who seek to obtain such knowledge of recent researches in sexual physiology as will help them in their practice. The author states in the preface that the "volume deals essentially with the sexual and reproductive phenomena in the female in relation to the activity of the sex hormones". It will be seen therefore that the title is misleading; a more appropriate one would have been "Recent Advances in the Endocrinology of the Female Sexual Organs", but even within the scope of the subject as thus limited, it is not always easy to

see by what principle the author has been guided in deciding what to include and what to omit.

Prof. Crew contributes a preface, and one would have expected to find in the book some account of the work on sex change by the Edinburgh group and some mention of the researches of Lipschütz, Pézard, Domm, Zawadowsky and others. In view of the statement quoted above, it was to be anticipated that the physiology of the testis and other male organs would find no place, and this branch of sexual study is almost completely omitted; but, on the other hand, there is some account of the viability of the spermatozoa in the female generative tract. Again, there is no mention of Bissonette's remarkable discovery as to the effects of luminous radiations in inducing œstrus in the ferret though this has an obvious possible practical bearing, but Evans's work on vitamin E as a factor in placental development and fertility is referred to. One would have liked to have found some account of the pregnancy tests other than those based on the detection of hormones in the urine, since such observations cannot fail to be of interest to clinicians besides having a bearing on the secretory activities of the essential sex glands.

Apart, however, from a curious inconsistency in the selection of the subject matter, the book possesses considerable merit. It is written clearly and concisely, and shows a critical capacity which is most marked when the author is dealing with work connected with his own studies. Moreover, he is fair in his criticisms of other investigators and states their views clearly, though he may not be in agreement with them. The final chapter entitled "Clinical Applications" should be definitely useful, and the book will be of interest to the advanced student of physiology as well as to the clinician in general practice. In the references to literature at the ends of the chapters, and again in the index, it is unfortunate that the initials of the authors should not be given, especially in cases of two authors with the same name, since these are not distinguished and the work of different investigators is thereby confused. The illustrations are well chosen, but it is regrettable that some of the photomicrographs are badly reproduced. An index to the figures would have been helpful.

(2) Dr. Cox's work on "Clinical Contraception" was written at the instigation of the National Birth Control Association. Lord Horder supplies a preface stating the purpose of the book. Like Dr. Robson's work, it is written for clinicians, and it is intended to serve "as a guide to the complete application of the principle [of contraception] in general practice".

As medical officer to one of the largest birth control clinics in England, the author has had an exceptionally wide experience in giving instruction in the practical use of contraceptive appliances, and her intimate knowledge of the respective merits of some of the better-known methods of birth control is apparent in her descriptions. But Dr. Cox includes also an account of chemical, hormonic and spermatoxic sterilisation, with which her acquaintance is necessarily mostly second-hand or derived from the literature. Many of these methods are at present of problematical value, but we think that the author has done well to include some descriptions of them since they add to the interest of the subject and point the way to future developments. Contraception by means of intra-uterine appliances is also discussed, and the limitations and dangers attached to these methods are pointed out.

There is a useful chapter at the beginning of the work on the physiology of reproduction in relation to the problem, and this treats of various matters of interest and importance which are still omitted or only imperfectly dealt with in the ordinary textbooks of physiology and gynæcology. In regard to the time of ovulation in women, the author might have quoted the exact records of Dr. W. Shaw. It is scarcely true to say that ovulation is usually temporarily suspended during lactation, since Dr. Dingwall Fordyce has shown that menstruation occurs in 40 per cent of cases during actual suckling, and as the author herself states, the resumption of ovulation after pregnancy often precedes menstruation.

The chapter on the evaluation of contraceptive methods contains some interesting statistical records obtained from 'women's welfare' centres and it is shown that the clinic results, so far from being discouraging, "are surprisingly good, where the methods proved acceptable". The last chapter is on "Contraception and the Public Health Services" and this is followed by appendixes containing lists of clinics, of contraceptives, and of manufacturers and agents. Whether it was wise to include the latter without explanatory comment is doubtful since some of the appliances or substances advertised by the firms mentioned are of very questionable value. There is as yet no perfect method of contraception, and having regard to the extent to which different individuals vary anatomically, physiologically and psychologically, even within the limits of the normal, it is possible that no one mode may ever be devised such as would be suitable for all cases. Yet the study of the subject is steadily advancing with results that cannot fail in course of time to become of great advantage to the community, and the progress that is being made is clearly set forth in Dr. Cox's book.

F. H. A. MARSHALL.

## The World Power Conference

*Transactions of the World Power Conference, Sectional Meeting, Scandinavia, 1933.* Vol. 1. Pp. 763. Vol. 2: *Electrical Energy.* Pp. 702. Vol. 3: *Gas, Solid and Liquid Fuels.* Pp. 336. Vol. 4: *Power and Heat Combinations, Steam Heat Consuming Industries.* Pp. 615. Vol. 5: *Iron and Steel Industry, Electrical Heating, Transmission and Adaptation of Motive Power for Industrial Machinery.* Pp. 692. Vol. 6: *Railways, Urban and Suburban Traffic.* Pp. 781. Vol. 7: *Marine Transport.* Pp. 294. (Stockholm: Svenska Nationalkommitten för Världkraftkonferensen, 1934.)

THE management of an international conference nowadays has become no mean task. But since "practice makes perfect", those responsible for the World Power Conference, the first of which was held in London in 1924 in connexion with the British Empire Exhibition, have built up an organisation which has become a model of its kind and affords a first-rate example of what scientific management really can achieve.

The last sectional meeting of the Conference was held in Scandinavia in 1933, and there have recently appeared the "Transactions" of the meeting in seven volumes of a high standard of quality, printed in Stockholm in three languages, of which English predominates.

It was a happy thought to preface the first of these volumes with a detailed and illustrated account of the organisation: this is of value both as a record of what exactly was done and as a source of information for those who are preparing future international meetings. No detail is left unrecorded—for example, the age of the members, the numbers announcing special interest for different sections, the distribution of the members according to language, are all used to plot graphs. It is of interest that English was the most commonly understood language of the three, English, French and German, used at the Conference.

It is no longer the practice for speakers to read their original papers; these are available in type beforehand with a summary in the other two languages, as also are the general reports, which contain an analysis of the papers presented in the section together with the remarks of the reporter and suggestions for discussion, these last being printed in all three languages. Inaudibility is no longer tolerated at conferences; at large meetings, loud speakers were installed, but at the smaller technical meetings head telephones were used in a novel apparatus involving high frequency electrodynamic radio transmission, which allowed the listener to move freely about the hall. Some of the discussions were recorded phonographically. It is evident that the new methods are going to do much for international fraternising, especially when it is possible to instal them economically at meetings lasting only a few days.

General reports were presented on eleven subjects in the three languages and these are included in the first volume. The other volumes deal each with a section of the Conference; they contain the above general reports as well as the individual communications.

Reference in detail to any of these is impossible, but a few thoughts of a general character on power may be placed on record.

The production of power is a highly competitive process technically—oil, electricity, coal, gas, each in turn is used in new machines with greater economy. There is always progress.

The engineer has still a long way to go in making anything like complete use of the energy in the fuel he uses. Locomotives use but 5 per cent of the total, marine turbines but 10 per cent, large steam turbines less than 20 per cent. Gas engines use about 25 per cent of the energy in the gas supplied, a petrol or kerosene engine uses 17–20 per cent and the Diesel engine as much as 35 per cent. The energy in water can be converted usefully to about 50 per cent into power, though as this is produced at a fixed centre, transmission losses have to be taken into account.

Each of these figures is undoubtedly still capable of improvement; for example, the economy in heat consumption in the turbo-generator has increased within twenty-five years from 3,000 calories to 2,000 calories per horse-power.

Denmark, the first host of the last Conference, is not by any means an engineering industrial country, yet it has played a leading part in two matters, the development of ferro-concrete and of the Diesel engine, both at sea and on land. The pioneer ocean-going Diesel ship was built in Copenhagen in 1912; the twin engines developed 2,000 horse-power. Twenty years later, the White Star liners, *Britannic* and *Georgic*, with Diesel engines of 20,000 horse-power, are looked on as the last word in ships. To-morrow, if not already, the Diesel engine will be invading all branches of power production including the motor-lorry.

The power requirements of the world are continually increasing, and, if anything like the same rate of progress is continued, will soon necessitate the consumption of stupendous quantities of coal and oil, which presumably will become increasingly difficult to win and more costly to produce. At the moment, the only desire in all lands is to increase the consumption of both coal and oil, either to provide employment or to realise capital

assets in the lifetime of the owner. Sometime there must come a halt to this procedure; the capital is exhaustible.

Fortunately, water-power is increasingly available and, subject only to climatic variations, is inexhaustible, so that it is probable that we shall see a change over to its more extensive use, as indeed is already happening in Canada. When this day comes, the power-using industries may also have to migrate from the coalfields to nearer the sources of water power, although it may be expected in the meantime that the efficiency of electric transmission will have been improved so that factories will not necessarily have to move up into the hills. NATURE has frequently directed attention to the development of water-power in Canada, which country is particularly favoured in this respect: if the above forecast is in any way realised, the potentialities of Canada a generation hence will be very great.

It would appear at least desirable to press forward the development of such water-power as is available in Great Britain, and in this connexion a survey of our water resources appears highly desirable.

Any mention of the World Power Conference without a reference to Mr. D. N. Dunlop, its founder and most energetic leader and supporter, is of course impossible. It is understood that next year a sectional conference on chemical engineering is to be held in London. E. F. A.

## Birds of Eastern China

*A Handbook of the Birds of Eastern China* (*Chihli, Shantung, Kiangsu, Anhwei, Kiangsi, Chekiang, Fohkien and Kwangtung Provinces*). By J. D. D. LaTouche. Vol. 2, Part 3: containing *Families Falconidæ* (*part*), *Columbidæ, Pteroclidæ, Phasianidæ, Tetraonidæ, Turnicidæ and Rallidæ*. Pp. 193–288+plates 18–19. Vol. 2, Part 4: containing *Families Jacanidæ, Rostratulidæ, Gruidæ, Otididæ, Glareolidæ, Dromadidæ, Stercorariidæ, Laridæ, Sternidæ, Rhyncopidæ, Charadriidæ and Scolopacidæ* (*part*). Pp. 289–400+plates 20–22. Vol. 2, Part 5: containing *Families Scolopacidæ* (*part*), *Pelecanidæ, Phalacrocoracidæ, Sulidæ, Phaethonidæ, Fregatidæ, Alcidæ, Procellariidæ, Puffinidæ, Diomedeidæ, Plataleidæ, Plegadidæ, Ciconiidæ, Ardeidæ and Anatidæ* (*part*). Pp. 401–496+plates 23–24. (London: Taylor and Francis, 1932–1933.) 7*s*. 6*d*. net each.

MR. LATOUCHE is getting within sight of the end of his great work, an attempt to bring our knowledge on this subject really up to date.

The general format of parts 3, 4 and 5 is, of course, in agreement with previous numbers, a noticeable feature being especially brought out in part 3 when dealing with the Accipitres, the plumage of which varies in a most extraordinary manner, both in regard to sex and to age. The author gives a general description of the plumage of the male, female and nestling, and then refers also to the plumage of individual birds which do not agree with the general description. This will undoubtedly be a great help to students of this very difficult order. We are glad to see that the author keeps the genera *Astur* and *Accipiter* separate, for though these forms may in rare instances inter-grade, it is usually very easy to distinguish between the short sturdy-legged *Astur* and the long, slight-limbed sparrow-hawk.

As regards the treatment of the other families dealt with, we have little comment to make. The classification is satisfactory and up to date, and the field notes interesting and complete; in fact, one of the most noticeable features of Mr. LaTouche's work is that, all through, the reader feels he is learning something about living birds in addition to reading descriptions of dried skins. We notice that the author still retains *Ceriornis* as a generic name for the *Pucras* pheasants, but since Stuart Baker wrote his work on the birds of India, the classification of which the author has followed, it has been shown that Linnæus's name really referred to *Meleagris satyra*, and we can therefore return to the name of *Pucrasia* for these pheasants.

The author's remarks on the old English pheasant *Phasianus colchicus* are most interesting, and much information is given on the extreme geographical variation which occurs in these birds. Especially is this the case in regard to the ringed races, where he shows the great difference in the size and completeness of the neck-ring which occurs in quite small areas. Altogether the author admits ten races of *Phasianus colchicus*, of which he gives four, *torquatus, karpowi, pallasi* and *kiangsuensis*, as occurring within the limits of eastern China.

In dealing with the little Hemipodes, the author still retains *Turnix dussumieri* as specifically distinct from the European form *Turnix sylvatica*, although it is now generally, and we consider correctly, held to be merely a race of the latter. The printing of the work is excellent and misprints or slips are but few in number, but we would direct attention to the fact that on p. 204 the Formosan green pigeon has been given the generic name of *Sphenurus* instead of *Sphenocercus*.

For Part 4, the author has had the advantage of Dr. P. Lowe's most recent works on the classification of the great families of waders and has followed him practically *in extenso*. We note, however, that he still retains Baker's two orders,

Jacanæ and Rostratulæ. This is possibly wise for, as Dr. Lowe himself says, we have still much to learn about this great division, and it may well be that eventually these two most aberrant groups will have to be given the status of orders or sub-orders rather than that of families only.

We notice that in dealing with the gulls and terns, the author retains *Thallasseus zimmermanni* as a full species, in this respect following Peter's "Birds of the World". We should ourselves have considered this bird to be merely a race of *T. bergii*. Characters differentiating *zimmermanni*, "a heavier and thicker bill", do not suffice to constitute a species unless it can be shown that the breeding habits of this and some other supposed form overlap.

The author calls the Eastern grey plover *Squatarola s. hypomelana*, Pall. 1811–27, but this name is ante-dated by *Charadrius hypomelas*, Pall. (*Reise Russ. Reich*, 3, 699 ; 1776). *Ochropus*, the scientific name of the green sandpiper, should be spelt *Ocrophus*. This spelling was repeatedly employed and cannot therefore be looked upon as a misprint or clerical error.

Among some of the most interesting of the author's remarks on various birds, we note especially those in reference to the Little Ringed Plovers and that he records having found the typical form, *Aegialitis d. dubius*, in North China, giving bill measurements to show his identification is correct. The author thinks that the Large Sand Plover, *Cirrepedesmus leschenaultii*, may possibly be found breeding "all the way up the China coast in suitable places". We confess that we should be very much surprised if the author's speculations are ever confirmed. Birds of this genus, so far as we know at present, are birds of bleak areas, breeding at great altitudes or very far north, and Mme. Koslova's record of the breeding of this species is in quite typical country, the northern Gobi Desert.

In part 5 there is but little to comment on. LaTouche still retains *Capella gallinago raddei* as a race of the fantail snipe but agrees with Stuart Baker that it is doubtfully divisible. The proper spelling of the scientific name of the Malay Bittern and its allies is *Gorsakius* (Gray, "Cat. gen. and sub-gen. Birds", p. 114, April 1855) not Gorsachius ("Bonaparte Gonsp. *Av.*", 2, 138, *after* April 1855), while *Cygnus jankowskii* of Alpheraky, 1904, is the same as *Cygnus minor* of Keyserling and Blasius ("Wirbelth. Europas", pp. 132–222, 1840) and must therefore bear the latter name.

As in the former numbers, printing errors are few and the only one we have found of any importance is on p. 300, where *Calidris* has been spelt *Calibris*. We would also record that we do not ourselves agree on the retention of the name *Gygis* (Wagler, 1832), as this is invalidated by *Gyges* of Bery de St. Vincent, 1825. We think the name employed should be *Leucanous* (Mathews, "Birds Austral.", 2, 432 ; 1912).

We congratulate the author on these three parts of "The Birds of Eastern China", in which he has fully kept up the standard of the previous numbers. We are sure that the work, unlike so many others, will interest not only the scientific bird worker, but also the field naturalist and lover of birds, and that to each one of these whose interests lie in China, the work will be absolutely indispensable.

E. C. S. B.

## Short Notices

*Introduction to Physiological Chemistry.* By Prof. M. Bodansky. Third edition, rewritten and reset. Pp. xi+662. (New York : John Wiley and Sons, Inc. ; London : Chapman and Hall, Ltd., 1934.) 25*s.* net.

THIS is the third edition and the tenth printing of this textbook since it was first issued in 1927, so it is evident that it has found wide favour and support. The research activity in the field of biochemistry is described by the author as unprecedented, a qualification with which few will be disposed to quarrel : as a result, much new information has had to be incorporated without unduly enlarging the size of the book. Additional space has been given to such subjects as enzymes, gastric acidity, muscle metabolism, the mineral requirements in nutrition, vitamins and hormones ; the question of the composition of the blood and other body fluids has been treated in greater detail.

It is a very definite achievement to condense so much information into a book of about 600 pages, which is printed in clear type with excellent chemical formulæ and numerous references to the original literature.

It is obviously impossible either to criticise or review such a work in detail ; the examination of particular chapters serves to bring out the speed at which new discoveries are being made and the new theories made to fit into the whole. A case in point is the intermediate metabolism of the carbohydrates, which has proved to be of considerable complexity ; the formation of phosphoric esters, the chain of events pictured by Meyerhof, the new emphasis laid on glycuronic acid and the discovery of ascorbic acid have all needed interpretation. Yet, as showing how much requires to be discovered, it may be cited that we are still ignorant as to the mechanism of the conversion in the body of glucose into galactose, which is the sugar of the brain and the component of lactose synthesised in the mammary glands.

*Essentials of Histology: Descriptive and Practical, for the use of Students.* By Sir E. Sharpey-Schafer. Thirteenth edition, edited by Dr. H. M. Carleton. Pp. x+618. (London, New York and Toronto: Longmans, Green and Co., Ltd., 1934.) 15*s.* net.

FOR a textbook to retain its youthful vivacity after fifty years' wear and tear one expects that magical forces have been at work, and one is not surprised to find that the number of this new edition is the bewitching '13'. This well-known manual of descriptive histology so well conceived by Sir Edward Sharpey-Schafer has served as the chief handbook of medical students for two generations, and there are many instances where both father and son have used it; now there is also the possibility of the grandson using it as well. This is indeed a remarkable achievement for a scientific textbook. With the co-operation of Dr. Carleton we now expect it to run into the next century.

As indicative of its rejuvenescence, we may point to the inclusion of a new section on the development of the cells of the blood. This account is in line with the findings of Miss Sabin and her co-workers. It is a subject which has assumed prominence in recent years in view of the success which has attended the treatment of pernicious anæmia with liver extract. Another section which has been remodelled to conform with the advances made in other fields is the growth and development of bone.

The substitution of photomicrographs in selected instances for line drawings has made a further appeal to the student in thus more nearly approaching to the appearance revealed by his microscope. Although he does not obtain as complete a picture as the composite line drawing of many observers yet the strain on his faith in his teachers is easier to bear. This textbook is likely to remain the favourite account of descriptive histology to medical students.

*Die Tierwelt Deutschlands und der angrenzenden Meeresteile nach ihren Merkmalen und nach ihrer Lebensweise.* Begründet von Prof. Dr. Friedrich Dahl. Weitergeführt von Maria Dahl und Prof. Dr. Hans Bischoff. Teil 28: *Tausendfüssler oder Myriapoda.* 1: *Diplopoda.* Von Dr. Otto Schubart. Pp. vii+318. (Jena: Gustav Fischer, 1934.) 24 gold marks.

THIS is one of an excellent series of publications dealing with the organisms of the countries bounding the southern part of the Baltic, including Denmark, and those parts of Germany and Holland against the North Sea. This may not be a geographical region, but there are certain similarities in environments, both of land and water, so that it forms a convenient entity. Millipedes here are considered in an entirely systematic manner, and they are well treated, with tables for the identifications of family and genus, the whole accompanied by a good bibliography. Each species is given an excellent and well-illustrated systematic description, and this is followed by accounts of its biology and distribution. Clearly we have a reference book necessary to every library of zoology and one not likely to be superseded for several decades.

*An Essay on Philosophical Method.* By R. G. Collingwood. Pp. xii+227. (Oxford: Clarendon Press; London: Oxford University Press, 1933.) 10*s.* net.

MR. COLLINGWOOD has produced a profound and useful monograph which raises and discusses the question of what philosophy is and what methods should be used in approaching it. Owing to the variety of systems in existence, it may seem that classification should render some service to philosophy. Yet, the theory of classification, which may be applied to exact as well as to empirical sciences, cannot be rigidly applied to philosophical concepts. The determination of a scale of forms is the first objective of the philosopher. Then he must consider the quality of his judgments and of its inference in all their aspects; only then can he hope to build up a systematic whole and pass judgment on its value. The views expressed by the author require careful consideration, as his suggestions will be found to be extremely important in a subject which appears to the layman, wrongly we believe, to be in a chronic state of chaos. T. G.

*Vie et rajeunissement: une nouvelle méthode générale de traitement et mes expériences de rajeunissement de Bologne et Paris.* Par Dr. Francesco Cavazzi. Pp. xii+73+17 plates. (Paris: G. Doin et Cie, 1934.) 22 francs.

THIS is a communication made to the Society of Medicine of Paris with discussion and author's reply. The new method of treatment is the subcutaneous injection of the serum of the efferent vein from the testicle of a young healthy animal. It is stated that the internal secretion of the testicle flows into the blood stream so soon as it is formed, and therefore the serum is more potent than an extract of testicular tissue. Remarkable rejuvenating effects are claimed. A record of cases with photographs is given, showing that the effects last for at least two or three years. It is suggested that the effects are due not to a temporary stimulation which would use up the existing available energy of the body, but to the improved nutritional state of the central nervous system, especially the spinal cord.

*The Naturalist on the Prowl.* By Frances Pitt. Pp. x+137+32 plates. (London: *Country Life*, Ltd., 1934.) 5*s.* net.

IN easy style, Miss Pitt achieves the double purpose of presenting a series of descriptive and pictorial vignettes of animal life in the country, and of revealing how the novice may attempt to follow in her steps. Her quarry ranges from spiders' webs to bats, otters and seals, but it is mainly birds, and the account of blackcock tournaments, repeatedly observed when no female birds were present, shows that sexual selection may not enter into what appears to be an ebullition of high spirits.

Some of the photographic hints are well worth consideration by experienced workers, such as the possibility of using a hide without elaborate camouflage, and the desirability of carrying a selection of lenses of different focal lengths. Miss Pitt's photographs justify the means.

# New University Buildings at Cambridge

## THE NEW UNIVERSITY LIBRARY

THE University Library, after occupying its old site for four hundred and sixty-four years, has now removed to a new building on a new site. The difficulties, not only of storage but also of the proper handling of the books in a medieval building, have long been recognised, and records of debates in the Senate House on what ought to be, or could be, done go well back into the last century. Many suggestions for alterations and hoped for improvements were made from time to time, but all with the view of remaining on the old site. Ideas for additional stories, for covering in the old courts, for excavating cellars underground were in turn suggested and debated, but without any definite move ever coming out of it all.

Meanwhile the pressure on the Library steadily grew: a flood of books burst out after the War and the problem of how to store, handle and make accessible a collection increasing each year by as much as a third of a mile of shelving became more and more acute. All available space in the town was requisitioned and each part contained its host of 'little used' books which necessitated an outlay on a special messenger service.

In 1921 a definite move was made to tackle the situation seriously, and a syndicate was appointed to consider the needs of the Library and the best way of meeting them. The syndicate reported in due course that in its opinion the only method was to build a new library on a new site. This suggestion was adopted by the Senate, not without some opposition from those who regretted a break in the historical continuity of the old site and who perhaps dreaded the upheaval (the Library Syndicate allowed three months for the move ; actually it was finished, without a hitch, in eight weeks).

The special syndicate then proceeded to consider possible sites, and chose that of the King's and Clare playing fields across the river (the Eastern Hospital during the War) as the most central and accessible of the few remaining positions that were available. The two colleges concerned showed great public spirit in meeting the wishes of the University, and eventually Sir Giles Scott was asked to prepare plans for a new library.

At that time, although the financial aspect was a matter of grave concern, the University, recognising the desperate need of the Library and its importance as the pivot on which so much of its work turned, determined to risk all and go ahead. Certain bequests and the assistance of the Rockefeller Foundation, which agreed to take into consideration the University outlay on the Library to count as part of its contribution to the Rockefeller scheme for certain scientific departments in the University, thereby greatly eased the situation. A complete building has, therefore, been opened by H.M. the King instead of, as might have been the case, only a part awaiting time and opportunity for its continuation.

Sir Giles Scott has planned a building which combines an exterior of great dignity with an interior admirably designed for its purpose. Libraries differ considerably in their policy towards their readers. All of them provide one or more reading rooms, and the Cambridge Library for the first time in its career has followed suit with a main reading room to accommodate two hundred readers, not to mention smaller rooms for special purposes and tables and seats in all the book stacks. The Library, however, has a policy, not to be found everywhere, of allowing all members of the Regent House and, under certain not very arduous regulations undergraduates as well, free access to the great majority of the shelves. This is a great privilege, since in looking for one book another may be noticed the existence of which the reader was previously unaware. In addition, most books can be borrowed and taken away home or to the laboratory.

The needs of those working in the sciences do not differ materially from those of readers in other branches of knowledge, and the same general rules are made to apply to all. It is impossible to give a full account, or even a partial one, of the scientific books in a general collection of a million and a half volumes, but mention may be made of the periodical department. Periodicals form a branch of literature much consulted by the sciences. To this department a large wing is devoted. Current numbers are to be found in pigeon holes, and the bound volumes of each series are close at hand ; all 'dead' periodicals are stored elsewhere to avoid confusion but are easily obtainable. The classification is minute, and there are some eighty separate headings into which the sciences are divided.

Apart from its service to present readers, a great library has another function to perform, namely, that of conservation of literature for the reader of the future. This applies especially to those few libraries, of which Cambridge is one, which receive books under the Copyright Act, and this is perhaps the main reason why many libraries allow no book to pass out of their precincts. In Cambridge the risk of undue wear and tear on books and periodicals that are likely to be much used as laboratory tools is minimised by the use of the numerous well-equipped libraries attached to the

various departments, such as the Balfour Library of Zoology, the Philosophical Society's library and those attached to the Departments of Botany, Geology, Physiology and so on, to mention only those concerned with sciences. The colleges in their libraries are more and more taking heed to the needs of the undergraduate as well.

Science has its rarities in the book world, not equal in fame to Caxtons or folio Shakespeares, but of these the University Library has its fair share. The scientific worker is usually concerned with the more modern book and with the facility

FIG. 1. Drawing of the north-east corner of the Zoology Court with the main entrance.

with which he can obtain it. This aim the new University Library now satisfies as never before.

C. F.-C.

### NEW DEPARTMENT OF ZOOLOGY

The University of Cambridge only awoke to an interest in biological science about sixty years ago. The evolution controversy between Huxley and Owen at the British Association meeting at Cambridge in 1862 started it. There were at Cambridge collections of vertebrate animals, insects and birds, and both controversialists undoubtedly urged their proper housing. In consequence Cambridge decided to build a museum, the opening of which was followed by a proposal to create a professorship. Finally, Newton was appointed professor in 1866. His department consisted of a room for himself, and here he used to meet all who cared to come, conducting informal classes. Arthur Balfour used to say that he enjoyed these, and he introduced his younger brother, Francis Maitland, who in the next ten years established embryology as a distinct division of animal science. Newton lent F. M. Balfour his private room for practical classes in 1875, and the University created a chair of animal morphology for him in May 1882, but he lost his life when climbing a spur of Mont Blanc two months later. Among his pupils in this period were Sedgwick, Garrod, Milnes Marshall, Bridge, Hickson, Lister, Weldon, Harmer, Shipley and Bateson, all men of high repute in zoological science.

The chair of animal morphology died with Balfour, but his teaching was continued by Adam Sedgwick first as lecturer and then reader at a nominal salary of £100 a year, Trinity College providing a fellowship and other emoluments. Other colleges, noticeably King's, Christ's, John's and Caius were similarly benefactors to the new Department, and so the Cambridge school of zoology grew into existence. Classes increased and biological teaching for medicine was called for, and the University raised the roofs over the Department of Mineralogy and over the Philosophical Library, providing large and most picturesque attics for practical zoology. Sedgwick succeeded Newton as professor, remaining such for two years before moving to the Imperial College of Science. I succeeded him and in my first year I had to have a research guest in my own room, which was also my office and the storeroom for the research material of Balfour and others, as indeed it remained for twenty-five years more. Classes in comparative physiology, entomology and hydrobiology were established, and it soon became apparent that they were filling long-felt wants. The University helped the subject all it could, adding rooms vacated by mathematics, botany and physiology in turn, thus providing a ramshackle and widespread laboratory, no part of which was even reasonably fireproof, or suitable for that experimentation which the modern development of zoology makes imperative. The task before the University was to provide a modern building for at least 400 students and 36 research workers, these being the laboratory attendances of 1932–33.

The Empire Marketing Board was interested in entomology and offered a conditional grant. This led to an investigation by the Rockefeller Trustees that embraced not only the biological departments of Cambridge but the University Library as well. The necessary sum to secure a Rockefeller grant was raised by private donations and by a State grant. Zoology benefited both by building costs and endowment for experimental zoology

(comparative physiology) and for entomology, and to these the University added such funds as were necessary to build an entirely new laboratory, where the Medical Schools formerly stood, only one wall of which was retained.

The Zoological Laboratory as it now exists occupies three sides of a square, the fourth or west side belonging to chemistry. The north side is the old Museum building with a vertebrate hall to the north. The director of the Museum is also reader in vertebrates and he conducts the advanced and research classes of his subdepartment in this building. The vertebrate museum includes both living and fossil forms treated together as is necessary for any study on evolutionary lines. Associated with it are eight research rooms which are a hive of mechanical and chemical industry as the fossilised vertebrates, collected by workers in various parts of the world, are developed. There are also housed here large collections of insects and other invertebrates, but the labelling and illustration necessary to successful display allow only a very few forms in each group of animals to be shown.

The other sides of the square form the new building, which is hence L-shaped, 292 feet long by 43 feet wide. It has a basement and four floors above, with the lecture room extending from the basement through the ground floor at one end. The construction is steel and concrete with narrow stanchions 13 feet apart in the walls, one row of stanchions down the centre to carry the cross girders. The whole is faced with brick. Between the steel stanchions are secondary false columns and behind these are carried the necessary services to all rooms. Except for these narrow divides, the wall is glass on each floor above the bench level. Three staircases are necessary to secure the requisite safety of the occupants, and the roof, of concrete, is flat. The upper floor is slightly recessed, this and a slight narrowing at the inner angle giving pleasing effects of light and shade. At the outer corner of the laboratories lies an old building, once used as a medical museum; it has been reconstructed and opened up, thus giving a wing, 65 feet deep, on the three lower floors.

The whole of the ground floor forms one great teaching laboratory, the service being from the wing. It has six rows of working benches, of which five are divided into student's places, each between four and five feet long, with a locker and the necessary electric lamp; about two hundred students can be accommodated. The central sixth row forms a series of demonstration benches, and these are fitted with water, direct and alternating current and compressed air, so that the demonstrators can start and carry on experiments for their individual classes. The lecture room has its projector and cinema.

The first floor carries the necessary offices and an advanced laboratory with places for thirty students, each of whom has a cupboard and shelves which extend outwards from the benches and form partial partitions. There is special provision for aquaria and for section cutting, and the laboratory has its own library. On the same floor are the Balfour and Newton Libraries, the former with about 25,000 catalogue entries; it has been developed in the last fifty years on the nucleus of F. M. Balfour's books presented to the University by his sister, Mrs. Sidgwick. The latter library is the bequest by Prof. Alfred Newton of his specialist ornithological library. There are also eight research rooms off a central corridor lit by borrowed light; these are devoted mainly to systematic and invertebrate zoology and here the collections of the Murray Expedition are at present housed. The professor of genetics is a guest in the Department on this floor, pending the provision of laboratory accommodation for this subject by the University.

FIG. 2. Northern wing of the Elementary Zoology Laboratory.

The second floor is the Subdepartment of Experimental Zoology, the teaching of which, formerly termed comparative physiology, has been a feature of Cambridge zoology for the last twenty-five years. At one end is an advanced laboratory with window benches for routine work and central benches, on which experimental problems, which

may extend over several weeks, are worked out by the students. It has its own workshop and dark rooms, students being required to set up and even to make their apparatus. Every part of this floor is equipped with direct and alternating current, gas, water and compressed air. There is an aquarium, where animals under continuous observation are kept, apart from the larger basement rooms designed for freshwater and marine aquaria. The rest of the floor is devoted to research, and there are sixteen separate rooms as well as three dark rooms, the necessary workshops and a special chemical room. A feature is the control of temperature in each room, and there are also four constant-temperature rooms in the basement, which can give a range from arctic to tropical conditions. Freshwater biology has a special centre here.

The top floor is the Subdepartment of Entomology—but subdepartments are not rigid entities, all interdigitating, their research students working where facilities can be most conveniently given. Here are a large incubator room, a freshwater aquarium, insect rearing rooms and nine research rooms. In addition, there is a field station situated near the University farm, with its laboratories and its greenhouses ranging to tropical heats in which locusts are most happy, the whole built on 2½ acres of ground, where large-scale experiments are possible.

Perhaps the most important and indeed unique feature of this new zoological laboratory is the extensive provision in all parts for keeping animals alive and under observation in conditions closely approximating to those occurring in Nature, special attention being paid to temperature and humidity in all parts. The furniture of the whole building has been especially designed and is interchangeable ; each worker has his own cupboard, bookcase and writing table. The rooms are for the most part 13 ft., 19½ ft. or 26 ft. long with two, three or four window units, and 17 ft. broad. The walls between the same are of hollow tiles, and it is a simple matter to remove or to build, according to the needs of any research. The whole, indeed, internally simulates factory construction, allowing the maximum adaptability, the planning being on the idea that all scientific buildings should be such that their use can be altered as the centres of scientific interest shift. Every floor can be gutted, leaving the strength and rigidity of the building as great as ever. A shift, however, seems unlikely just at present, for the Department is housing 57 research workers (including the staff) as well as 26 advanced and about four hundred elementary students. J. S. G.

## Underground Water Supply

ONE of the subjects discussed at the recent meeting of the British Association at Aberdeen was that of the underground water supplies of Great Britain, which occupied a morning's session of Section C (Geology). Public anxiety as to the sufficiency and proper distribution of water supplies during the recent drought was partly a reason for choosing this topic, but there are deeper and more cogent reasons which prompted the present writer to introduce it, and the interest shown by geologists and engineers who took part in the discussion was a sufficient justification for departing from the more usual type of paper and discussion in this Section. The Committee on Inland Water Survey, inaugurated at the York meeting of the British Association two years ago, submitted a report to Section G (Engineering) at the same meeting, in which reference was made to the joint deputation of the British Association and the Institution of Civil Engineers to the Government, urging the necessity of a complete and systematic survey of the water resources of the country. The very timely and forceful leading article which appeared in NATURE on August 4, dealing with the reception of this deputation, will be fresh in the minds of many. But the chief motive which weighed with the writer in opening the discussion in Section C was to rouse geologists to the urgent need of investigation of our underground water resources, not merely by accumulating, checking and co-ordinating records at present available, but also by starting new hydro-geological investigation, the results of which should be available ultimately for public use.

It is startling to find how much misconception exists when the subject of underground water is discussed by general folk. During recent months, letters and special articles have appeared in the public Press, which have given the impression that we have underground in Great Britain an inexhaustible supply of potable water, and that it is only necessary to bore down to a sufficient depth almost anywhere to get all the supplies we need. Again, water engineers, who are fully alive to the importance of some reform in conserving, developing and allocating underground supplies, think mainly in terms of the present and potential yield of existing wells and borings.

The opening up of new sources of supply usually means starting a fresh investigation, laboriously collecting new data where available, which when

they have served their immediate purpose, may lie dormant in the private possession of some individual or water authority, and in some cases are lost or forgotten.

It is true that statistics of existing water undertakings have been collected for many years past by the Ministry of Health, and used for official purposes, and the Geological Survey also collects records of wells and borings, where they are likely to help geological mapping, and, incidentally, hydrological data are also recorded. But, as the Director of the Geological Survey reminded us in the discussion, the Survey has no powers to investigate underground water. We all recognise the great value of the County Water-Supply Memoirs already published by the Survey, due largely to the enthusiastic labours of the late Mr. Whitaker, and other similar memoirs are in preparation. Yet these memoirs are necessarily a compilation of records of data and facts supplied by well borers, water undertakers and others, many of them unchecked and antiquated, and some of them supplied by incompetent persons, so that the records may be useless and even misleading.

If the Geological Survey were to undertake a systematic survey of underground water in Great Britain, it would mean the creation of a new branch, adequately financed and staffed for the purpose, as in the case of the Geological Survey of the United States.

One of the points raised in the discussion was the desirability of the compulsory registration of all well sinkings and borings for water below 100 feet in depth, as is required by the Act of 1926 for all mineral borings; and a resolution to that effect was sent to the Council of the Association from Section C. In the case of borings and sinkings for minerals, secrecy for a period of ten years may be imposed by an owner on the Government department receiving the records, but in the case of borings for water, it was generally thought that such claims for secrecy would be seldom lodged.

Attention was also directed to the very large quantities of underground water now being separately pumped by industrial undertakings, sometimes to the serious depletion of public domestic supplies. As the law governing underground water stands at present, it is possible for an individual or company to put down a deep well or boring in the immediate vicinity of an existing pumping station belonging to a statutory water undertaking, and from it pump water in such large quantity as to interfere with and perhaps seriously deplete the public supply, which may be the sole source of supply for a large community. In such a case there is no penalty or restraint imposed on the private owner, nor any compensation allowed for the statutory undertakers. Whereas the statutory undertakers have imposed upon them the obligation of fully compensating the owners of wells and borings within a radius, it may be two miles or more, if it can be shown that they have produced interference by their pumping.

Another matter referred to was that of geophysical methods of investigating underground water, and also 'water divining'. Fortunately, the latter subject was allowed to drop, otherwise there might have been much time spent—and heat generated—to little purpose. But in passing, one is tempted to refer in this connexion to the great waste of private and public money which still continues, and to a much greater extent during the past year or so.

Attention was directed, in opening the discussion, to the need of systematic study of hydrogeological conditions in natural unit areas, such as a single watershed or geological formation, or well-defined tectonic area. This would involve periodic observation of the depth and movements of the underground water-table in wells and borings, gauging of springs and streams, records of quantities and analyses of underground water pumped, pumping levels, effect on neighbouring wells, and so forth. Surface configuration, rainfall, and cultural features, as well as underground geology, would naturally come into the picture. By using the published ordnance maps, it would be possible to assemble in graphic form such a body of hydrological fact, so that ultimately one might look forward to hydrological survey maps being available for all the more important areas in the country. One of the speakers in the discussion suggested that some of these hydrological data might be inserted on the geological maps published by the Geological Survey. Many of these maps, however, are already so crowded with detail that it might be better to have a separate series of ordnance maps with hydrological data superposed and perhaps the geology in outline.

There was general agreement that such investigations are urgently needed, and that the work should be undertaken if possible in the near future. Competent individuals or groups, with the necessary acquaintance with the local geology, could doubtless do something in furtherance of this investigation, but it was felt that some national organisation is required, if such a general survey is to be undertaken for the whole country.

Thus we are faced with the same problem which the British Association Committee on Inland Water Survey is attempting to solve. Indeed, investigation on underground water, as implied by its inclusion in the terms of reference of the Committee, is intimately connected with river gauging and surface supplies in general.

No one who has been following the trend of thought among water engineers and all those interested in our water resources during the past year, can fail to be impressed by the almost unanimous desire for some Government action which will respond in a practical way to the repeated demands for an organised survey of our water resources. Increasing quantities of water, for an ever-increasing variety of purposes, are required, and the first necessity is to know where and in what quantities they are available, both above and below ground. As already indicated, this information cannot be obtained merely by collecting such data as are at present known, and of the kind which the Ministry of Health has been collecting, and which is compiled in the Water Supply Memoirs of the Geological Survey. But this is not to minimise in the least the importance of the systematic collection and collation of existing data, which are of primary value, and must be continued and extended.

An increasing body of opinion is demanding that there should be some central Government authority exclusively concerned with our water supplies. Further, when we realise the diversity of surface configuration, geology and hydrological conditions, as well as population and industry, in the various regions of the country, it becomes evident that the conservation and allocation of supplies should be dealt with in the first instance by local or regional bodies with statutory powers, but subordinate to the central authority.

In planning any such national scheme it is important, in the writer's opinion, to provide so that scientific investigation of overground and underground resources is kept separate from the purely administrative branch, which would be concerned with the allocation, distribution and conservation of water. The continuous and systematic gauging of rivers and springs, and the varied problems involved in underground hydrology, should be pursued independently of the immediate use of the water for any single interest or authority or combination of such, in much the same way that the national survey of our rocks and minerals by the Geological Survey is run independently of any one industry or profession, but is meant to serve any or all national interests.

It is for this main reason that the writer would prefer that the more purely scientific part of hydrological investigation which is now under consideration should be brought under the control of the Department of Scientific and Industrial Research, or a special branch of that Department. This need not mean that there should be any sort of barrier between the Department of Scientific and Industrial Research and the central or the regional water authorities here envisaged. On the contrary, there should be the closest collaboration between the investigation side (which would be continuously adding to our knowledge of the amount and location of available resources) and the more practical engineering and industrial side.

In any such comprehensive and national scheme, there might still be room for valuable work carried on by competent and enthusiastic geologists and others, whether amateur or professional. Short of a whole-time staff of Government experts, capable of conducting a systematic survey for the whole country, which may be impossible under present conditions, it would be possible for the Department of Scientific and Industrial Research to assist by money grants this work, and provide for its publication in such form as to be readily available for public use. W. S. BOULTON.

## News and Views

### Intellectual Freedom

GENERAL THE RIGHT HON. JAN CHRISTIAAN SMUTS was installed on October 17 as Rector of the University of St. Andrews after the honorary degree of doctor of laws had been conferred on him by Mr. Stanley Baldwin, Chancellor of the University. In the presence of a distinguished audience including Sir James Barrie, a former Rector, whose address twelve years ago on "Courage" is still vividly remembered, General Smuts addressed his constituents. He delivered a characteristic speech on "The Future of Liberty", and the students of the scarlet gown gave him an enthusiastic welcome and a most attentive hearing. South Africa and Scotland are linked together by many ties including the love of liberty—"We decline to submerge the individual in the State or in the group, and we base our organisation of the State and society on individual freedom and the free initiative of the citizen". Surveying the condition of the world as it passed through and emerged from the War years, General Smuts admitted that "mankind stands perplexed and baffled before the new situation and the new problems". But in spite of all grounds for anxiety, General Smuts finds none for real pessimism—having passed through rough passages, having sampled the world and human nature at many points, he remains at heart an optimist.

IN a striking tribute to science, General Smuts claimed that it would provide a solution of many of the difficulties of the age. "Science has perhaps made more fundamental progress in the last thirty years than in the preceding two thousand. In particular, as is to-day commonly recognised, the problem of food shortage, of starvation and famines, the most

dreadful spectres of all history, is at last yielding to science, and the most fruitful cause of war in the past is thus being eliminated. Instead we are now oppressed with the novel problems of plenty, the solution of which will in due course mean not only the passing of war, but of grinding poverty and slavish toil for the masses of mankind. In these and other ways the scientific results of the last twenty years will come in the future vastly to overshadow in importance the losses and dislocations of the Great War which still bulk so large in our view." General Smuts believes that scientific invention will make war more and more impossible. There is a more serious problem even than the risk of war, and that is the maintenance of liberty. It is the decay of principles that must be feared, and the disappearance of intellectual freedom. Every sincere thinker and every scientific investigator must welcome the challenge of this rectorial address. We must seek, with John Milton, to preserve "the high hopes and aims, the diligent alacrity of our extended thoughts and reasonings in the pursuance of truth and freedom".

### Memorial to Carl Daniel Ekman

AN interesting ceremony was performed on behalf of the Swedish Cellulose Association by Consul T. Lundgren on October 19, when he unveiled a memorial to Carl Daniel Ekman, the inventor of the sulphite wood-pulp process, at Northfleet Cemetery. In the addresses by Baron Palmstierna and others at the dinner afterwards given by the Swedish Chamber of Commerce in London and the Society of Swedish Engineers in Great Britain, great emphasis was laid on the strengthening of Anglo-Swedish relations by mutual exchange of experience in science and technology. Sweden owes much to the many English pioneers who settled in Gothenburg during the last century and organised railways, exploited iron ore deposits and developed industrial life generally in the west of Sweden, but the debt has, however, been amply repaid by the work in England of many Swedes. The current issue of the Yearbook of the Society of Swedish Engineers deals with the work of some of these, such as Alfred Nobel, John Ericsson (1803–89) the inventor of the marine propeller and the first steam fire-engine, Nordenfelt (1843–1920) the gun and submarine designer, Sandberg (1832–1913) of steel-rail fame, and Ekman (1847–1904).

IN 1870, attempts were being made to improve Mey's steam-cooking process for the conversion of wood into pulp for the manufacture of paper by adding soda to the liquor, but even then the product was not entirely satisfactory; it was not until 1872 that Ekman at Bergvik found that a solution containing sulphurous acid and magnesite was the key to the problem. He thus laid the foundation of the sulphite process, the present world-production of which (6,130,000 tons a year) exceeds that of the sulphate or mechanical process in quantity as well as in value; further, the consequent cheapening of paper has brought the pleasures of reading into many homes. In 1883, Ekman became manager of a mill at Northfleet, Kent, and it was in his well-equipped laboratories there that much of his work on digesters and beaters and on the utilisation of the waste liquors was carried out. Ekman was the traditional type of inventor, and economics had no place in his enthusiasm for his technical work. As a result he died a poor man, and since the subscriptions to his memorial fund were devoted to the Ekman family and to the founding of scholarships, his grave became neglected. The memorial at Northfleet Cemetery is a result of the attention directed to this fact by Mr. J. Strachan, of the present Northfleet Mills.

### England–Australia Air Race

MR. C. W. A. SCOTT and Mr. T. Campbell Black arrived at Melbourne at 5.35 a.m. (G.M.T.), on Tuesday, October 23, thus winning the England–Australia air race. The flyers left Mildenhall, England, at 6.35 a.m. on Saturday, October 20, thus completing the journey, a distance of 11,300 miles, in 2 days 23 hours. The aeroplane was a new D.H. Comet, constructed at the de Havilland works specially for the race. It was a low-wing monoplane with two unsupercharged Gipsy Six engines (230 horse-power). Mr. C. W. A. Scott has already several notable flights to his credit. In 1931, he flew from England to Australia in 9 days 4 hours 11 minutes, in 1932 he did the same journey in 8 days 20 hours 44 minutes, and in 1931 he flew from Australia to England in 10 days 23 hours. Mr. Campbell Black set up a new world Puss-Moth record in 1931 by covering 1,600 miles in a single day. The second arrivals at Melbourne were Mr. Parmentier and Mr. Moll, flying a Dutch K.L.M. (Douglas) air liner carrying three passengers, who reached Melbourne at 12.54 a.m. (G.M.T.) on October 23, thus having completed the flight in just over three days. The flights are noteworthy achievements, for which tribute is due to the pilots for their skill and endurance, and not less to the designers and makers of the engines.

### Memorial to Capt. Cook

ON October 15, during the Victorian centenary celebrations at Melbourne, the cottage from Great Ayton, North Riding of Yorkshire, associated with Capt. Cook, which was purchased by Mr. W. R. Grimwade, taken to Australia and re-erected in Fitzroy Gardens, was formally handed over to the care of the Melbourne City Council. On the same day, at Great Ayton, Mrs. R. Linton, wife of the Agent-General for Victoria, unveiled a memorial which has been erected on the site once occupied by the cottage. The memorial consists of an obelisk of granite blocks brought from Cape Everard near Point Hicks, Australia, and is a facsimile of the obelisk at that spot, which states that Cook "First sighted Australia near this point which he named 'Point Hicks' after Lieutenant Zackary Hicks who first saw the land, April 19th (Ship's Log date), April 20th (Calendar date) 1770". In reply to a vote of thanks to Mrs. Linton and himself, the Hon. Richard Linton said: "We stand to-day beside a granite monument. It is a piece broken off from that

continent whose discovery by Cook began the process of events that gave Britain one of the most faithful and loving of her daughters. It has been sent you in exchange. We have taken from you the home in which Cook's father and mother lived, which this day is being opened in Melbourne in one of the loveliest of our gardens. Beautiful English trees overhang it, green English lawns surround it, and glowing flowers form its setting." In the course of his speech Mr. Linton said: "Such men as James Cook are beacons. In our schools it should be our care that men like this should be held up to our children to follow, quite as much as those great warriors whose ultimate building lay through destruction rather than in construction."

### The Linnean Society of London

THE annual dinner of the Linnean Society of London was held at the Hotel Washington on October 18. The president, Dr. W. T. Calman, was in the chair, and the official guests were Sir Richard and Lady Gregory, and Dr. G. F. Herbert Smith. Following the dinner, a reception was held by the president and Mrs. Calman in the rooms of the Society at Burlington House. Dr. J. F. G. Wheeler, director of the Bermuda Marine Biological Station, gave a lecture, illustrated with coloured lantern slides, on the natural history of Bermuda. A number of zoological and botanical exhibits were shown in the library, including a series of manuscripts and printed documents, from the Society's archives, relating to the younger Linnæus, and to his visit to England in 1781–82. The Botanical Department of the British Museum (Natural History) had on view a large series of coloured drawings of fungi of the genus *Russula*, and a selection of dried plants from British Columbia. Miss F. L. Stephens exhibited cultures and microscopical preparations of two species of the fungal genus *Neurospora* showing varying degrees of the 'sub-sexual' difference known as heterothallism. A selection of coloured fruits and seeds exhibited by the Royal Botanical Gardens, Kew, attracted much attention. Prof. G. D. Hale-Carpenter showed a series of butterflies with marks on, and mutilations of, the wings caused by the attacks of birds. Capt. J. G. Dollman exhibited a series of skins of certain antelopes showing the uniformity of pattern in the fœtal and young animals, with diversity in the adults. Mr. J. Omer-Cooper had on view a living specimen of the crustacean *Apus*, hatched from mud taken from a pond in the New Forest. This crustacean had not been found in England for about half a century.

### Rainfall Records and Drought Periodicity

MR. W. R. BALDWIN-WISEMAN, lecturer in hydraulics in the University of Western Australia, writing in reference to our leading article of August 4 on the "Government and Inland Water Survey", emphasises the need for an organised hydrographic service, and instances the Hydrographic Survey of the Po as one of the most efficient services in the world. From analyses of many lengthy records of rainfall in his possession, he contends that there is little justification in many cases, and no justification in some, for the assumption that any 35-year-mean approximates fairly closely to the true mean, or that a 20 per cent deficiency adequately represents the average annual deficiency of the three driest years in a lengthy rainfall record. Consequently, water works planned on these assumptions may make a too generous allocation of compensation water, while making inadequate provision for a storage sufficient to tide over the contingencies arising from a prolonged, or frequently recurrent, drought. He goes on to point out that Dr. E. Huntington has demonstrated the existence of a climatic pulse of about 640 years, which is probably a multiple of the sunspot period of 11·2 years ($57 \times 11{\cdot}2 = 638{\cdot}4$); if A.D. 1372, the year of maximum sunspot activity in the Chinese record, which has now been unofficially maintained for nearly a thousand years, be taken as a nodal point in this pulse, previous points will have occurred about 543 B.C., A.D. 95, and A.D. 734—all four points being in periods of notorious aridity. If the sequence is maintained, the next occurrence may be expected about A.D. 2010, with a prevalence of drought conditions, either prolonged or frequently recurrent, towards the close of the present century.

### The North-East Coast Institution

AT the annual general meeting of the North-East Coast Institution of Engineers and Shipbuilders held at Newcastle-upon-Tyne on October 19, the report for 1933–34 was submitted, and Mr. J. T. Batey delivered his presidential address. In spite of the severe depression in the shipbuilding industries, the membership of the Institution has been well maintained, several valuable papers have been read and attendance at meetings during the past year was the highest recorded. Among other matters referred to were the grant of armorial bearings, the Sir Charles Parsons Memorial and the opening on July 20, 1933, of the Municipal Museum of Science and Industry, the formation of which the Institution did much to promote. The honorary curator of the Museum is Capt. E. W. Swan, a member of the Institution. A part of Mr. Batey's address was devoted to the problem of using technical progress. Technical progress, he said, is like a fine machine; it has to be properly used or it may be dangerous. Mechanical science has outstripped progress in the science of living, and it is evident that in this field there will be many and startling developments before the Institution is a century old. To the question whether the suspension of scientific progress is conceivable, it might be replied that the advance of science is so inevitable that for all practical purposes we may regard it as one of the laws of life. The Institution's purpose, "the advancement of the sciences of engineering and shipbuilding", is a definite function of the organised form of society ruling to-day. The responsibility for the misuse or oversight of technical progress must be accepted by finance, commerce and the State, internationally. In the session just opening, the Institution, he said, would commemorate its jubilee, and he continued:

"I feel that if it were possible for those far-seeing men who founded this Institution to come amongst us to-day, they would consider that the great heritage which they left us has been fully preserved."

### Training of Mercantile Marine Officers

SOME important recommendations for the better training of apprentices for sea service are contained in a report just issued by an Advisory Committee to the Manning Committee of the Shipping Federation. To qualify for the position of a junior officer in the British Mercantile Marine, it is necessary to serve an apprenticeship of four years, or three years if a boy has passed through the *Conway*, or *Worcester*, or Pangbourne College, and to pass the Board of Trade examination for second mate. At present, there is no recognised course of instruction or any uniformity in training for apprentices or cadets, and very often it is only with the greatest difficulty that apprentices prepare themselves for examination. Some shipping companies have special schemes of training; but such is not the general case. It is now proposed that a Central Board of Control should be set up with the power to draw up a standard syllabus of instruction, to set annual examination papers, to give practical advice to captains of ships in matters of education, to appoint local boards of examiners and to publish periodical statistics relating to the scheme of education. The Advisory Committee expresses its belief that, if shipowners adopt the scheme and give it their practical support, it will secure the sympathy and assistance of both the Board of Trade and the Board of Education. Apprentices at sea suffer from many disabilities as compared with their fellows ashore, and some recognised course of training such as is proposed has long been overdue. It is to be hoped, therefore, that the recommendations put forward will receive the support they deserve.

### Research in the Automobile Industry

AT the annual dinner of the Institution of Automobile Engineers on October 12, Sir Herbert Austin referred to the debt the automobile industry owes to the Department of Scientific and Industrial Research; and the extent to which the industry receives help from the Department is dealt with in the recent annual report of the Research and Standardization Committee of the Institution. During the year ending June 30, 1934, the total income of the committee was £9,963, which included £5,000 from the Society of Motor Manufacturers and Traders, £1,962 from subscriptions and £2,500 from the Department. The year's expenditure on research was about £6,000. To stimulate further research, the Department has offered to increase its contribution to £5,000 if the industry will find £10,000, and to £10,000 if the industry will find £15,000. As the output of motor-cars in Great Britain was stated by Sir Frank Smith at the dinner to be 285,000 a year, it should not be difficult for the industry to find a sum which amounts to practically a shilling a car. Researches are already in hand on cylinder wear, valve seat wear, bearings, oil consumption, piston temperatures, brakes and other matters, and from these valuable information has been obtained.

### Battery-Electric Cars

AFTER many years of almost suspended animation, the battery-electric vehicle industry is showing signs of life. At the Exide motor show, Mr. D. P. Dunne stated that the monthly output of these vehicles in Great Britain is larger than it has ever been before. Compared with petrol vehicles, they make less noise and produce less atmospheric pollution. Statistics prove that their life is much longer and their maintenance is much less than that of any other form of mechanically propelled road vehicle. Several corporations are using electric vans in connexion with their electrical apparatus hiring schemes. The West Ham undertaking has vans with a speed of 20 miles per hour and a range of 50 miles per charge. They use an electric motor coupled to the back-axle through differential gearing. The charging arrangements are quite simple: a 'jack' is provided on the dashboard for connecting with the mains and there is an automatic control to limit the rate of charging. This undertaking has introduced a night tariff of 0·66*d.* per unit for vehicle charging. In certain cases, such vehicles will prove more economical than petrol vans.

### Investigation of Cosmic Rays by Sounding Balloons

ACCORDING to a recent article distributed by Science Service, Washington, D.C., Dr. Arthur H. Compton, of the University of Chicago, proposes to use small sounding balloons that will automatically send wireless signals recording pressure and temperature of the air and the intensity of the cosmic rays. The idea is not new, having been developed for example by Prof. J. M. Benade, of Lahore, and by Prof. Moltchanoff, of Leningrad (NATURE, Dec. 31, 1932, p. 1006). The risks attending direct exploration of the stratosphere are obvious, and these special balloons are designed to avoid them, while greatly reducing expense; they are said not to exceed 15 ft. in diameter at release, and to weigh only 16 lb. Radio signals are to be emitted from a single valve oscillator. The movements of a special barometer will affect the wave-length of the signals, and the signals will be interrupted by a balance wheel, of which the rate of oscillation will be controlled by temperature. They will also be interrupted at each discharge of a cosmic ray counter—an instrument which discharges at a rate dependent upon the conductivity of the atmosphere, which in turn is affected by the cosmic rays—the length of time between such breaks giving an indication of cosmic ray intensity just as the lengths of the intervals between interruptions previously mentioned will indicate the temperature. It is understood that Dr. Compton's measurements will not entirely replace those made with manned 'stratosphere balloons', but will supplement them and allow some information to be obtained from sparsely populated regions where neither manned balloons nor balloons that release self-recording instruments when they burst can be employed, in the first case

because of the risk of descent far from help and in the second because of the small hope of recovering the instruments.

### New British Birds

THE addition of six birds new to the British list, and the alteration in nomenclature of another, has been agreed to by the council of the British Ornithologists' Union (*Ibis.*, July 1934); and no less than three of the new types are birds from South Uist, Outer Hebrides, where they were distinguished and described by Col. Meinertzhagen. The newly added species are: the Hebridean twite (*Æanthis flavirostris bensonorum*) which is darker and not so red as the common twite (*Linota* (*A.*) *f. flavirostris*) and with blacker centres to its feathers, the underparts being similar to the mainland birds; the Hebridean stonechat (*Saxicola torquata theresoe*), the female of which is not so red and darker above and below than the common stonechat (*Saxicola t. hibernas*), the black bases of her throat-feathers being more conspicuous—the male is slightly darker above, especially on the forehead, but with the underparts similar; the Hebridean hedge-sparrow (*Prunella modularis hebridium*) with general darker plumage than the common hedge-sparrow (*Accentor modularis occidentalis*), the flanks being more heavily marked and streaked, the upper parts richer and more distinctly marked and the grey on the throat darker. The types of these three birds were obtained from South Uist, the latter bird being the least common. The other additions are the Scandinavian jackdaw (*Corvus monedula monedula*) from a specimen obtained at Lowestoft and described as a migrant to the east coast of England; the arctic ringed-plover (*Charadrius hiaticula tundrae*), a well-established race distinguished from the common bird (*Ch. h.h.*) by its smaller size and darker colour, nesting in Lapland, Arctic Russia and Siberia, a specimen in the British Museum being from Poole Harbour, Sussex; and the bridled or lesser sooty tern (*Sterna anæthetus*) of the West Pacific and Indian Oceans, which has been obtained from Dungeness and a Thames lightship. The British song thrush has been altered from *Turdus philomelus clarkei* to *Turdus ericetorum ericetorum*, and correspondingly, the continental song thrush to *T. e. planiceps*, and the Hebridean song thrush to *T. e. hebridensis*.

### High Wind Speed at Mount Washington

IN the *Engineering News-Record* of May 10, 1934, there is an article about the alleged wind speed of 231 miles an hour said to have been attained at the meteorological observatory of Harvard University on Mount Washington, New Hampshire, on April 12, 1934. Most meteorologists—at least European ones—probably paid little attention to the reports of this wind that appeared in the newspapers soon after that date, on the grounds that such a wind could not have been measured even if it actually occurred, but Dr. C. F. Brooks, professor of meteorology at Harvard, is quoted as stating that the speed in question was recorded by an anemometer of the cup pattern, similar in principle to the well-known Robinson anemometer, and is probably correct to within about ten miles an hour. It appears that the design of the instrument was roughly copied from an experimental anemometer seen at Bergen in 1931, modifications being introduced to meet the difficult conditions sometimes experienced at Mount Washington, in very windy weather, that may result in massive ice formations due to rime. Electrical heating of the anemometer of a very powerful kind had to be introduced, and hot air was made to pass through the six cups, which were fitted closely round a copper disc placed over an electric stove, and were driven in the normal manner by the pressure of the wind. The instrument was tested in a wind tunnel at the Bureau of Standards up to a speed of 150 miles an hour, and as the calibration curve became nearly straight towards the maximum speeds it seemed justifiable to extrapolate to 231 miles an hour, with the probability of obtaining a figure not significantly different from the true figure. The speed in question was the average, while three contacts were made, each representing the passage of 1/30 mile of air past the cups and was therefore for a gust.

### Forestry in Trinidad and Tobago

THE annual report of the Forest Department of Trinidad and Tobago, 1933, has recently been published (Govt. Printer, Port of Spain, Trinidad, 1934). The satisfactory lines upon which the Department has been working, with the active support of the Government, is evident. The Government has obviously placed implicit trust in its Conservator, Capt. R. C. Marshall, who, after eleven years in the colony, is now taking up the post of conservator of forests in the Gold Coast. The acting conservator, the writer of the present report, seizes the opportunity of taking stock, in an introduction, of the progress made by the Department during Capt. Marshall's tenure of the post. This review covers all the branches of forest activity and is well worth reading. Progress in sylviculture has been considerable, but there are problems connected with the cedar which have yet to be solved. Most of the Colonial services are as yet so backward in the working plans branch of forestry that it is of interest to read that outline working plans or working schemes have been prepared for an area of approximately 90,000 acres of reserves. Under finance, the acting conservator shows that the surplus of revenue over expenditure for the eleven-year period, exclusive of free timber supplied to the P.W. Department (an iniquitous practice since, as a former Governor-General of India expressed it, Government is in effect taking free from the State forests materials for which the public has to pay), amounted to £51,017; revenue fluctuated from £25,054 in 1927 to £8,466 in 1931. The writer continues: "The Forest Department has repeatedly emphasized in its Annual Reports that the higher revenues are liable to be unstable, much of them being due to the clearing activities of Oil Companies, and that the Department's endeavours in this direction are primarily concentrated on obtaining a stable

revenue by supplying the Colony's ordinary wood-consuming industries with local timber. Some of this high revenue is in reality trust capital and strictly speaking ought to be treated as such."

### Nature Protection in Poland

DURING its spring session, the Parliament of Poland discussed and passed a new law for the protection of Nature, a comprehensive measure covering many objects (*Kwartalny Biuletyn Informacyjny*, **4**; 1934). The threat of the erection of tourist mountain railways on the Polish, as well as on the Czechoslovakian, side of the Tatras has aroused much concern and opposition, for it would interfere with the object, which seemed to be on the point of fulfilment, of creating a grand Tatras National Park jointly cared for by Poland and Czechoslovakia. In the eastern Carpathians, there has been created by the Metropolitan of the Greek-Catholic Church, a new Nature reserve, interesting because it protects a fine forest of Cembro pines (*Pinus Cembra*) growing upon the summit of Mount Jajko. Indeed the protection of ancient trees is one of the features of the Polish scheme, and one of the most remarkable grows in the village of Harbutowice in the west Carpathians —the oldest yew in the country, having a circumference of 2·80 metres. An excellent step has been taken in enlisting the co-operation of the school authorities in the Cracow and other districts; and with the object of familiarising school teachers with the objects and methods of Nature protection, special conferences have been held at which discussions have taken place on the feeding of birds in winter, and on the plants specially protected in the school districts. Another step, which might well be copied in Great Britain, is the agreement come to with the Polish radio authorities arranging that talks will be broadcast once a month on different aspects of the protection of Nature.

### Activities of the Post Office

THE last annual report of the Post Office was issued nearly twenty years ago. Since then, there have been many radical changes and important developments in the work of this Government department which are not yet well known. We therefore welcome "The Post Office, 1934" (London: G.P.O. 1*s*.) which has just been published. In the preface the Postmaster-General reviews some of the developments, and he may indeed be proud of his department, which has kept well abreast of all the latest scientific advances. Owing to the competition of telephony, the traffic handled by the telegraph service shows a considerable falling off, but the rapid and revolutionary changes introduced are checking this decline. The teleprinter is now the standard machine in use in Britain; Morse signalling is rarely used. A motor-cycle service has quickened delivery, and incoming liners are met by telegraph representatives. As an experiment, boy messengers are attending a few of the main railway stations to accept telegrams from outgoing passengers. Up to twenty years ago, the telegraph was the only means of communication with foreign countries; now a telephone subscriber in Great Britain can communicate with 95 per cent of the telephone subscribers of the world. Wonderful progress has been made with radio services. For broadcasting, unfortunately, the wave-length position in Europe is very difficult owing to the fact that there are far more broadcasting stations than there are wave-lengths available for their use. Some countries were not satisfied with the allocation of wave-lengths made at the Lucerne Conference and are using waves contrary to the Lucerne plan.

### Electricity Development in France

THE aim of electrical engineers in France is to create a huge network of high-voltage transmission lines which will connect the generating stations with the great centres of consumption. The systems of transmission are being standardised. For the high-tension lines, 220 and 150 kilovolts are being used, and secondary pressures of 90 and 60 are employed. This compares with the 132 kilovolts used in the British Grid. A report issued by the Department of Overseas Trade on "Economic Conditions in France" by Sir Robert Cahill (London: H.M. Stationery Office, 7*s*. net) gives much instructive information on this subject. It is stated that the production and distribution of electricity in France provide employment for 150,000 workers. The yearly output has been estimated at about one twentieth of the total world output. There are 1,200 companies producing or distributing electricity, and the productive capacity of the stations increased very rapidly before the commercial depression and is still increasing. The output of the great thermal stations of the coal-mining, metallurgical and industrial areas, north and east of Paris, and in the vicinity of Lyons, will form in a few years' time part of a comprehensive electrical supply system, so that any temporary breakdown in the supply from one station can be made good from the others. The output of the thermal is double that of the hydro-electric stations. There still remains about 60 per cent of the maximum possible water-power not utilised. The Rhine development scheme includes the erection of eight large power stations at intervals along the river. The first, which is already in operation, is at Kembs, about ten miles below Basle, and is equipped to produce nearly 200,000 kilowatts. The combined power of the eight stations will be 650,000 kilowatts. Various schemes have been proposed and stations built for utilising tidal power on the coast of Brittany, but so far none of them seems to have been commercially successful.

### Social Insurance

THE importance of demographic considerations in relation to social problems are stressed by Prof. J. P. Dalton in a pamphlet on "Social Insurance" recently published by the University of the Witwatersrand Press, Johannesburg. The author claims that the demographic consequences of social processes are in the long run of paramount importance, though they are usually ignored or ill-understood. He argues

that unemployment insurance can do no more than offer a temporary palliative, and that the experience of England and Germany shows all too clearly the limitations from which it suffers. Likewise public works, though necessary to relieve immediate distress, are of but temporary advantage. This is true even of the multiplication of resources provided by schemes of such magnitude as the draining of the Pontine Marshes or the reclamation of the Zuider Zee. The fundamental problem is to secure a stable balance between production, consumption and population. In this connexion, the biological ageing of a population must necessarily have economic repercussions, European South Africa is still demographically some twenty-five years behind England, but South Africa is also ageing. He suggests as a solution for South Africa's problems, a vigorous policy of immigration, and points out that so long as America keeps an open door, her unemployment difficulties are not very serious. There remains, he adds, an alternative way of controlling the contraction of South Africa's market, and that is by enhancing the purchasing-power of the non-European population.

### Cultivation of Onions

A NEW bulletin (No. 69) recently issued by the Ministry of Agriculture (H.M. Stationery Office, 1*s*.) deals with onions and related crops. Considering that more than 90 per cent of the onions consumed in Great Britain are purchased from abroad at an annual cost of nearly 2 million pounds, it is evident that this is an instance of a crop which could with advantage be much more extensively grown in this country. The acreage devoted to onion growing in England and Wales has seriously declined since 1913, the reduction in some instances amounting to 50 or even 75 per cent. The soil in many parts of the country is eminently suited to the crop, and although a certain degree of skill is required in cultivation, manuring, harvesting and storing, there seems no reason why onion production should not be substantially increased. Besides the wealth of practical information provided in the bulletin, interesting comparisons are drawn between the methods of cultivation employed in the principal onion-growing countries such as Spain, Holland, Egypt and the United States, and the respective seasons at which their produce is imported into Great Britain.

### Air-Speed Record

IT is announced by the Milan correspondent of the *Times* that Warrant Officer Francesco Agello, flying at Desenzano, on Lake Garda, on October 23, attained an average speed of 709·202 kilometres (440·67 miles) an hour, and a maximum speed on one run of 711 kilometres (441·22 miles) an hour. Agello was flying a Macchi-Castoldi 72 seaplane with a Fiat engine similar to that in which he set up a record on April 10 last year of 682·4 kilometres an hour.

### Announcements

WE regret to announce the death of Prof. Santiago Ramón y Cajal, For.Mem.R.S., professor of histology and pathological anatomy in the University of Madrid, on October 18, at the age of eighty-two years.

A DISCUSSION on the John Murray Expedition will be held at the Royal Society on November 1 at 4.30, to be opened by Lieut.-Col. R. B. Seymour Sewell. Preliminary accounts of the work of the Expedition have appeared in NATURE of January 20, p. 86, and May 5, p. 669.

IT is announced that Mr. J. M. Edmonds has been appointed geologist on the staff of the Geological Survey, Khartoum, Anglo-Egyptian Sudan.

AT the annual statutory meeting of the Royal Society of Edinburgh held on October 22, the following officers were elected : *President :* Prof. D'Arcy W. Thompson ; *Vice-Presidents :* Sir Thomas Holland, Prof. C. G. Darwin, Prof. R. A. Sampson, Principal O. Charnock Bradley, Prof. P. T. Herring, the Marquis of Linlithgow ; *General Secretary :* Prof. J. H. Ashworth ; *Secretaries to Ordinary Meetings :* Prof. F. A. E. Crew and Prof. J. P. Kendall ; *Treasurer :* Dr. James Watt ; *Curator of Library and Museum :* Dr. Leonard Dobbin.

THE beautifully illustrated and printed *Natur und Volk*, published in Frankfurt, is mainly for popular reading. The August number contains, in addition to botanical and geological articles, papers on the work of Canadian beavers and on abnormalities in the teeth of rodents, both informative and with good photographs.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned :—A lecturer in mathematics at the Borough Polytechnic, Borough Road, London, S.E.1—The Principal (Nov. 1). A headmaster of the Junior Technical School, Acton Technical College—The Secretary, 10 Great George Street, Westminster, S.W.1 (Nov. 3). A director of the New Art Gallery and Museum, Perth —The Town Clerk, City Chambers, Perth (Nov. 3). An examiner in the Aeronautical Inspection Directorate—The Secretary (S.2), Air Ministry, Adastral House, Kingsway, W.C.2 (Nov. 5). An assistant professor of gunnery and mathematics at the Military College of Science, Red Barracks, Woolwich, S.E.18 (Nov. 12). A director of research at the Wool Industries Research Association, Torridon, Headingley, Leeds, 6—The Secretary (Nov. 15). A physiologist at the Marine Biological Laboratory, Plymouth—The Director (Nov. 19). A professor of modern experimental physics at the National Central University, Nanking, and a professor of hydraulic engineering at the National Chekiang University, Hangchow, China—The Universities China Committee, 91, Gower Street, W.C.1. An advisory entomologist at the Harper Adams Agricultural College, Newport, Shropshire—The Principal. Two assistants in the Directorate of Technical Development, Royal Aircraft Establishment, South Farnborough, Hants.

## 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.*]

### Relation between Temperature and Radius in the Cepheid Variables

THE most important objection raised against the pulsation theory of Cepheid variation lies in its failure to explain the observed phase relation between temperature and radial velocity. In a pulsating star it would appear that maximum temperature and luminosity should coincide in phase with minimum radius. Actually, however, observations of radial velocity show that at maximum light the stellar atmosphere possesses its greatest velocity of approach towards the observer. Eddington has shown that this phase-displacement cannot be explained as due to a lag of energy-flow introduced in the upper, non-adiabatic, layers of the star.

A possible explanation of the phenomenon, however, is that the observed radial velocity, measured as it is from the displacement of absorption lines in the stellar spectrum, is not an index of the radial pulsations of the star as a whole, but that the oscillations of the stellar atmosphere differ in phase by approximately one quarter of a period from the pulsation of the body of the star.

In this case, measurements of radial velocity variation will give an incorrect picture of the radial pulsations, and the stellar radius, that is, the radius of the photosphere, must be determined throughout the light cycle by some other means. The interferometer is at present incapable of producing results of the required accuracy, and more doubtful methods must be employed.

On the assumption that these stars radiate approximately as black bodies, their temperatures and bolometric luminosities can be determined at various phases from the visual and photographic light-curves. The material available for this purpose is extremely scanty, mainly on account of the lack of continued observations based on a standard magnitude sequence. But one extended series of standardised observations was available to me; namely, that on RS Bootis, due to Seares and Shapley[1]. From these observations of magnitude and colour index, the bolometric magnitude $B$, the temperature $T$, and the radius $R$ have been computed for different phases over the entire light-curve. A harmonic analysis of the resulting curves over a light-cycle gives the following results:

$$B = 10{\cdot}33^{m} + 0{\cdot}53^{m}\cos(v - 246^{\circ}) + 0{\cdot}26^{m}\cos(2v - 270^{\circ}) + 0{\cdot}20^{m}\cos(3v - 281^{\circ})$$

$$T = 7{,}900^{\circ} + 2{,}080^{\circ}\cos(v - 71^{\circ}) + 1{,}130\cos(2v - 96^{\circ}) + 950^{\circ}\cos(3v - 106^{\circ})$$

$$R = 0{\cdot}148 + 0{\cdot}033\cos(v - 256^{\circ}) + 0{\cdot}019\cos(2v - 281) + 0{\cdot}010\cos(3v - 288^{\circ})$$

It appears, therefore, that maximum temperature and luminosity and minimum photospheric radius nearly coincide in phase.

A further result leading to the same conclusion is that in this star the temperature and radius throughout the cycle satisfy closely the relation

$$R.T = \text{constant},$$
$$\log RT = -5{\cdot}95 \pm 0{\cdot}01.$$

This result has been tested for a number of stars for which the available data are not so complete, and appears to hold, with a larger degree of scattering. The maximum probable error of the mean value of $\log RT$ for any group of observations was found to be eight per cent.

The conclusion of the pulsation theory, therefore, that maximum temperature and minimum radius should coincide, is borne out by the available material. The behaviour of the atmosphere is a problem that still requires theoretical investigation. The relation between radius and temperature found above has not been explained, but further work is being undertaken in this connexion, particularly in the light of the recent paper by Prof. Milne[2].

A. E. H. BLEKSLEY.
University of the Witwatersrand,
Johannesburg.

[1] Seares and Shapley, *Astrophys. J.*, **48**, 214; 1918.
[2] Milne, *Mon. Not. Roy. Astro. Soc.*, **94**, 418; 1934.

### Preparation of Protium Oxide and Determination of the Proportion of Deuterium in the Hydrogen of Normal Water

WE have recently prepared specimens of highly purified water almost free from deuterium and have compared their densities with that of similarly purified, ordinary water. The preparations were effected by electrolysis, by the decomposition of water with metals, and also, partly, by fractional distillation.

The relative densities were determined by a float method, which allows comparisons to be made with an accuracy of about 1 part in $10^{7}$. Of the specimens of water examined, that which has the lowest density should contain at the most a few units per cent of the original deuterium: it is nearly pure 'light water', or protium oxide. It proves to be lighter than purified London and Leeds tap-water by 12 parts per million at 20° C. Our samples of purified London and Leeds tap-water have an identical density, which was made the standard of the comparisons.

From this value and Taylor and Selwood's determination of the density of deuterium oxide, we calculate that the molecular proportion of heavy water in our standard water is 1 in about 9,000; that is to say, there are about 110 atoms of deuterium per million in the hydrogen of the standard water. This proportion is considerably smaller than is usually assumed: it is possible that the further experiments now in progress may cause some increase, but any large change seems unlikely.

Accepting this value provisionally as a lower limit, it is of interest to calculate from Aston's measurements the chemical atomic weight of normal hydrogen. For $H^{1}$ Aston has obtained the value 1·00778 on the scale $O^{16} = 16$. Using our value, the atomic weight of normal hydrogen should be 1·00789 on the same scale. Corrected to the chemical scale by means of Mecke and Childs' factor, this becomes 1·00767, whilst if Babcock and Naudé's factor is employed the value obtained is 1·00777. The most probable value as calculated from chemical data is given by Birge as 1·00777, but it is doubtful whether the ratio H : O has ever been determined using gases of normal isotopic composition.

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## Cause of Changes in Rate of some Gas Reactions

In 1932 Travers and Hockin described a phenomenon associated with the formation of methane and of condensation products during the pyrolysis of pure ethane[1]. When this gas is heated to the neighbourhood of 600°, ethylene and hydrogen are formed very rapidly, and a state is approached rapidly approximating to equilibrium in the ethane-ethylene-hydrogen system. Methane and condensation products are also formed, and as Travers and Pearce show in a paper which will shortly appear in the *Transactions of the Society of Chemical Industry*, both processes originate independently from the ethylene. When the pyrolysis has proceeded for a short time, the rates of formation of methane and of condensate suddenly and simultaneously slow down. However, if instead of using pure ethane, a mixture of ethane, ethylene and hydrogen in equilibrium proportions is used, no breaks are observed in the graphs representing the rates of formation of methane and condensate at all. The initial rate of both processes is definitely greater when starting from pure ethane than when starting from an equilibrium mixture, and while in the former case the processes are markedly affected by surface, in the latter the effect of surface appears to be negligible.

In the paper now in the press, Travers and Pearce explain the phenomenon in the following way. The energy of activation of the primary decomposition of ethane into ethylene and hydrogen is about 76 k.cal. while the energy requirements of the process are about 31 k.cal. As a consequence, the energy to be disposed of is 45 k.cal. The result is that, superimposed upon the process by which methane and condensate are formed in equilibrium mixtures, there is, in the case of the initial stages of the pyrolysis of pure ethane, an energy chain mechanism, which continues up to a point which is possibly determined by the formation of condensation products of high molecular weight, of which the rate is determined by surface conditions. However, the cause of the whole phenomenon is to be found in the existence of the reaction involving the primary decomposition of the ethane. This is what is referred to in this laboratory as a *background process*, and on such background processes identical phenomena in the case of other reactions appear to depend.

In the course of the discussion at the Royal Society on May 10, we described some experiments which were being carried out in this laboratory on the thermal decomposition of acetaldehyde, which indicated that a similar phenomenon occurred in this case. Attention was directed to the fact, because it seemed to have some bearing on a phenomenon observed by Mr. Hinshelwood[2] in an investigation on the thermal decomposition of the same compound, to which he has made reference in several papers. Mr. Hinshelwood, in commenting on our note[3], denied that there was any connexion between our observations and his own, but we find it difficult to see wherein the difference lies. However, we feel very sure that the following facts cannot be ignored.

One cannot consider the pyrolysis of acetaldehyde without taking careful account of the experimental work of Prof. W. A. Bone[4] on the occurrence of this compound and its isomers, among the products of oxidation of ethylene, or avoid the possibility that internal change such as,

Acetaldehyde = Vinyl alcohol,

may constitute a *background reaction* such as operates in the early stages of the pyrolysis of pure ethane. In this case, the system may be a much more complex one than that which we have to consider in the case of ethane, which may account for the facts put forward in our contribution to the discussion of May 10. It does not seem to be at all unlikely that the formation of methane and carbon monoxide from acetaldehyde involves the previous formation of vinyl alcohol, and that the mechanism of the subsequent reaction is similar to that which Travers and Pearce have suggested for the formation of methane and condensation products from pure ethane.

In the case of the thermal decomposition of dimethyl ether, we have a process operating in two stages. In the first stage methane and formaldehyde are formed, the rate of the reaction being measured by the rate of formation of methane. There are no breaks in the graphs representing this process, which is in accord with the view which is now put forward, for there is no obvious background process. The second stage, the decomposition of the formaldehyde, which can be followed separately when using our analytical method of investigation, exhibits the phenomenon which we have described. The background process is most probably the process of primary decomposition of the dimethyl ether.

Finally, we must refer to an investigation on the hydrogenation of diphenyl to benzene which was carried out in this laboratory by Dr. J. E. Sisson. In this case, breaks which occur in the graphs representing the rate of formation of benzene appear to be related to maxima in the concentration of diphenyl-benzene, which is formed during the process of hydrogenation by a process which does not appear to be a simple one, and may act as a background reaction to the hydrogenation process.

It seems possible that reactions involving the thermal decomposition of organic substances fall into two classes. In one of these, in the early stages, an energy chain system is imposed upon a simpler process, the energy chains being initiated by some *background process*, tending towards equilibrium in the system. In the other class such a background process does not operate, and the main process is of a simpler character. However, even in such processes the products of reaction may still influence activation, as indicated in our contribution to the discussion on May 10, and developed in the paper by Travers and Pearce to which reference has been made.

We are continuing the investigations on acetaldehyde and dimethyl ether by the method of detailed analysis which has been described elsewhere. Though exact, the method is laborious and the work takes a long time.

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Sept. 29.

[1] *Proc. Roy. Soc.*, A, **136**, 1; 1932.
[2] NATURE, **131**, 24, Jan. 7, 1933.
[3] *Proc. Roy. Soc.*, A, **146**, 252; 1934.
[4] *Proc. Roy. Soc.*, A, **143**, 16; 1933.

## Spectra and Latent Energy in Flame Gases

AFTER flame has travelled through an inflammable gaseous mixture the gases remaining are not merely hot $CO_2$, etc. They emit luminous radiation for a long time (if their temperature is kept up), their temperatures as determined by the sodium line reversal method are too high, and they have associated with them a long-lived latent energy which amounts to a considerable proportion of the heat of combustion. The evidence for this has been summarised in a recent article in the *Engineer*[1].

The spectral examination of the after-glow of $CO_2$ after excitation in a vacuum tube, and of CO-flames, by Prof. Fowler and Mr. Gaydon[2] suggests that during combustion $CO_2$ molecules are formed of a type similar to those responsible for the after-glow. It is conceivable that the latent energy in flame gases may be associated with metastable $CO_2$ and $H_2O$ molecules, or it may be that it results from a dissociation of these molecules in a manner quantitatively widely different from that of ordinary thermal dissociation.

In the case of CO-air combustion we have found that the latent energy is much greater in constant pressure combustion than in closed vessel explosions. To take a typical example, in a particular mixture burning at 5 atmospheres the latent energy is 15 per cent of the heat of combustion, whereas when this mixture is exploded in a large closed vessel at such initial pressure that the explosion pressure is 5 atmospheres, it is only about 5 per cent (and would only have been about half of this had the initial pressure been 5 atmospheres).

An interesting correlation with flame and explosion spectra may be made. Prof. Bone and his co-workers have shown that there is a "marked shortening in the ultra-violet" in CO-explosion spectrograms when compared with those from ordinary CO-flames[3]. It would thus seem that the greater the latent energy in the CO-flame gases the greater the relative intensity of the ultra-violet radiation; and this suggestion is further supported by a comparison of Prof. Bone's spectrograms with our latent energy determinations in the constant pressure burning of pure CO-mixtures at various pressures.

As will be clear, however, from the typical example given above, there appears to be some essential difference between combustion in CO-explosions in a large vessel and in CO-flames. It would be of interest to take spectrograms of the after-glow from the flame gases left behind the flame front as it travels through a long tube filled with CO-mixtures. It seems possible that, whereas after the uniform slow movement the spectrogram would be of the ordinary flame type, its character may change to that of the explosion type when nearing detonation.

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Oct. 2.

[1] "Temperature and Latent Energy in Flame Gases", *Engineer*, June 1, 1934.
[2] *Proc. Roy. Soc.*, A, **142**, 362; 1933.
[3] "Gaseous Combustion at High Pressures". Bone, Newitt and Townend. (Longmans, 1929.) Pp. 196.

## Lunar Periodicity in the Conjugation of *Conchophthirius lamellidens* Ghosh.

THE ciliate *Conchophthirius lamellidens*, living as an ectoparasite on the gills of a fresh-water mussel *Lamellidens marginalis* Lamarck, has been under our observation for nearly two years. The specimens were collected from ponds in Calcutta. We had seen conjugation in this ciliate from time to time, but it was not until September 1933 that we started keeping proper records in order to determine the frequency of occurrence of this process. Our method of procedure has been to examine four mussels every day and search the gill scrapings for conjugants.

The accompanying diagram (Fig. 1) on which we have plotted the average number of conjugants against the day on which they occurred during six months, together with the maximum and minimum air temperatures for those months in Calcutta, is self-explanatory. It clearly shows that the number of conjugants for the month has usually been highest on the day following the new moon. In the month of December the peak was shifted by five days. In this month the temperature graphs show the arrival of the first cold wave of the season (though mild) a few days before the new moon. This appears to be not only responsible for shifting the anticipated date from December 18 to 22, but also for making the process linger over a number of days. The 'slackers', therefore, were in evidence even up to January 8, 1934. The data for March were just available at the time of writing. The arrival of an unusual cold wave about the middle of the month appears to have retarded the process so much that only one pair of conjugants was seen on the date anticipated, namely, March 16.

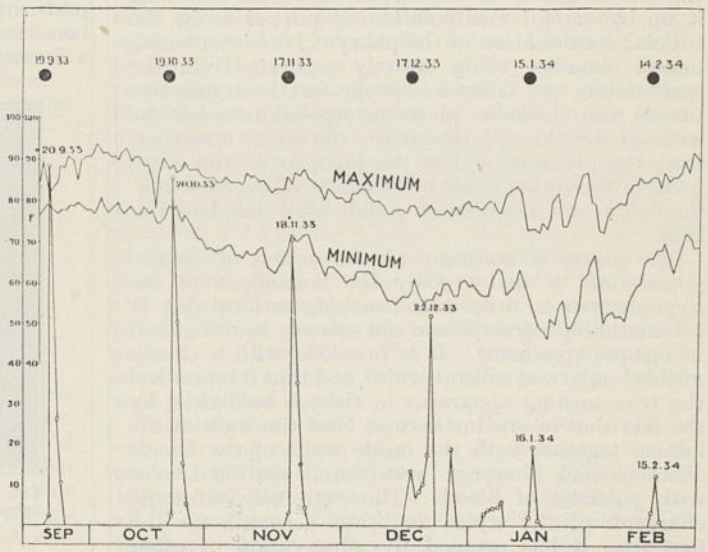


FIG. 1. Lunar periodicity in conjugation of *C. lamellidens*. Ordinates show average number of conjugants.

The graph suggests that (*a*) normally the peak occurs on the day following the new moon if there are no disturbing factors, of which the air temperature fluctuations is an important one; (*b*) the number of conjugants simulates the annual variation of the air temperature. That the air temperature and its oscillations do exercise a controlling effect on the number of conjugants in a month is apparent from

the graph, but the lunar periodicity also appears to be an independent factor.

We expect to publish the details of our investigation elsewhere.

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## The Sucking Apparatus in Ticks

THE mouth-parts hitherto recognised in ticks comprise a hypostome and a pair of cheliceræ, the three together forming what is believed to be the piercing and sucking organ. The actual mouth-opening, however, has never been observed.

In the course of my studies upon the anatomy of *Ornithodorus papillipes*, Birula (= *O. crossi*, Brumpt), I was successful in differentiating a stylet overlying the dorsal gutter of the hypostome. On following it up by careful manipulation, it proved to be the tubular continuation of the pharynx, the intervening buccal chamber being entirely separate from the surrounding exo-skeleton, except for the connective tissues and chitinous plates interposed between the walls of the two. Furthermore, the entire structure, from the proximal end of the pharynx to the distal point of the stylet, could be lifted out of the surrounding debris and mounted on a slide after due dehydration.

The stylet is resistant to the action of caustic potash and is undoubtedly the homologue of the hypopharynx in other blood-sucking arthropods. It is remarkably refractile and can scarcely be recognised in opaque specimens. It is provided with a clearly visible lumen and a distal orifice, and that it represents the true sucking apparatus in ticks is evidenced by the fact that in one instance at least the walls of the lumen, together with the inside walls of the buccal chamber and pharynx, were found scattered over with particles of blood. The extremely refractile character of the stylet doubtless accounts for the fact that it has escaped the observation of other workers on the subject.

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## Unique Structure in the Adrenal of the Female Opossum

THE cortex of the adrenal of the Australian opossum (*Trichosurus vulpecula*) cannot be divided into the typical zona glomerulosa, zona fasciculata, and zona reticularis of Arnold (1866). Completely surrounding the medulla is a thin rim of cortex in which there is no zona glomerulosa, and which is divided into an outer zone containing fat, fatty acids, lipoids, cholesterol, etc., and an inner, practically lipoid and fat-free, zone. These two zones are to be described as the 'alpha' and 'beta' zones. Scattered amongst the cells of the 'beta' zone are cells with oval nuclei which contain a number of unusually large karyosomes; these cells have an unknown function and are to be called 'gamma cells'.

In the male opossum the adrenal possesses but a thin cortex made up of 'alpha' and 'beta' zones. In the virgin female there are the beginnings of hypertrophy of the 'beta' zone on one side of the gland, which pushes into the medulla. This hypertrophy continues to maturity. At maturity the 'beta' zone cells nearest the medulla commence to change from the small, compact cell with relatively large, deeply staining nucleus and scanty, rather neutophilic cytoplasm to a cell with at least four times as much cytoplasm which stains homogeneously with eosin, and with a slightly larger, more vesicular, and lightly staining nucleus. From the medulla towards the cortex, the 'beta' cells become transformed into these new cells and build up a zone which stands out from the rest of the gland as an eosinophilic zone, and is to be described as the 'delta' zone.

At early pregnancy, there is a slight decrease in the size of the 'delta' zone (compared with the size of the gland) but the 'beta' zone (also compared with the size of the gland) remains the same. At mid-pregnancy the 'beta' zone has nearly doubled its breadth and the 'delta' zone has increased considerably. At late pregnancy the 'beta' zone has grown until it occupies more than three quarters of the hypertrophied area. In a female in which a recent parturition had occurred, half the 'beta' zone had been transformed into 'delta' zone cells again. In a female suckling a small pouch young, the 'delta' cells of the hypertrophied area had been entirely replaced by 'beta' cells, and as the suckling continued nearly all these metamorphosed into 'delta' cells. The hypertrophied area at this stage is larger, relative to the size of the gland, than at any other stage. During the remainder of the suckling the hypertrophied area continued to grow 'beta' cells which eventually became changed into 'delta' cells, were destroyed and replaced by fresh 'beta' cells and so on. Although the sizes of the adult glands, and therefore of the hypertrophied area, vary considerably in different specimens, the size of the hypertrophied area expressed as a percentage of the size of the gland is practically constant in adult females.

FIG. 1. Section through adrenal of female of *Trichosurus vulpecula* showing hypertrophied zone extending into the medulla.

It is difficult to explain why the 'beta' zone, which extends completely around the medulla, hypertrophies and produces 'delta' cells only on one side (Fig. 1). There is a true zona reticularis connecting the 'delta' zone and the remainder of the cortex to the medulla.

The function of this hypertrophied area is quite unknown. The 'delta' zone contains a small amount of argentophile material, which is probably vitamin C, when subjected to techniques which I have described in various communications. It contains only an occasional droplet of lipoidal material and no cholesterol, fatty acids or fats as shown by various

histological techniques. The 'beta' zone contains slightly more lipoid and rather more vitamin C, but these materials and the fats, etc., are concentrated chiefly in a very thin peripheral cortical rim—the 'alpha' zone.

The 'beta' zone, and more rarely the 'delta' zone, may be stained bright yellow due to the diffusion through the cytoplasm of a lipochrome pigment, presumably a carotene. The occurrence of this pigment bears no relation to the reproductive cycle. At times, masses of lipochrome may be seen in the vascular clefts of the cortex and in the medullary sinuses. The latter are sometimes crammed with these masses. The cells of the zona reticularis are invariably packed with lipochrome in the form of globules of various sizes. The pigment is present in the glands of male and female animals. The 'delta' zone, as is to be expected, occasionally contains quantities of a black pigment which appears to be melanin.

It is impossible to observe the striking association of this pigment (presumably a carotene) with the adrenal of the opossum without coming to the conclusion that the adrenal must play an important rôle in the vitamin A metabolism in this animal.

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Arnold, J., *Virch. Arch.*, **35**, 64; 1866.
Bourne, G., NATURE, **131**, 874, June 17, 1933.
Bourne, G., *Aus. J. Exp. and Med. Sci.*, **11**, 261; 1933.
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## Alleged Stimulation of Moulds by Paraffin in Heavy Water

IN a recent communication, Klar[1] has questioned the results of experiments which seem to indicate that diplogen exerts a stimulative effect. He would attribute any such increase in growth as has been noted to the presence of organic impurity rather than to the heavy isotope of hydrogen. The investigations of Barnes[2], Barnes and Larson[3], Richards[4], and Meyer[5] have shown that such stimulation does occur and it has been attributed to the presence of the D atom. I was aware that there was a certain amount of inorganic, and possibly organic, impurity in the 'Ohio'-water used, approximately 0·04 per cent or less, but am of the opinion that the method of purification by a careful double- and triple-distillation in pyrex glassware removed any such impurity. The investigations reported here seem to substantiate this view.

After the double distillation of the 'Ohio'-water used in the experiments with *Aspergillus* sp., there was no detectable odour and the water had the 'flat' taste which is so characteristic of distilled $H_2O$. Approximately 25 c.c. of the 0·5 per cent deuterium oxide, twice-distilled, in each of four 125 c.c. Erlenmeyer flasks, left freely exposed in the laboratory for a period of 44 days, showed no growth of mould of any kind, whereas a solution of Pfeffer's three-salt and sucrose medium showed a heavy fungus growth within a week. If the organic impurity suggested by Klar were present in the heavy water, it was neither of a kind nor in sufficient quantity to serve as a nutrient for the growth of mould. Furthermore, the solution in which the *Aspergillus* sp. was grown, in the investigations reported, was Pfeffer's three-salt medium with sucrose as the source of carbon, a full nutrient solution for the growth of the fungus. There was much more available organic compound present than the plants could possibly use in the five-day growth period. It seems exceedingly unlikely that this suggested organic impurity, if present, would have exerted so profound a stimulative effect in a medium already rich in available organic material.

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[1] Klar, NATURE, **134**, 104, July 21, 1934.
[2] Barnes, *J. Amer. Chem. Soc.*, **55**, 4332; 1933. *Amer. J. Bot.*, **20**, 679; 1933. *Science*, **79**, 370; 1934.
[3] Barnes and Larson, *J. Amer. Chem. Soc.*, **55**, 5059; 1933. NATURE, **133**, 873, June 9, 1934.
[4] Richards, *Amer. J. Bot.*, **20**, 679; 1933. *J. Bact.*, **28**, 289; 1934.
[5] Meyer, *Science*, **79**, 210; 1934. *J. Tenn. Acad. Sci.*, **9**, No. 4, 1934 (in press).

## Titration of Protein with Trichloroacetic Acid

In a paper to the recent Faraday Society discussion on colloidal electrolytes, one of us (R. K. S.) pointed out that some of the difficulties encountered in the acid titration of proteins would be overcome by using an acid of which the anions become firmly bound to the positive groups of the protein. As a particular case, metaphosphoric acid was cited, the powerful coagulating power of which makes it a simple matter, after adding an excess of acid, to extract an aliquot free from protein for back titration.

We have just completed some preliminary trials with trichloroacetic acid, and find that edestine added to a 0·1 molar solution of this acid at the rate of about one gram per 100 c.c. and centrifuged, gives a clear liquid which contains only a trace of the added nitrogen and can be back-titrated to a sharp end-point. Similar results are obtained with the mixed proteins of wheat flour. The acid binding capacity of edestine determined in this way is in good agreement with published figures.

Trichloroacetic acid appears, therefore, to be a valuable reagent not only for the precipitation of protein, for which purpose its use in solutions of 10 per cent and upwards is already recognised, but also, when more dilute, for the rapid estimation of titratable amino-groups. Ordinary meta (glacial) phosphoric acid is a mixture of a number of acids of general formula $(HPO_3)_n$, some of which are therefore polybasic. This introduces difficulties both in the back-titration and also in the interpretation of the results, so that this acid will probably prove to be less generally useful than trichloroacetic. The matter is being further investigated.

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## The Lobster, *Enoplometopus occidentalis*, Randall, in South Africa

RECENTLY Mr. E. C. Chubb, curator of the Durban Museum, sent for identification a very fine specimen of the above species. First recorded from Honolulu, the records of its occurrence have been proceeding westwards: Reunion (Milne Edwards), East Indies (de Man), and Mauritius (Bouvier). Its presence on the Natal coast is therefore not unexpected, but nevertheless interesting and worthy of record.

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## Research Items

**Prehistory of Indo-Iranian Borderlands.** A report of the Huxley Memorial Lecture of the Royal Anthropological Institute, delivered by Sir Aurel Stein during the session of the First International Congress of Anthropological and Ethnological Sciences on July 31, appears in *Man* for September. The subject matter of the lecture was gathered on five journeys between 1927 and 1934 in British Baluchistan, Makran and Fars, the ancient Persis. The plentiful remains of the chalcolithic and later periods, in an area inadequately explored archæologically, provide links with the earliest civilisations of Mesopotamia and Elam on one hand and with the Indus valley on the other. Great ethnic movements have passed across these areas and penetrated India; and their effects are felt down to the present day. Prehistoric settlements are to be traced west of the Indus at a great line of mounds stretching along the barren foot of the south-western Waziristan hills. Their size suggests climatic conditions more favourable to settlement than those of the present day. In considering the probable line of migration of the Aryan tribes speaking Vedic Sanskrit, who conquered the Punjab about the second millennium B.C., attention is directed to the tribes worshipping Vedic divinities and apparently speaking a Sanskrit language, who are mentioned in Hittite inscriptions of the seventeenth century B.C. as leading a pastoral life in the Mitanni country roughly located in Kurdistan. Both archæology and history fail to throw any light on the great movement of Aryan conquest, which may be supposed to have started from this area; but geographical considerations suggest that it is likely to have passed south of the great belt of central Persian deserts to the northern portion of Persian Baluchistan and the Helman basin.

**Social Life in Ancient India.** Incidental references, mainly in a Pali commentary known as the *Vimānavatthuatthakathā*, throwing light on social observances in Ancient India have recently been collected by Kalipada Mitra (*J. and Proc. Asiatic Soc. Bengal*, N.S., **29**, No. 1). Festivals hold a prominent place. A description of the necessary preparations for such festivals says that the citizens had the streets swept clean, and sprinkled on them sand and five kinds of parched rice and flowers. At the door of every house, banana plants and full pitchers were placed. According to their means they caused flags and streamers of many colours to flutter. All the people attired themselves in their best robes. The king came out with a great retinue and in magnificence to make a circuit of the city—apparently a usual practice. The festivals, however, were only for those who could afford them; the poor did not take part or interrupt their work. Players, dancers, rope-dancers, wrestlers, boxers, jesters, story-tellers and others of like occupation were present in large numbers. On the 'Public Day Festival', families, who do not ordinarily go out, come forth to go unclothed to the river to bathe. Sons of men of the warrior caste stand by the side of the road, and when they see a maiden who pleases them, throw a garland over her. In the 'Simpleton's Holiday' feast, foolish people used to smear their bodies with ashes and cowdung, and for a period of seven days go about uttering all manner of coarse talk. At this time people showed no respect for kinsfolk, friends or monks when they met them, but stood in the doorways and insulted them with coarse talk. Those who could not endure this talk paid the holiday makers half or quarter of a penny to go away from their house. Even ladies of respectable family came out to see the festivities and to bathe in the river.

**The 'Elephant Fish'.** The Smithsonian Institution reports that six specimens of this peculiar fish have been identified by Prof. Carl L. Hubbs, of the University of Michigan, in its fish collection. It has just been described as a new genus, *Elephantichthys*, by Prof. Hubbs and his associate Dr. L. P. Schultz, on the basis of a single specimen collected at Kodiak Island, Alaska. It is now found that it was first collected about thirty years ago in Alaskan waters by Dr. Leonard Stejneger, head curator of biology, Smithsonian Institution. It was named the 'elephant fish' because of the very rough, tough skin and clumsy body, but is not identical with the African elephant fish, which has an extension of the head which looks like a trunk, nor with certain marine chimæra groups, sometimes called by the same name. *Elephantichthys* is to a certain extent compressible, and when laid on a flat surface out of water, it flattens out. Its body is very soft, but its skin nearly a quarter of an inch thick. It is a member of the cyclopterid family which cling to the rocks by a sucker on the ventral surface, the 'lump-fish' being one of its relatives.

**Nerve Cells of Earthworm.** F. Ogawa (*Sci. Rep. Tôhoku Imp. Univ., Biol.*, **8**, No. 4; 1934) records the results of observations on the number of ganglion cells and nerve fibres in the central nervous system of the earthworm, *Pheretima communissima*. The number of ganglion cells in the cerebral ganglion (12,829) is much larger than in the subœsophageal (5,146) or any other ganglion of the ventral nerve cord, but the cells of the cerebral ganglion are smaller in size. The ratio of cells in the cerebral ganglion to the fibres in the circumœsophageal connectives is 2·3 : 1, hence the author infers the existence in the cerebral ganglion of many association cells the fibres of which do not leave the ganglion. The subœsophageal ganglion appears to be formed by the fusion of four ganglia belonging to the first, second, third and fourth segments, as it gives off four pairs of single and of double nerves. There are more ganglion cells and larger cells in this ganglion than in any other ganglion of the ventral cord. In general, the number of nerve elements in a ganglion depends on the complexity of organisation of its segment; a table shows that the number of cells varies from 931 to 4,471. The last or terminal ganglion appears to remain in an embryonic condition.

**The Ascidian *Clavelina* in the Pacific.** The well-known genus *Clavelina* has been regarded in its typical form as a native of the Mediterranean Sea and of the seas of north-western Europe. Now an example of the genus, described as a new species by Asajiro Oka, has been found at Shifushi, Kyushu, Japan (*Proc. Imp. Acad. Tokyo*, **10**, 365, June 1934). The species, which has been named *Clavelina coerulea*, is closely related to *C. lepadiformis*, but has fewer tentacles, and the individuals are beautifully blue in colour.

Northward Extension of Mediterranean Flora. In his presidential address to the Linnean Society (*Proc. Linn. Soc.*, 3, September 1934), Prof. F. E. Weiss deals with this problem. He points out that the principal northward routes taken by Mediterranean plants have been along the Atlantic coast and up the Rhone valley. The greater number have taken the Rhone route, which is climatically better suited to their requirements. Some travelled eastwards to Switzerland along the Rhone to Geneva, some up the Saone to northern France and Belgium and some by way of the Doubs through the gap of Belfort to Alsace and the upper Rhine, which, between Basle and Mayence, is rich in Mediterranean plants and climatically well suited to them on account of the hot dry summers and maximum rainfall during the winter months. Both these latter routes were probbably taken by *Buxus* and some other plants which have reached England, whilst the southern species of *Erica* have taken the Atlantic route. Evidence from distribution suggests that *Polypodium vulgare* var. *serratum* and *Ruscus aculeatus* have entered Switzerland along the Rhone valley but Chodat's contention that many species have penetrated up the southern valleys and crossed the Alps is supported in the case of *Ephedra helvetica* and other plants. The problem of the Lusitanean element in the Irish flora is reviewed, and the theory of a post-glacial immigration, probably by direct seed dispersal, is favoured.

Genetics of *Datura*. A very good account of the work of Blakeslee and his collaborators with the genetics of *Datura* has recently been published with an elaborate set of very useful illustrations (*J. Hered.*, 25, No. 3). Much of this work is already familiar to geneticists in papers published during a period of more than twenty years, but a synthetic account of the main results and the steps by which they were attained will be welcomed, for the conceptions here developed have since been widely applied to other genera. Most of the 12 chromosomes are sufficiently unlike to be recognisable, and the 12 corresponding primary trisomic mutants have all been found, as well as the two secondaries belonging to most of the primaries. For example, the primary 'buckling' has an extra 5·6 chromosome in its cells, but some of its derivatives show more extreme characters in opposite directions and the extra chromosome in them is regarded as 5·5 or 6·6 respectively due to interchange of segments. Tertiary types have also been recognised, in which the extra chromosome is composed of parts of two different chromosomes. Cultures and crosses of *Datura* from many parts of the world have shown that there are at least four types with interchanged chromosome segments, which when intercrossed produce chromosome rings. Compared with the standard line, most European races are of the *B* type, in which chromosomes 1·2 and 17·18 have interchanged giving 1·18 and 2·17. Similarly, in Peru, the races of *Datura* have the chromosomes 11·21 and 12·22, and in Jamestown, Virginia, 3·21 and 4·22, through segmental interchange. By radium treatment, which breaks the chromosomes, and subsequent self-pollination of trisomic forms, new balanced conditions have been reached with an extra pair of chromosomes. These forms breed true and are in effect new species.

Summer-Flowering Phloxes. A useful and interesting booklet on the "History, Culture and Varieties of Summer-flowering Phloxes" has been published (Bull. 588, Cornell Univ. Agr. Exp. Sta., Ithaca, N.Y., March 1934). The early-flowering species are divided into three groups—*Subulata*, *Divaricata* and *Ovatae*, whilst the late-flowering phloxes have two main groups—*Suffruticosa* and *Decussata*. The history of the cultivation of these charming plants in England and America is described, and their cultivation and propagation are discussed in detail. It is very gratifying to note that mention of diseases and insect pests can be enclosed within the compass of 130 words. The section on varieties reveals a wealth of different forms, of diverse shades of pink and white, and of all degrees of vigour.

Weather in the Northern Hemisphere. The monthly weather summaries that have been published by the *Staatlichen Forschungsstelle für langfristige Witterungsvorhersage* of Frankfurt during the past few years refer to a large part of the northern hemisphere outside the tropics, and give some information about the course of the drought that has been felt for nearly two years over large areas in Europe and North America. Among the various charts included in these reports is one which shows on a map the deviations of barometric pressure from the normal over a region that includes all the drought area. A similar map for a period of a year up to the end of last June appeared in the July report. Almost the most conspicuous feature on it was a very large area with pressure above the normal which had its centre to the north-west of the British Isles. The existence of such an area is a demonstration of the weakening of the prevailing damp south-westerly winds that in normal times are directly or indirectly the source of so much of Europe's rainfall. It is interesting to note that although many parts of England, especially eastern England, had less than their normal rainfall in August, the abnormal pressure conditions over the drought area as a whole were absent during that month, pressure being subnormal over almost the whole of North America except northern Canada, as well as over the northern part of the North Atlantic, the British Isles and Central Europe. European rainfall made for the most part a generous response in August to the increased inflow of Atlantic air, more than twice the normal having been measured at Rome, Madrid and Prague, and from one and a half to nearly twice the normal at Paris, Vienna and Berlin. The stormy first week of September in the British Isles, and particularly the activity of the Icelandic 'low', seemed almost to suggest that the abnormal régime was vanishing as quickly and mysteriously as it began, but September has a reputation for spells of quiet sunny weather and before the second week was far advanced the development of a huge European anticyclone marked the beginning of yet another chapter of the drought, the rainfall of the first half of the month being generally below the average.

Theory of Liquids. In Edser's theory of the liquid state, the expression for the surface tension involves $\mu$, the force constant of the inverse $m^{th}$ power law of attraction between molecules, and $\sigma$ the molecular radius. Edser assumed that $\mu$ varied with temperature but later work indicates that in gases $\mu$ is indepndent of temperature. In two recent papers (*Indian J. Physics*, 8, 521; 1934; *Proc. Indian Acad. Sci.*, 1, 105; 1934) Dr. T. S. Wheeler has adopted the view that $\sigma$ increases with temperature. $\sigma$ is regarded as the radius of the spherical space

which the rotation of the molecule keeps clear of other molecules. On this view, Dr. Wheeler obtains expressions for the internal latent heat and other properties. An analysis of experimental data indicates that for certain monatomic and diatomic liquids $m$ is 8, and for many organic liquids has the value 10. A general parachor relation of the form $\gamma \propto V^{-(m+1)/3}$ is deduced simply from Dr. Wheeler's theory. From Macleod's rule the exponent of $V$ should be $-4$, which gives $m = 11$.

**Artificial Radioactivity produced by Neutron Bombardment.** E. Fermi, E. Amaldi, O. D'Agostino, F. Rasetti and E. Segré have recently published an account of their experiments on the artificial production of radioactive elements by bombarding various elements with neutrons (*Proc. Roy. Soc.*, A, Sept.). Preliminary announcements have appeared in NATURE and in Italian papers. The neutrons can enter the nuclei of even the heaviest elements, and more than forty elements have been activated. The activity decays with halving periods varying from a few minutes to some days. In all the cases where the activity was sufficiently strong to be tested by Thibaud's inhomogeneous magnetic deflection method, the particles emitted were found to be β-particles. In many cases the artificial radio-elements could be separated out by chemical precipitations after addition of an isotopic element, and the chemical nature of the radio-elements could therefore be securely placed. The nuclear reactions studied are of the following types:

$$_{13}Al^{27} + {}_0n^1 \rightarrow {}_{11}Na^{24} + {}_2He^4,$$
$$_{14}Si^{28} + {}_0n^1 \rightarrow {}_{13}Al^{28} + {}_1H,$$
$$_{25}Mn^{55} + {}_0n^1 \rightarrow {}_{25}Mn^{56}.$$

**Atomic Arrangement in Alloys.** W. L. Bragg and E. J. Williams have recently published a discussion of the theory of alloys which formed the subject of Prof. Bragg's Bakerian lecture (*Proc. Roy. Soc.*, A, July). The lattice of an alloy differs from that of a chemical compound in that it may be considered as a pattern of sites which may be occupied alternatively by atoms of the different constituents. If there is a regularity in the distribution of the atoms among these positions, it gives rise to a superlattice, but in general, atoms are interchanged between the sites by thermal agitation without destroying the crystalline structure. This is shown by experiments on the interdiffusion of metals and on the effects of heat treatment on the X-ray structure. The present paper regards the crystal as being in a state of dynamic equilibrium, the tendency to form orderly superlattices of lower potential energy being opposed by the random heat motion. A general analysis shows that there is a critical temperature at which a degree of order suddenly appears, an effect closely analogous to that obtained for the Curie point in magnetic theory. A particular measure of orderliness is used which probably corresponds closely to the detection of superlattice structure by X-rays and to the effect on electric resistivity. The discontinuity in properties at this critical temperature simulates a change of phase. A theory of the rate at which an alloy, not in equilibrium, relaxes towards its equilibrium condition, enables the effects of annealing and quenching to be predicted.

**Thermionic Valves for Ultra-High Frequencies.** Reference was made in NATURE of October 14, 1933, p. 608 to the production in an experimental laboratory of a midget type of three-electrode valve for use at radio frequencies corresponding to wave-lengths of less than one metre. The September issue of *Electronics* contains an article by B. Salzberg describing the principles of the design and construction on a manufacturing scale of such 'acorn' tubes, as they are termed—presumably from their shape and size, which is about $\frac{3}{4}$ in. overall. The elements of the tube, comprising an indirectly heated cylindrical cathode, an elliptical grid with a large number of turns, and a rectangular anode, are connected to heavy leads suitably spaced and fastened to a mica base. These leads are sealed through a small glass bowl forming the bottom of the envelope. The conventional form of pinch stem and standard base assembly has thus been abandoned in an attempt to obtain short leads and low losses suitable for working at very high frequencies. The article referred to above illustrates the construction and characteristics of one type of this valve, which has an amplification factor of 25, and an anode circuit resistance of 12,500 ohms. The interelectrode capacitances are 1·0, 0·6, and 1·4 μμF. for the grid to filament, anode to filament and grid to anode paths respectively. Such valves have been operated successfully in the usual retro-action type of oscillator circuit at wave-lengths down to about 40 cm.

**Origin of the Solar System.** H. P. Berlage, Jr., has recently summed up his own work on the 'disc theory' of the origin of the solar system (*Ann. Bosscha-Sterrewacht* (*Lembang, Java*), **4**, 79; 1934). This worker developed an expression for the electrostatic field of the sun, due to its emission of charged particles (*Proc. Kon. Akad. Wet. Amsterdam*, **33**, 614; 1930). He supposes that the sun is continuously emitting positively charged particles, driven off by radiation pressure as suggested by Milne, and that electrons must be driven off in equal numbers by an electrostatic field, so that the sun does not acquire a secularly increasing negative charge. On the assumption that the electrostatic field is stationary, the author proves that the limiting velocities of the two kinds of particles are equal and that the space charge surrounding the sun is alternatively positive and negative. In a later paper (*Proc. Akad. Wet.*, **33**, 719; 1930) he goes on to suggest that if such a sun was surrounded by a disc of nebular matter, this matter would tend to be drawn into rings by the space charge—as soon as an atom has become ionised, it experiences a force drawing it towards a circle, the intersection of the disc with a sphere of minimum potential. The author compares this with Chladni's sand figures on a vibrating plate. The diameters of the rings then satisfy Bode's law. If the limiting velocity is $v_0$ and $n$ material positively charged corpuscles are radiated by the whole sun per second, we must have, if the ring diameters are to coincide with the actual orbits of the planets, $ne^2/mv_0^3 = 80$, where $m$ is the mass of the electron. It is suggested that the solar system actually originated in an original disc being broken up into rings by an electrostatic field, and that the rings later aggregated into planets. It is further suggested that the planetary satellite systems were formed by exactly the same process. The author adds that it remains to be proved that the planets have been the sources of emission of charged particles, and that, so far as he can see, these rays are the sole agencies by which gaseous discs surrounding planets can be compelled to condense into satellites.

## Chemistry of Milk

RECENT work on the chemistry of milk was discussed at a joint session between Sections B (Chemistry) and M (Agriculture) on September 11 at the Aberdeen meeting of the British Association. For convenience the discussion was divided into two parts: (1) a consideration of milk, normal and abnormal, from the analytical point of view; and (2) a survey of recent work on some of the more important organic constituents of milk, namely, casein, milk fat and vitamins.

Prof. H. D. Kay (Reading), in a general introductory paper, pointed out that despite their inherent academic interest and their enormous importance in human nutrition, in agriculture and in industry, it is only comparatively recently that the chemistry and physiology of milk secretion have become subjects of serious study and research. Our fundamental knowledge of lactation from the chemical and biochemical point of view is still surprisingly meagre. To mention a few only of the many questions on which little effective light has as yet been thrown, we are almost entirely ignorant as to what factors control the chemical quality of milk as secreted by the cow; we do not know why the main protein of milk is a peculiar and unusual one—a phosphoprotein—or why milk fat has its very peculiar composition with its high percentage of volatile fatty acids, or why the sugar in milk is lactose and not some more common sugar, or why citric acid is present in appreciable quantities in fresh milk. Have these peculiarities arisen during long ages of evolution to meet specific needs of the young suckling, or are they the result of some secretory necessity of the mammary gland? No answer to these and other fundamental questions, many of which are both scientifically fascinating and economically important, can be attempted until a wider and more precise knowledge of the chemistry of milk is available.

In the analytical part of the discussion, Dr. J. F. Tocher (Aberdeen) considered the composition of milk in relationship to the existing regulations, designed to safeguard the consumer against having his milk spuriously diluted, and described methods used for determining, from the predicted and observed values of certain of the non-fatty solids in the milk, whether or not a sample of milk has been 'watered'. He also described critically his recent work on the determination of the freezing point of milk, the range of variation of which, over a large number of samples of fresh milk, is known to be small, but which according to his own findings is rather larger than the usually accepted range. His variations are from $-0{\cdot}50°$ to $-0{\cdot}56°$ C., and he finds that the mean value of the freezing point of the milk of individual cows is not the same from one herd to another. He advocated caution in making any statement, based on cryoscopic determinations alone, as to the exact quantitative extent to which a given sample of milk has been adulterated with water.

Dr. W. L. Davies (Shinfield) dealt with the limits between which cow's milk may vary in analytical composition and still be considered normal. In abnormal milk the percentage of specific milk constituents, particularly casein and lactose, is usually low. If it is assumed that normal milk contains 76 per cent of its total nitrogen as casein nitrogen, then abnormal milk may be regarded as normal milk plus a diluting fraction, and the nitrogen distribution, chloride content, etc., of the diluting fraction can in any given case be calculated. On making this calculation it is found that the diluting fraction is not far removed in composition from blood serum or from certain types of œdema fluid. These findings appear to put the changes known to occur in abnormal milk on to a more intelligible basis.

A short but lively discussion on these two papers was opened by Capt. John Golding (Shinfield). Capt. Golding believes that Dr. Tocher's range of variation in freezing points is much too great for fresh samples of genuine milk, and quoted a very extensive series of determinations of his own, where, with genuine milk of the most abnormal composition, the freezing point was so constant from one milk to another as to be scarcely ever outside the small experimental error of his method. Never under any conditions has he himself come across a fresh, genuine milk with a freezing point outside the range $-0{\cdot}537°$ to $-0{\cdot}570°$ for mixed milks: 99 per cent of these determinations fall between $-0{\cdot}545°$ and $-0{\cdot}555°$. Mr. A. L. Bacharach (London) emphasised that the long contest between analyst and adulterator is by no means rendered one-sided by the increasing use of the cryoscopic test, despite the remarkable constancy of the freezing point in fresh milk. By careful sophistication with 'solutions of electrolytes', the scientific adulterator can evade even the freezing point test. Sir Robert Robertson (London) mentioned the difficulties that arise if milk for a freezing point test is received after some souring has taken place. It is, however, possible, even with milk in which bacterial changes are already advanced, to compute with some accuracy, from the results of a careful analysis of the milk, what the original composition would have been, and thus give an opinion as to whether the freezing point claimed for the milk in its original fresh condition is likely to be correct.

The second half of the discussion was opened by Dr. K. Linderstrøm-Lang (Copenhagen), who described his work on the fractionation of casein into several different protein components which show marked differences in their content of phosphorus, tyrosine, tryptophane, histidine and alanine, as also in their specific rotation and base-binding capacity. It appears from this work that casein should be regarded not as a single protein of very large molecular weight but as a mixture of smaller protein units, with certain chemical similarities, and possibly very loosely linked together. It forms a co-precipitation system which is, however, fairly readily resolvable by simple physical methods.

Dr. Linderstrøm-Lang also dealt with recent work on the chemical make-up of casein, particularly the form in which phosphoric acid is combined with the rest of the protein molecule. The recent isolation by Lipmann of a new amino acid, phosphoserine, from casein hydrolysates demonstrates that some at least of the phosphorus in casein itself is present linked to serine. From other recent work of Levene and Hill, it may be concluded that a glutamic acid molecule is also a near neighbour of phosphoserine in the casein molecule. Investigations of the rate of splitting off of phosphorus as phosphoric acid suggest that all the phosphorus in casein is bound in a similar way, which is almost certainly an ester linkage to hydroxyamino acids, but all the phosphorus is not necessarily bound to the *same* hydroxyamino acid.

The peculiar constitution of milk fat is emphasised by the recent work which was reported by Prof. T. P. Hilditch (Liverpool). It has been known for some time that there is a large proportion of fatty acids of relatively low molecular weight, from butyric acid upward, in milk fat. Whilst on the whole there is a remarkable constancy in the proportions of the various fatty acids in milk fat from cows in countries so far apart as England, New Zealand and India, there are minor variations depending in part on the diet. Stall-fed cows produce a more saturated butter fat than cows at pasture, and the unsaturation is increased shortly after the cows go out to grass in spring. As the unsaturation increases, the quantity of low-molecular fatty acids diminishes. Increasing age of the cow appears to increase the proportion of oleic acid slightly at the expense of palmitic acid. A diet in which fat containing fatty acids of a particular or unusual type is present influences the composition of the butter fat by slightly increasing the content in the butter of such characteristic fatty acids, and correspondingly diminishing the content of certain of the fatty acids present in normal butter. The influence of cod liver oil is particularly marked in diminishing the amount of volatile fatty acids in the butter.

The comparative heterogeneity of the triglycerides present in butter contributes very considerably to the important economic quality of 'spreadability' and to the relatively low melting point of butter fat.

Dr. S. K. Kon (Shinfield) contributed the last paper. He described work extending over three complete years on the changes in vitamin content of milk throughout the year. Winter butter from cows on the usual winter rations has been clearly shown to have a smaller vitamin content than summer butter from the same cows. Direct photometric measurement of the vitamin A *sensu stricto*, and of the carotene content of butters in relation to their total vitamin A activity as estimated biologically, has yielded the interesting finding that the biological growth-promoting power of true vitamin A of butter is 5–7 times that of an equal weight of butter carotene. Experiments were described which showed that the antirachitic effect of butter is due only in part to the classical vitamin D. There is another factor in butter which, unlike irradiated ergosterol, is easily inactivated during saponification, but which is effective in the prevention or cure of experimental rickets in rats. The reversible oxidation of vitamin C in milk in the presence of light was described. Ordinary daylight even through glass bottles is effective in accelerating this oxidation, which appears to be less and less reversible as the time of exposure of the milk to the light increases.

## The Frontiers of Science

SCIENCE, as an advance of organised knowledge into Nature, is constantly driving its frontiers into the region of the unknown and the unexplained. The record of that conquest is as dramatic and important as any that historians have to analyse and describe. But the frontiers of science are not merely abstract ones in the realm of thought; historically they have also moved geographically into new worlds, and new influences have penetrated into systems of organised knowledge by geographical routes which are still traceable. Within the system of science also, the lines between various departments have been constantly moving and classifications of knowledge transmuted. Historians of science are largely occupied with this problem of the external and internal boundaries of science, and their attempts to map out the development is of great importance as a contribution towards science's understanding of itself.

The increasing self-consciousness of science, shown by the philosophic preoccupations of physicists and biologists and the development of a social conscience by the British Association, stimulates its historical memory. After congresses in Paris in 1928 and in London in 1931, a third international congress under the auspices of the International Academy of the History of Science was held this year in Portugal on September 30–October 6, under the presidency of Dr. Fernando de Vasconcelos. Besides a distinguished group of Portuguese scholars, representatives from, among others, Belgium, Czechoslovakia, Egypt, France, Great Britain, Italy, Morocco, Norway, Roumania, Spain and the United States were present. The absence of German representatives was conspicuous.

The obligations of science and in particular of historians of science were emphasised by Dr. George Sarton of Harvard in an inaugural address. He directed attention to the dangers that threaten the independence of science in many countries to-day, and protested against the prostitution of the history of science to serve the narrow ends of national or political propaganda. He believes that in the true history of science there is a firm basis for international understanding and a potent method of humanising the sciences and more intimately relating the interests of humanists and workers in natural science.

These general questions were considered further in a discussion on the unity of science in which Dr. Henriques of Rome urged that it is one of the important tasks of the history of science to emphasise the relative and temporary nature of the subdivisions of the sciences, often artificially perpetuated by administrative and teaching habits, and to insist always that the necessarily specialised studies of experts should be approached from, or at least related to, the concept of the unity of science. Although the idea of unity raises problems of definition of a metaphysical character, the practical bearing of the suggestion for the teaching of the history of science was recognised by the decision to appoint a committee of the Academy under the chairmanship of Dr. A. Reymond of Lausanne to investigate and report on a programme of international collaboration in the teaching of the history of science.

The international character of science, and the fictitiousness of the boundaries between the various branches of sciences, were shown by the papers presented at the sectional meetings. The general theme was the geographical expansion of scientific knowledge, the function of the various sciences in shaping the movement of European expansion in the age of the discoveries, and the diffusion of knowledge within Western culture. A series of papers by Portuguese representatives showed that the fundamental work of Joachim Bensaude on early Portuguese astronomy has been followed by similar studies in other fields. Perhaps the most important of these papers were

those by Dr. Fontoura da Costa on "Portuguese Maritime Science in the Age of Discoveries", summarising the contributions made by the Portuguese to cartography, navigation technique and other nautical sciences; by Dr. Ricardo Jorge on "The Place of Medicine and Doctors in Portuguese Expansion", particularly interesting for its discussion of the exchange between East and West of drugs and diseases; and by Dr. Arlindo Monteiro on "Portuguese Influence on Japan". They showed how fundamental scientific and technical advances are to overseas discovery and what complex repercussions the discoveries had on European learning.

Among the other papers illustrating this general theme of the movements of learning were those by Dr. Fernando Correia on "Portugal in the History of Public Health", and more specialised studies by Dr. Max Meyerhof, M. Tricot-Royer, Dr. H. Renaut, M. Quido Vetter and Dr. Joachim de Carvalho. It is intended to publish these and other papers presented to the Congress shortly.

The social success of the Congress was due to the well-conceived plans of the secretary, Dr. Alberto Pessoa, and the genius which the Portuguese possess for cordial hospitality. The opening session was held at Oporto, which gave the members of the Congress an opportunity to see the Colonial Exhibition and the impressive historical procession through the city illustrating Portuguese expansion which marked the end of the exhibition. After a reception by the municipality in Oporto and excursions to Gaia and the wine vaults, the Congress travelled to Coimbra and held its main sessions in the beautiful buildings of that old University, in the library of which a special exhibition of medical books of the sixteenth and seventeenth centuries had been arranged. Official receptions were given by the Rector of the University and by the municipality. The members of the Congress then travelled by motor coach to Lisbon, visiting the monasteries of Batalha and Alcobaça, and being officially received by the municipality of Caldas da Rainha. The closing session at Lisbon was followed by a reception by the municipality. In this way, members of the Congress were enabled to see very fully the richness of the historical remains in Portugal and to appreciate the greatness of its colonial past and present.

The International Academy decided to hold its next Congress in Prague in 1937, under the presidency of M. Quido Vetter.

## Bearing Metals

IT is now nearly a century since Isaac Babbitt introduced a bearing comprising a liner of a relatively strong and rigid material coated with a thin layer of white metal. The advantages of this combination have proved of great importance in engineering practice, but more attention has been directed to the metallurgy of the white metal coating than to the mechanics of the bearing as a whole.

The advent of the high-speed aeroplane has brought in its train certain difficulties, particularly a type of cracking of the white metal which has been generally ascribed to 'fatigue', though the evidence for this has not been conclusive. The Institute of Metals at its meeting in Manchester on September 4 devoted considerable attention to this question. D. J. Macnaughtan, director of the International Tin Research and Development Council, presented a general discussion of this type of cracking and for the first time provided a rational explanation of the stress conditions under which the fatigue is set up. In essence, the explanation depends upon the simultaneous action in the white metal of a varying compressional stress and a tension which appears to be mainly due to the different coefficient of contraction of the bearing metal and the liner into which it is cast.

From this work the conclusion may be drawn that the fatigue range of the antifriction metal is the mechanical property of prime importance, though the coefficient of expansion of the liner, by determining the value of the tension, plays an important part. The author showed that in a series of copper, antimony, tin alloys with 3·5 per cent of copper, the fatigue range increases as the antimony content is raised up to about 10 per cent. It is generally recognised that in similar materials the tensile strength and the fatigue range follow more or less parallel curves, whilst in addition the Brinell hardness number would be expected to follow a similar course. The confirmation that in the white bearing metals these three properties are interconnected results in the tensile strength and the Brinell hardness, which are relatively easily determined, representing reasonable qualitative measures of the fatigue limit.

This paper was followed by an account of three researches on the general behaviour of white bearing metals when subjected to various deformation tests. Part 1, by A. S. Kenneford and Dr. H. O'Neill, dealt with the measurement of hardness and, quite apart from the specific application of this work to the bearing metals themselves, forms a very valuable contribution to the general question of the measurement of hardness of soft metals. If one particular section of this research may be picked out for special reference, it is the use of cones of the alloy, chill cast with an angle of 60°, which are compressed under known loads. The degree of compression gives a measure of the hardness of the material, whilst the cracking, or absence of it, of the lip extruded at the top, provides qualitative information regarding its ductility.

The tensile strength at ordinary temperatures of a number of typical white metal bearing alloys cast at different temperatures and into moulds at different temperatures, are recorded in a paper by R. Arrowsmith. The strongest alloy was found to be one containing about 10 per cent of antimony and 4 per cent of copper hardened by the addition of 1 per cent of cadmium. The best casting conditions were a pouring temperature of 450° C. into a mould at about 200° C.

The third and last section of the work dealt with pounding tests by H. Greenwood. Despite the obvious practical importance of a test of this character, very little work has previously been done and even this is by no means free from criticism. Greenwood has shown that the rate of deformation—after a preliminary period due to the bedding-in of the indenting tool into the bearing—is constant, and may be employed to give a strictly quantitative measure of the resistance of the alloy to pounding stresses. The alloy which gave the highest tensile strength was also found to be most resistant to this type of deformation. These tests have been carried

out at temperatures up to 160° C. using 100,000 blows from a modified Stanton impact testing machine as standard.

The results published in these papers represent a preliminary survey of the mechanical properties of white bearing metals which is essential if the effect on the standard alloys of other additions is to be measured. The work, which has been carried out in the Metallurgical Department of the University of Manchester, has been rendered possible by financial assistance from the International Tin Research and Development Council, and is, even in its present stage, one of the most comprehensive examinations of these alloys which has yet been undertaken. F. C. T.

## The Origins of Plankton

IN the course of a discussion on the "Biological Problems of Fresh Water" before a joint meeting of Sections D and K of the British Association at Aberdeen (NATURE, Sept. 22, p. 467), Prof. F. E. Fritsch pointed out that one of the outstanding problems confronting workers in this field is that of discovering the origins of the many recurrent cycles of free-floating organisms (plants and animals) that occur in the surface layers of standing waters and at times populate them in such enormous numbers that they lend a definite colour to the water.

Such populations, constituting the plankton, often last only for a few weeks and then vanish completely, only to reappear each year usually at approximately the same time. They are often a source of considerable trouble in reservoirs. On the other hand, the plankton is also of great economic importance in that, directly or indirectly, it constitutes an important part of the food-supply of fish.

A small number of the manifold plants (algæ) of the plankton, at the end of their period of abundance, form special resting-stages (spores) which gradually sink to the bottom or into the deeper waters, but there is no evidence that this is of general occurrence. Most species must persist from one season to the next in the form of occasional unaltered individuals. The problem at issue is whether such persisting individuals and spores remain viable wherever they are deposited, or whether it is only those that settle in the shallower waters round the banks that retain their vitality and give rise to a fresh crop in the next season. It is known that some of the diatoms of the plankton are bred in the shore waters and from there gradually spread into the general body, but for the vast majority of plankton algæ there is no evidence that this happens, and it is likely that many are derived from spores or persisting individuals which have lain dormant at the bottom under the deeper waters during their period of absence from the surface layers. This is particularly likely to be true of the numerous blue-green algæ of the plankton. These forms owe their buoyancy to the development of minute cavities, containing gases, in the protoplasm of their cells. Continental workers have found some evidence that these so-called gas-vacuoles are a result of the fermentation processes which are believed to take place in the cells in the absence of oxygen, when such forms—either as individuals or spores—are resting at the bottom. The production of gas renders them buoyant so that they float to the surface and appear in the plankton, while new spores which lack the gas-vacuoles are heavier than water and again sink to the bottom.

It is thus probable that the plants of the plankton are recruited from two sources, in part from resting-stages or persisting individuals lying on the bottom under the deeper waters, and in part from similar stages that survive near the banks. The degree of importance of the latter element will depend on the extent of the shallow water near the banks and the facilities for the distribution of the forms growing there into the open water.

Much detailed research is still requisite before precise knowledge on these matters is available, research which is of fundamental importance in all aquatic biological investigations. G. A. S.

## University and Educational Intelligence

CAMBRIDGE.—J. S. Turner of Selwyn College has been appointed University demonstrator in botany.

L. J. Audus of Downing College has been appointed to the Frank Smart University studentship in botany.

At Queens' College the following have been elected into reserved fellowships :—F. Goldby of Gonville and Caius College, University demonstrator in anatomy ; J. A. Ramsay of Gonville and Caius College. At Downing College, E. B. Verney, Shield reader in pharmacology, has been elected into a professorial fellowship.

LEEDS.—Dr. L. H. Stickland has been appointed biochemist in the Cancer Research Laboratories, in succession to Dr. Havard, who has resigned.

LONDON.—The Surrey County Council has decided to make a grant of £50,000, payable over ten years and subject to the approval by the County Council each year of the inclusion of the amount in the annual estimates, towards the erection of the University buildings in Bloomsbury. A grant towards the same purpose of £10,000, payable over ten years, has also been made by the Hertfordshire County Council. The Worshipful Company of Turners has made a donation towards the Ceremonial Hall.

FOREIGN students in the United States in 1931 numbered more than eight thousand according to a report recently published by the Federal Office of Education, as Pamphlet No. 48 on "Residence and Migration of College Students". A similar report published in 1926 as Bulletin No. 11 gave the number of foreign students in 1923 as 6,692. Although the two sets of statistics are not strictly comparable, it seems clear that there has been a substantial increase in the number of students resorting to the United States from other countries for post-secondary education and for research. Analysing the figures according to the students' home-residence, one finds noticeable increases under Canada (from 1,251 to 1,896), Mexico (298 to 402), Central America (118 to 187), Colombia (40 to 67), Scotland (26 to 55), Ireland (32 to 59), Belgium (30 to 51) and Italy (35 to 82), but decreases under China (1,605 to 1,317), Japan (583 to 502), India (288 to 235), Russia (190 to 153), South Africa (130 to 73), Argentina (51 to 29), Chile (60 to 36) and Peru (54 to 25).

## Science News a Century Ago

### Meteorology in America

On October 29, 1834, a joint committee of the American Philosophical Society and the Franklin Institute issued a circular with the object of obtaining a complete knowledge of all the phenomena accompanying one or more storms of rain or hail, not only where the violence of the storm was felt but also at and beyond its borders. Various hints were given to observers on the observation of the wind and clouds. They were asked particularly to "inquire the course of the wind at the commencement of the storm, and at its termination; the width of the storm; its direction; its velocity; the direction of the wind at its sides; how the wind veers round—whether in different directions at its sides, or not; whether in case of hail, there are two veins, or only one; where there is the greatest fall of rain . . . and whether this fall takes place near the beginning, middle, or end of the storm; whether the clouds are seen moving with the wind or against it; and whether differently among themselves; and everything else which you think may tend to an explanation of this most interesting phenomena." The circular gave instructions for the construction and use of simple apparatus for taking the dew-point, but it said nothing about observing the movements of the barometer.

### Road Travel a Century Ago

On Friday, October 31, 1834, the *Times* published a long account of a dinner given two days earlier in Glasgow to the Earl of Durham. At the same time it gave some information as to the methods by which news had been obtained so quickly. "Our express," it said, "left Glasgow at 12 o'clock on Wednesday night and reached us at half past 7 o'clock this morning. . . . On completing a second journey of considerable length and extraordinary speed we should be guilty of great injustice if we did not offer our warmest acknowledgements to the innkeepers throughout the whole line for the zeal and ability with which they accomplished their essential part of the task. . . . The mode by which a more expeditious communication between London and Edinburgh may be obtained is obvious. All local feelings and prejudice should be laid aside. An accurate survey of the whole extent of the road should be procured, similar to that which was made some years ago of the country between London and Holyhead. . . . It will be found that in Scotland the distance may be reduced not less than 30 miles, and a new road from Doncaster to Selby affords a further reduction of five miles. The mail may thus perform the journey from Edinburgh to London in three hours and a half less than the present time, without increasing the speed to a degree which would be dangerous to the passengers and ruinous to the contractors".

### Public Education in Great Britain

A Select Committee of the House of Commons was appointed in June 1834 to inquire into the state of education in England and Wales, but by the end of the session, it had only examined 21 witnesses and thus was not in a position to issue a report. Certain evidence was, however, printed, and on November 1 the *Times* published some of that given by the Lord Chancellor. To the question, "Do you think that a system of primary education established by law would be beneficial?" he had replied, "I think that it is wholly inapplicable to the present condition of the country, and the actual state of education. Those who recommend it on account of its successful adoption on the Continent, do not reflect upon the funds which it would require". It was probable, he said, that the present schools supported mainly by voluntary contributions were capable of educating nearly 1,400,000 children. For the Government to establish schools throughout the country for 2,000,000 children, no fewer than 40,000 schools would be required "which allowing only 50£ a year for all expenses of salary and rent would cost 2,000,000£ a year". The Lord Chancellor also considered that compulsory education was not justifiable on principles of public utility or expediency.

## Societies and Academies

### PARIS

Academy of Sciences, September 17 (*C.R.*, 199, 593–608). CHARLES CAMICHEL, EUGÈNE FISCHER and LÉOPOLD ESCANDE: The use of different vertical and horizontal scales in studies on reduced models in hydraulics. The practice is common in laboratory experiments in hydraulics. There is no geometrical similitude between the work and the model: the latter is a conventional representation of the work to be studied and there is no theoretical reason for assuming that the hydraulic movements existing in the model will be the representation, on the same conventional bases, of phenomena capable of being reproduced in the work. Experiments bearing on this problem are described and it is found that in some respects, such as the surfaces examined in the actual study, there is no concordance between the various models. PAUL DELENS: Isothermal families of developable surfaces. A. J. MACINTYRE: A theorem on ultraconvergence. R. DE MALLEMANN and P. GABIANO: The magnetic rotatory power of hydrogen arsenide and of hydrogen phosphide. Hydrogen arsenide gave a Verdet constant of $A_0^{760} = 68 \times 10^{-6}$ (minute): hydrogen phosphide, $A_0^{760} = 57 \times 10^{-6}$ (minute). J. WOHLGEMUTH: Study of the binary systems water — sodium hydrazoate, water — potassium hydrazoate. T. TARADOIRE: The action of sulphur on chlorates. Mixtures of barium chlorate and sulphur, or of lead chlorate and sulphur are stable when dry and can be kept for a long time in closed vessels without alteration. On adding water, these mixtures after a time inflame spontaneously at the ordinary temperature. The presence of combustible material is not a necessary condition for inflammation. LOUIS FAUCOUNAU: The action of ethylene oxide on acetylene magnesium compounds: the preparation of substituted acetylenic alcohols of the type $R.C \equiv C.CH_2.CH_2OH$. The preparation and properties of the alcohols containing amyl, hexyl and phenyl are described. ALFRED CARPENTIER: Contribution to the study of the male fructifications of the Neuropterideæ.

September 24 (*C.R.*, 199, 609–620). D. POMPEIU: The definition of analytical functions of two variables. MLLE. SUZANNE VEIL: Qualitative chemical observations in flat sheets of gelatine. The two drop method on a gelatine plate, previously studied from the point of view of the periodicities of precipitation, can be used as a general method of qualitative analysis. Some examples are given. HENRI GAULT and ALBERT ROESCH: Dimethylolmalonic acid and

ester. ROBERT LAMI : Specific alkalinisation and the distribution of Algæ in coast pools. A. JHILLET and R. ZITTI : *Molinia cærulea*, a toxic grass, containing hydrocyanic acid. MLLE. EDNA HARDE : Ascorbic acid (vitamin C) and toxic effects. From the observations described it would appear that ascorbic acid exerts a protective function against a certain number of infections and toxic effects, especially those giving rise to lesions of the suprarenal cortex and the gastro-intestinal tract.

CRACOW

Polish Academy of Science and Letters, July 2. E. ZYLINSKI : Some linear spaces. M. WOJCIECHOWSKI : Thermochemical researches on the diazo derivatives of *p*-chloraniline and of some other amines. K. DZIEWONSKI, ST. KUZDRZAL and J. MAYER : Studies on 2,7-diacetofluorene. K. SMOLENSKI and S. KOWALEWSKI : A combustible liquid obtained starting with ethylene. With an initial pressure of 34–90 atmospheres, polymerisation commences at 300°–350° C. and is completed at 400° C. The whole of the ethylene can be converted into liquid products. H. LICHE : The photic reactions of *Limnaea stagnalis*. Proof that the gasteropods can distinguish colours. J. ZACWILICHOWSKI : Researches on the innervation of the sensorial organs of the wing of *Oxypterum* (*Diptera puppipara*). L. W. WISNIEWSKI : *Prohemistomulum opacum*, larval form of the Cyathocotylidæ (Trematoda). S. KÉLER : The Mallophaga of Poland. ST. SMRECZYNSKI : Contributions to the knowledge of the embryonic development of the curculionid, *Phyllobius glaucus*. L. J. BLACHER, L. D. LIOSNER and MME. A. WORONZOWA : The mechanism of the perforation of the opercular membrane in the tail-less batrachians.

GENEVA

Society of Physics and Natural History, July 5. CH. WAKKER : The application of some photoelectric cells to the determination of nitrous gases and ozone. The author describes a continuous and rapid method of determination of the oxides of nitrogen and of ozone utilising selenium or gas photoelectric cells : he shows that the former are more easy to use and are generally more certain. J. WEIGLE and H. SAINI : The transformation of ammonium bromide at − 40° C. The study of ammonium bromide (cubic lattice) has been carried out below its transformation point (about − 40° C.) first by the Laue method and then with a Böhlin precision chamber. These researches have shown that this salt ceases to be cubic below − 40° C., confirming the observations of Hettich, who found that at a low temperature it becomes doubly refracting. J. WEIGLE and R. LUTHI : Some negative results on the dielectric constant. Acting with ultra-sound waves on liquids, distilled water, acetone, nitrobenzene, amyl alcohol, butyl alcohol, it was attempted to destroy the relative arrangement of the molecules. Measurements of the dielectric constant showed no variation. Further measurements with liquids in eddying flow also gave no result. Now it is known that in the latter case the molecular arrangement is disturbed and consequently a change in the dielectric constant might be expected. The fact that it is invariable gives an important indication. J. WEIGLE and F. HUBER : The transformation of ammonium chloride at − 30° C. The authors have studied the transformation of ammonium chloride by means of the X-rays. The lattice expands but retains its shape. The transformation extends over an interval of about 5° C. These microscopic measurements differ considerably from macroscopic observations. P. BERNAYS and P. HERTZ : The axioms of Archimedes and of Cantor. We call the following proposition the topological Cantorian axiom : given a nest of segments, that is, a collection of segments each of which with the exception of the first is contained entirely inside the preceding, there is a point in the interior of all the segments. The question arises if the axiom of Archimedes is independent of the above. The reply to this question is in the affirmative and an example is given. G. TIERCY and A. GROSREY : The width of spectrograms of stars of the type *F*0. G. TIERCY and A. GROSREY : The width of spectrograms for stars of the type *G*5. The authors discuss the variation of the width of a spectrogram as a function of the magnitude of the star and of the time of exposure, as has been done earlier for other types of spectra. P. ROSSIER : The generalisation of the Russel formula for the calculation of the colour index of a star. A formula given by the author which takes account of the fact that receivers of radiant energy have an extensive range of sensibility, contains Russel's formula as a particular case, on condition that the sharpness of the sensibility maxima is infinite. P. ROSSIER : Relation between the effective wave-length and the absolute colour index of a star. These two magnitudes are generally expressed as functions of the temperature. Eliminating this, a relation is obtained in which only the magnitudes deduced directly from experiment appear. CH. E. GUYE : The ascending propagation of imbibition. W. H. SCHOPFER : (1) The nature of the growth factor of micro-organisms. The author discusses recent work of Wassink (Utrecht) which entirely confirms observations made during the last four years, namely, the necessity of a thermostable growth factor for the growth in a synthetic medium of *Phycomyces*. (2) The preparation by dialysis of the growth factor of micro-organisms. Its existence in the anthers of various flowers. The author has perfected a new technique for the extraction by dialysis of the growth factor of micro-organisms at the temperature of − 2° C. After some hours, a dialysate is obtained containing very little dry extract but a large quantity of growth factor. Tests have been carried out with pure wheat germs, normal or irradiated, stamens, pollen, as well as with the styles of various flowers. The dialysates of the wheat germs are more active than the usual preparations. The existence of the growth factor in pollen grains, already suggested as the result of practical trials with pollen from orchids, is fully confirmed. F. BATTELLI, DON ZIMMET and A. HERSCHBERG : The effects of the application of the skin secretion of the green frog (*Rana esculenta*) to open wounds : 'ranacicatrine'. L. W. COLLET and ED. PAREJAS : Contribution to the study of the Tertiary of the Saleve (1). The region of Mornex. The authors show that the upper part of the Mornex conglomerates, which have been considered by Joukowsky and Favre as representing a continental facies (siderolithic), are marine beds, as proved by fossils. They determine the Oligocene transgression. R. WAVRE : On the representation of certain multiform harmonic functions.

LENINGRAD

Academy of Sciences (*C.R.*, 2, No. 8). L. KANTOROVITCH : Conformal representation of multiconnected areas. A. SVETLOV : On the asymptotic expression of Bessel's functions with high indices. V. FESENKOV :

Determinations of the equivalent thickness of atmospheric ozone made at the Astrophysical Laboratory of Kutchino. P. TCHERENKOV : Visible luminosity of pure fluids under the influence of γ-radiation. S. I. VAVILOV : Possible causes of the blue γ-luminosity of fluids. M. P. BRONSTEIN : Some properties of radiation of very high "energy density". R. JAANUS and J. SCHUR : A new method of determining the magnetic susceptibility of gases and vapours. P. P. LAZAREV and Z. V. BULANOVA : Changes in the rate of reconstitution of the visual purple during pregnancy. P. P. LAZAREV, N. PILMANN and A. GAMBURCEVA : Influence of carbon monoxide on the adaptation of the eye. G. SMYSHLIAJAEV : Some special cases of the heating effect of the electric current in electrolytes and gases. G. CHELINTSEV : Mechanism of ester condensations. A. POLESITSKII : Distribution of radioactive elements between a liquid phase and a solid crystalline phase. The distribution of radium between the solution and the crystals of $BaCl_2.2H_2O$ in the presence of hydrochloric acid. M. IGNATJEV : Mathematical treatment of data on twins. G. CHRUSCOV : The cultures of blood leucocytes as a method of investigating the somatic karyotype of man. W. KROKOS : Contribution to the nomenclature of the quaternary deposits in Ukraine. A. TARANEC and A. ANDRIASHEV : A new genus and species, *Petroschmidtia albonotata* (Zoarcidæ, Pisces), from the Okhotsk Sea. D. TALIEV and A. BAZIKALOVA : Preliminary results of a comparison of the Baikal and the Caspian faunas by the method of precipitin reaction.

Academy of Sciences (*C.R.*, 2, No. 9). V. D. KUPRADZE : The solution of the limiting value of Helmholtz problems in exceptional cases. N. KOSHLIAKOV : Some identities in quadratic fields. L. KANTOROVITCH : A method of approximate solution of differential equations. J. MINDLIN : The generalisation of a development by Schlömilch. M. ELIASHEVICH : The high rotational levels of the water molecule. B. M. WUL and I. M. GOLDMANN : Penetrating a compressed gas in a non-homogeneous electric field. V. FREDERIKS and V. TSVETKOV : Orientation of molecules in a thin layer of anisotropic liquid and the measurement of two constants indicating their elasticity. G. LAEMMLEIN : Experimental production of vicinal phases on a growing crystal. P. DANKOV : Investigation of the surface of iron by the electronogram method. N. PREOBRAZHENSKIJ, A. POLIAKOVA and V. PREOBRAZHENSKIJ : Synthesis of homopilopic acids. V. SADIKOV, V. MENSHIKOVA, R. KRISTALLINSKAJA, E. LINDQUIST-RYSAKOVA, E. HALECKAJA, A. PESINA and L. RUBEL : Catalytic splitting of the serumalbumin by 3 per cent sulphuric acid. D. MICHLIN and Z. ZAPRUDSKAJA : Synthesis of fat in the milk gland. N. KRASILNIKOV : The developmental history of the soil microbacteria. N. CHLEBNIKOVA and G. BOLONOZ : Biochemical control of heat resistance. N. N. JAKOVLEV : A specimen of the genus *Gymnosolen* from the lower Cambrian in Eastern Siberia. P. SCHMIDT and A. TARANEC : The new southern elements in the ichthyofauna of the northern part of the Sea of Japan. N. KOZHANTCHIKOV : The rôle of the energy metabolism in the pupal development of *Agrotis segetum*, Schiff. and of *Ephestia kühniella*, Zell.

### MELBOURNE

Royal Society of Victoria, July 12. ROBERT B. WITHERS and R. A. KEBLE : The palæozoic brittle-stars of Victoria. This paper completes the work of the authors on the palæozoic Stelleroidea of Victoria. The list of brittle-stars in Victoria has been increased from 4 to 13 species. Seven of these are new to science and two new to Victoria. With one exception, this includes all the palæozoic brittle-stars recorded in Australia. The 13 species are comprised in 10 genera. R. T. PATTON : Ecological studies in Victoria (3). Coastal sand dunes. The flora is closely allied to characteristic Australian genera, although specifically there is no close connexion. The leaves are comparatively large and range from succulent, with 1,300 per cent of water, to sclerophyllous, with 118 per cent. Although the leaves are xeromorphic, the plants cannot be regarded as xerophytic, since generally there is no deficiency of moisture in the sand. The rainfall is fairly evenly distributed over the year and this sinks to lower levels in the sand. Experiments with dune-sand show that the amount of moisture in the upper layers is affected by time, depth of moist sand, and holding capacity of the sand itself. The sand-grains are mainly 1/40–1/80 in. in diameter. The vegetation consists of three phases, grass phase (*Spinifex hirsutus*), shrub phase (*Acacia Sophoræ*, *Olearia axillaris*), and tree phase (*Banksia integrifolia*, *Leptospermum lævigatum*). From front to rear the dunes exhibit a series of successions, in species, life forms, soil cover, and soil acidity. E. S. HILLS : Some fundamental concepts in the physiography of Victoria. Evidence is adduced for the existence of relics of a Cretaceous land surface, which upon uplift and dissection gave rise to the Oligocene (?) surface upon which the Older Basalts were extravasated. The divide in Older Basaltic times was close to its present position. Post-Kalimnan earth movements have determined the major topographic features of the State, with a maximum uplift in the Middle or Upper Pliocene. The existence of Tertiary faulting in the Eastern Highlands is questioned and stress is laid on the differential erosion as the chief factor determining the topography. F. CHAPMAN, W. HOWCHIN and W. J. PARR : A revision of the nomenclature of the Permian Foraminifera of New South Wales. This revision of the nomenclature published in 1905 is necessitated by the great advances made in the group during the last twenty years. Critical notes are given on the genera *Monogenerina*, *Spandelina* (including *Spandelinoides*) and *Geinitzina*. *Geinitzina* has a finely perforate shell-wall, and also, along with *Frondicularia woodwardi*, the rare character amongst palæozoic foraminifera, a stellate aperture. In the microspheric form there is a gently curved series of three or four chambers following the proloculum. This lends support to Hofker's theory that the openly coiled Marginuline type of the Nodosarians is geologically older than the closely coiled Cristellarians (*Lenticulina*). FREDERICK CHAPMAN : New species of a crinoid (*Lecanocrinus*) and a cephalopod (*Ophidioceras*) from the Silurian of Yass. *Lecanocrinus breviarticulatus*, sp. nov. is represented by a more or less perfect crown attached to a well-preserved mould of the stem. It is compared in general features with *L. billingsi* Angelin, from the Silurian of the Island of Gotland. This species was discovered by Mr. A. J. Shearsby and is apparently the first occurrence of the genus in Australia. *Ophidioceras giblini*, sp. nov. has distinctive features which separate it from known species in the Silurian of England and Bohemia. This fine specimen represents the first occurrence of the genus in Australia.

## Forthcoming Events

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

### Sunday, October 28

BRITISH MUSEUM (NATURAL HISTORY), at 3 and 4.30. Dr. A. T. Hopwood: "Geological Galleries".*

### Tuesday, October 30

ROYAL INSTITUTION, at 5.15.—Olaf Bloch: "Progress and Problems in Photography".

THE EUGENICS SOCIETY, at 5.15—(at the Linnean Society, Burlington House, London, W.1). Prof. H. Muckermann: "The Eugenic Movement in Germany".*

BEDFORD COLLEGE, LONDON, at 5.15.—Dr. Edwin Deller: "Some Principles of University Administration" (Stevenson Lecture).

### Thursday, November 1

ROYAL SOCIETY, at 4.30.—Discussion on "The John Murray Expedition". Opening address by Lieut.-Col. R. B. Seymour Sewell.

LONDON (R.F.H.) SCHOOL OF MEDICINE FOR WOMEN, at 5.30. Prof. G. Barger: "Some Chemical Problems related to Pharmacology" (succeeding lectures on November 2 and 9).*

### Friday, November 2

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—C. Day: Presidential Address.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.—Sir Arthur W. Johns: "Recent Progress in Naval Architecture" (Third Andrew Laing Lecture).

ROYAL INSTITUTION, at 9.—Dr. F. W. Aston: "Elements and Isotopes".

## Official Publications Received

### GREAT BRITAIN AND IRELAND

The Royal Technical College, Glasgow. Calendar for the One Hundred and Thirty-ninth Session, 1934–1935. Pp. 460+xxiv. (Glasgow.)

Air Ministry: Aeronautical Research Committee: Reports and Memoranda. No. 1590 (T. 3410, Part 2): An Experimental Investigation of the Wake behind an Elliptic Cylinder. By Dr. G. J. Richards. Pp. 6+6 plates. 9*d*. net. No. 1591 (S. 174): Full Scale Water Resistance in Steady and Accelerated Motion. By E. T. Jones. Pp. 30+16 plates. 1*s*. 9*d*. net. No. 1594 (S. and C. 590): Landing and Take-off Speeds of Aeroplanes. By R. S. Capon. Pp. 7+2 plates. 6*d*. net. (London: H.M. Stationery Office.)

Empire Cotton Growing Corporation. Second Conference on Cotton Growing Problems, July 1934: Report and Summary of Proceedings. Pp. 340. (London: Empire Cotton Growing Corporation.) 2*s*. 6*d*.

Directory for the British Glass Industry. Compiled by G. S. Duncan. Third edition. Pp. 412. (Sheffield: Society of Glass Technology.) 4*s*.; to Members of the Society, 3*s*. 6*d*.

University of Manchester: Faculty of Technology. Prospectus of University Courses in the Municipal College of Technology, Manchester, Session 1934–35. Pp. 396. (Manchester.)

Reports of the Imperial Economic Committee. Twenty-eighth Report: Maize. Pp. 60. (London: H.M. Stationery Office.) 1s. net.

Air Ministry: Aeronautical Research Committee: Reports and Memoranda. No. 1522 (T. 3298): Interference between Bodies and Airscrews, Part 2. By C. N. H. Lock and H. Bateman. Pp. 27+3 plates. 1*s*. 6*d*. net. No. 1584 (T. 3329 and "B"): Effect of a Contraction on the Turbulence in a Fluid Stream. By A. Fage. Pp. 8+2 plates. 6*d*. net. No. 1587 (S. and C. 540 and "b", 567): Wind Tunnel Tests on (1) Frise Aileron with Raised Nose, (2) Hartshorn Ailerons with Twisted Nose. By A. S. Hartshorn and F. B. Bradfield. Pp. 13+8 plates. 9*d*. net. (London: H.M. Stationery Office.)

Proceedings of the Royal Irish Academy. Vol. 42, Section C, No. 7: Studies in the Significance of the Irish Stone Age; The Campignian Question. By C. Blake Whelan. Pp. 121–143. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.) 1*s*.

Ministry of Agriculture and Fisheries: Fisheries—England and Wales. Salmon and Freshwater Fisheries: Report for the Year 1933. Pp. 44+6 plates. (London: H.M. Stationery Office.) 1*s*. 3*d*. net.

Recommendations of the British X-Ray and Radium Protection Committee. Fourth revised Report (June 1934). Pp. 10. (London: Prof. S. Russ, Middlesex Hospital.)

Aeronautical Research Committee. Report for the Year 1933–34. Pp. iv+89+4 plates. (London: H.M. Stationery Office.) 1*s*. 6*d*. net.

### OTHER COUNTRIES

Memoirs of the American Academy of Arts and Sciences. Vol. 17, No. 2: The Wood-Feeding Roach Cryptocercus, its Protozoa and the Symbiosis between Protozoa and Roach. By L. R. Cleveland, in collaboration with S. R. Hall, Elizabeth P. Sanders and Jane Collier. Pp. x+185–342+60 plates. (Boston, Mass.)

Bulletin of the Bingham Oceanographic Collection. Vol. 4, Art. 6: Report on Experimental Use of a Triangular Trawl for Bathypelargic Collecting, with an Account of the Fishes obtained and a Revision of the Family Cetomimidæ. By Albert Eide Parr. Pp. 59. Vol. 4, Art. 7: Littoral Penæidea chiefly from the Bingham Oceanographic Collection, with a Review of *Penæopsis* and Descriptions of Two New Genera and Eleven New American Species. By Martin David Burkenroad. Pp. 109. (New Haven, Conn.)

Field Museum of Natural History. Botany Leaflet No. 17: Common Weeds. By Paul C. Standley. Pp. 32. (Chicago.) 25 cents.

U.S. Department of Agriculture. Technical Bulletin No. 376: Habits, Life History and Control of the Mexican Bean Beetle in New Mexico. By J. R. Douglass. Pp. 46. (Washington, D.C.: Government Printing Office.) 5 cents.

Brooklyn Botanic Garden Record. Vol. 23, No. 4: Prospectus of Courses, Lectures and other Educational Advantages offered to Members and to the General Public, 1934–35. Pp. xi+211–246. (Brooklyn, N.Y.: Brooklyn Institute of Arts and Sciences.)

National Research Council of Japan. Report, Vol. 2, No. 2, April 1932–March 1933. Pp. iii+71–144. (Tokyo.)

Report of the First Scientific Expedition to Manchoukou under the Leadership of Shigeyasu Tokunaga, June–October 1933. Section 2, Part 1: Report of Diggings at Ho-Chia-Kou, Ku-Hsiang-Tung, Kirin, Manchoukou. By Shigeyasu Tokunaga and Nobuo Naora. Pp. iii+119+7+42 plates. (Tokyo: Waseda University.)

Union Internationale de Chimie. Premier Rapport de la Commission Permanente de Thermochimie. Texte de W. Swietoslawski et L. Keffler. Traduction allemande de W. A. Roth; Traduction anglaise de L. Keffler. Pp. 32. (Paris: Union Internationale de Chimie.)

Tanganyika Territory: Department of Geological Survey. Annual Report, 1933. Pp. iii+60. (Dar es Salaam: Government Printer.) 2*s*. 6*d*.

Colony of Mauritius: Department of Agriculture. Eighth Progress Report, being the Fourth Annual Report of the Sugarcane Research Station, Mauritius, for the Year 1933. Pp. 53+8 plates. (Port Louis: Government Printer.)

Smithsonian Miscellaneous Collections. Vol. 91, No. 16: Reports on the Collections obtained by the First Johnson-Smithsonian Deep-Sea Expedition to the Puerto Rican Deep—New Marine Mollusks. By Lois F. Corea. (Publication 3258). Pp. 9+3 plates. (Washington, D.C.: Smithsonian Institution.)

U.S. Department of the Interior: Office of Education. Bulletin, 1934, No. 4: The Welfare of the Teacher. By Dr. James Frederick Rogers. Pp. v+69. 10 cents. Leaflet No. 38: Instruction in the Effects of Alcohol and Tobacco. By Dr. James Frederick Rogers. Pp. 7. 5 cents. Pamphlet No. 53: Statistics of High Schools in Larger Cities. By Carl A. Jessen; Statistical Work by Lula M. Comstock. Pp. 11. 5 cents. (Washington, D.C.: Government Printing Office.)

U.S. Department of the Interior: Geological Survey. Water-Supply Paper 738: Surface Water Supply of the United States, 1932. Part 12: North Pacific Slope Basins. B: Snake River Basin. Pp. vii+197. 15 cents. Circular 10: The McCoy Mining District and Gold Veins in Horse Canyon, Lander County, Nevada. Papers by F. C. Schrader. Pp. ii+13. Circular 11: Review of the Petroleum Industry in the United States, April 1934. Compiled by Hale B. Soyster, in collaboration with G. B. Richardson, R. W. Richards, Foster Morrell, H. C. Fowler, G. R. Hopkins, A. J. Kraemer, A. C. Fieldner and H. J. Struth. Pp. iii+50. (Washington, D.C.: Government Printing Office.)

Conseil Permanent International pour l'Exploration de la Mer. Rapports et procès-verbaux des réunions, Vol. 90: Size-Limits for Fish and Regulations of the Meshes of Fishing Nets; Reports of the Proceedings of the Special Biological Meeting held on June 4th and 8th, 1934, at Copenhagen. Pp. xv+61. (Copenhague: Andr. Fred. Høst et fils.) 3.00 kr.

Report of the Aeronautical Research Institute, Tôkyô Imperial University. No. 109: Magnetic Pressure-Indicator for Internal-Combustion Engines. By Tatuo Kobayasi and Sumio Sakuma. Pp. 35. 30 sen. No. 110: On the Characteristics of Microphones, Part 1: The Amplitude and Frequency Characteristics. By Kôzi Satô, Heizi Kawai and Rinzi Tate. Pp. 37–61. 25 sen. (Tôkyô: Koseikai Publishing House.)

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