

Editorial & Publishing Offices :

MACMILLAN & Co., LTD.  
ST. MARTIN'S STREET  
LONDON, W.C.2



Telegraphic Address :  
PHUSIS, LESQUARE, LONDON

Telephone Number :  
WHITEHALL 8831

No. 3496

SATURDAY, OCTOBER 31, 1936

Vol. 138

## Taxation, Administration and Research in East Africa

IT has sometimes been questioned by purists in British constitutional practice whether it is advisable that the ministers of His Majesty's Government in charge of Departments of State should have personal experience of conditions in the affairs they are called upon to administer. Whichever way opinion may incline, it is patent that Mr. Ormsby-Gore's tenure of office will afford concrete material for judgment. His knowledge of conditions in the British dependencies is greater than that of any previous holder of the office of Colonial Secretary, and has been approached by none since the days of Joseph Chamberlain. Mr. Ormsby-Gore does not propose to allow his knowledge to lie fallow; and already both in matters which have arisen under his jurisdiction and in those which he has inherited from his predecessor in office, it has enabled him to show a ready appreciation of the necessity for prompt action and a strong forward policy in native affairs in Africa to remedy or to forestall the dangers, to which he is fully alive, arising out of the dislocation threatening the welfare of African peoples in the present rapid development of economic and social circumstances.

Mr. Ormsby-Gore's dispatch to the Governor of Nyasaland dealing with the report of the Committee on emigrant labour from the Protectorate (see *NATURE*, 137, 921) is remarkable alike for its independence of judgment and its well-balanced assessment of the conflicting forces, which have to be taken into account in devising measures to meet the trend of circumstances threatening the future stability of the country and its peoples. He intimates that he shares to the full the anxiety of the members of the Committee, and that he agrees to the necessity for immediate steps to remedy

a state of affairs, which seems to be bringing hardship and misery to many members of the native community. When he suggests, however, that less spectacular measures may serve the purpose of such of the remedial proposals of the Committee as he has been unable to accept in full, his reasons are in plain view. He goes on to point out that expenditure on a scale, which since 1930 has allocated more than £4,200,000 to the development of the Protectorate and to raising the standard of living of the native inhabitants, cannot continue.

The crux of the native situation in Nyasaland is undoubtedly the hut and poll tax. The Governor of the Protectorate, it is true, and as it appears from the dispatch of the Colonial Secretary, does not admit the contention of the Committee that taxation is the primary cause of the excessive emigration; but Mr. Ormsby-Gore, while recognizing the influence of a higher standard of living, of the spirit of adventure and of the attraction of conditions of employment in neighbouring territories, holds that the hut and poll tax must be regarded as a most important factor in the present situation. It bears heavily, he maintains, on natives in those areas in which the opportunities of obtaining employment or of selling crops for export are scarce. In this more limited sense, there cannot be two opinions but that he is correct. He suggests, therefore, that taxation in such areas should be reduced immediately. At the same time, he expresses himself as not in favour of the drastic methods of control and restriction of movement advocated in the report of the Committee. To some, Mr. Ormsby-Gore may appear to have been over-cautious; but in initiating changes among African peoples a certain restraint is no unwise policy.



It is interesting to note how closely in principle the suggestions of the Colonial Secretary addressed to the Governor of Nyasaland are in accord with the attitude of Sir Alan Pim when he touches upon native problems in his recent report on the financial position in Kenya\*. Sir Alan Pim's previous experience of adverse conditions among the peoples of the Protectorates of South Africa affords assurance that his diagnosis of factors detrimental to the native population of Kenya may be accepted as well grounded. That this, at any rate, is the conclusion at which Mr. Ormsby-Gore has arrived is indicated by the fact that he has intimated to the Governor, Sir Joseph Byrne, that the recommendations of the report are generally acceptable and should be adopted as a whole.

Not only does Sir Alan Pim regard the system of registration and labour control with little favour, but he also holds taxation of the native, as at present constituted, to be one of the principal factors operating to the detriment of social and economic conditions among them. The case for and against the hut and poll tax, which is estimated to produce the sum of £540,000 in the current year, is stated in detail in this report. No more need be said here than that broadly the conclusion is that this form of taxation is a cause of poverty, is difficult to assess, difficult to collect, and a source of injustice.

Hut and poll taxes were imposed originally on the natives of Africa, as is well known and as has been recalled frequently in recent discussion, in great measure to spur the native to greater activity as a producer and to stimulate and ensure a larger and more steady flow of labour into European employment. This object has been attained at a cost of no little disintegration in native social and economic institutions. In accordance with the recommendations of this report, revision in Kenya is now under consideration.

Sir Alan Pim's recommendations for retrenchment in the finances of Kenya, while sufficiently drastic, though in the opinion of some disappointing in result, are sympathetic towards native claims for consideration. In regard to the medical service, for example, to which the native looks in an increasing degree, he points out that since the Great War a complete change in outlook has taken place, and enlargement rather than retrenchment must be anticipated, although he indicates

the road to one possible economy in the development of the non-European sub-medical staff. At the same time, in the matter of scientific research he is by no means over-generous; and although he notes with some approval the desire of the Director of Medical Services to form an Institute of Medical Research for East Africa in Kenya, his general position is that what may be regarded as 'long-term' research must be met from outside sources. This will come as something of a setback to those who appreciate the urgency of inquiry on a much greater scale than as yet has seemed possible without official support on such matters as the nutrition, physical development and the mental capacities of the natives of East Africa, to mention one group only of questions needing investigation.

That there is a wide field for scientific research in matters directly affecting the life of both white settlers and natives in Kenya, and that it is largely untouched, has been deplored on many occasions. It is possible that the solution of the difficulties, financial and other, may lie along lines suggested in the report of this Commission. It is there pointed out that local research in agriculture, for example, might be associated with more advanced study in a centre at either the research institute at Amani in Tanganyika or at the centre for higher education at Makerere in Uganda. Such a solution would facilitate a scheme of co-operation as between the several Territories in East Africa, which might be made sufficiently wide to cover the whole field of appropriate research.

The possibilities of a scheme of co-ordinated and co-operative research in East Africa, in which responsibility for the various branches of inquiry would be distributed among the local governments, deserve to be explored further. Such a question may scarcely be considered to fall within the terms of reference of the newly appointed Commission, which is to proceed under the chairmanship of Lord De La Warr to Uganda early next year, for the purpose of inquiring into the constitution and working of the centre for higher education at Makerere and affiliated institutions, as well as to examine and report on their effect on the educational institutions and systems of the Territories affected (*The Times*, Oct. 20). At the same time, it is a matter upon which even a passing expression of opinion from the Commission, or better a suggestion as to a line of inquiry, would be of inestimable value as a stage towards specific action.

\* Report of the Commission appointed to enquire into and report on the Financial Position and System of Taxation of Kenya. (Colonial No. 116.) Pp. vii + 282. (London: H.M. Stationery Office, 1936.) 9s.



## High Court Procedure and the Cost of Patent Actions

AT the recent meeting in Blackpool of the British Association, the president of Section G (Engineering), Prof. W. Cramp, gave an address on "The Engineer and the Nation" in which he referred to the difficulties in the way of an inventor who patents his invention and attempts to create a new industry. As an illustration of these difficulties, Prof. Cramp mentioned a patent action within his own experience which cost £30,000, more than half of which was spent in obtaining a judgment (reversed on appeal) from a judge who, he stated, admitted that "he could hardly understand a word about it". On this state of affairs Prof. Cramp expressed the opinion that "there is no hope for the Patentee in this country under such a clumsy ineffective system; but to change it will be difficult. It will be necessary to break through the resistance of a thoroughly case-hardened Bar, and engineers know what that means. I believe that this Association is the only body with the necessary prestige and influence to produce the desired effect. I hope that this Section will urge the Council to take steps to bring about a reform that is so long overdue."

Reform of the patent system in Great Britain has been under consideration more than once during recent years, and the net result is that amended Rules of the Supreme Court are at the present moment being put into effect. This position has been reached by two stages. The first stage included the Departmental Committee on the Patents Acts, presided over by Sir Charles Sargant, and a discussion at the centenary meeting of the British Association in London in 1931. After the Departmental Committee had decided that the cost of patent actions was a subject outside its terms of reference, the subject was brought before the British Association at the centenary meeting. At that meeting, papers on "The Development of Invention" were read by nine representative authorities under the chairmanship of Sir James Swinburne, and the related subjects of High Court procedure and the cost of patent actions were carefully considered. There was general agreement that litigation over patents had become so slow and expensive that only the large corporations or companies and wealthy individuals could afford to go to law over patents, and that there was no satisfactory method of

obtaining a decision of very numerous disputes arising on patented inventions. Various suggestions for reform were put forward, of which probably the most interesting was one advocating arbitration of the disputes under procedure similar to that adopted under the London Building Acts. The suggestion, briefly, was that the advisers to parties in a patent dispute should call in either a member of the Patent Bar or some other experienced person to act as a third adviser, and that the parties should agree to abide by any award of the three advisers, signed by at least two of them. This suggestion has not apparently been at all widely adopted.

In the second stage, High Court procedure was considered by the Business of Courts Committee, presided over by Lord Hanworth, and recommendations on the subject were made in the Final Report, 1936. The Committee examined suggestions in regard to rearrangements in the constitution of the Court including (a) proposals for the delegation of the hearing of minor patent actions to the Comptroller of Patents or some special officer in his department and (b) proposals for the appointment of a special High Court judge to deal with patent business; and reported against each of these proposals. The Committee further expressed the opinion that the machinery for trial with assessors or with court experts was amply available under existing rules, and that there was not sufficient ground for forcing the machinery upon unwilling parties. In relation to this opinion it should be remembered that Section 31 (1) of the Patents and Designs Acts, 1907-1932, enacts that in an action or proceeding for infringement or revocation of a patent, the court may, if it think fit, and shall on the request of all of the parties to the proceedings, call in the aid of an assessor specially qualified, and try the case wholly or partially with his assistance.

The Business of Courts Committee also considered carefully the possibility of a reform of procedure in the High Court as at present constituted and found an almost universal agreement that it would be desirable, before patent actions come into court, that there should be some means adopted of crystallizing the issues, as well of law as of fact. The Committee recommended that the



rules should be amended so as to enable the judge, (a) to order the parties to embody their scientific evidence in affidavits to be subject to cross-examination and to be exchanged before the hearing in court, and (b) to order the parties to exchange statements (to be signed by counsel), setting out all matters of fact and contentions of law (including contentions on the construction of documents), on which they intend to rely at the trial. These recommendations are now being put into practice by the rules of the Supreme Court (No. 3), 1936, some of the rules being operative from July 13 this year and the remainder from October 12.

In commenting on the patent case that cost £30,000 in the English courts, Prof. Cramp stated that "In France, thanks largely to Napoleon's short way with legal privilege the case given above, with an appeal, cost less than one-tenth of the hearing in the English courts. There, to the best of my recollection, the system is as follows. The court sits to determine if there is a case. Having decided in the affirmative three technical experts are appointed, one by each litigant and one by the judge. These three have access to all apparatus, experiments and documents. Each presents an independent report to the judge and on these the issue is decided." It is a fact that, apart from fees paid to some members of the French Bar who are also eminent politicians or senators, the fees of our Patent Bar are higher

than those of the French Bar, and it is true that according to the present procedure in France, the evidence of the three experts is not subject to cross-examination in open court. Nevertheless, it would be unwise to infer from Prof. Cramp's statement that opinion in Great Britain is unanimously in favour of adopting the French procedure, and it is significant that, in the Bill at present before the French legislature, provision is made for cross-examination of the experts in open court, and that this system has already been adopted in the United States.

If any inference is to be drawn from this short statement of High Court procedure and the cost of patent actions, it may possibly be that Prof. Cramp's "case-hardened Bar" shows little indication of bending under the stress of the recent changes and not the slightest indication of breaking. The recent changes have established the present position, and it is unlikely that further changes will be adopted until the present position has been tested, unless they are generally acceptable. It is to be hoped, therefore, that, if the Council of the British Association decides to recommend any further change, it will be specified precisely and will be such as to receive the unanimous support of all the parties interested; otherwise it seems highly improbable that the recommendation will "break through the resistance of a thoroughly case-hardened Bar".

## Astronomical Telescopes

### Lunettes et télescopes :

théorie, conditions d'emploi, description, réglage. Par André Danjon et André Couder. Pp. xvi + 715 + 14 plates. (Paris : Éditions de la *Revue d'Optique théorique et instrumentale*, 1935.) 100 francs.

THE collaboration of MM. Danjon and Couder has resulted in a notable addition to astronomical literature. The volume under review is the best and most complete book on telescopes that has been written, and it will undoubtedly remain for a long time the standard work on the subject. M. Danjon is the director of the Strasbourg Observatory and a practical astronomer with wide experience; M. Couder, one of the astronomers at the Paris Observatory, is a skilled optician, who made the 81-cm. mirror and other optical parts of the reflector at the Forcalquier (Basses-Alpes) station of the Paris Observatory. The excellent

photographs that are being obtained with this instrument are a sufficient testimony to the high quality of its optics. The authors were therefore particularly well qualified for their task.

The volume is divided into five parts. The first part deals with the general theory and use of telescopes. The elementary geometrical theory is summarized, and the limitations of this theory caused by the diffraction of light are then considered. This leads naturally to the question of resolving power, which is discussed in relation to the resolving power of the eye in visual observations and to the resolving power of the photographic plate in photographic observations. The observation of point-sources (stars) and of bodies showing a sensible surface (planets, comets, nebulae, etc.) are separately considered. Of particular value is a chapter on atmospheric agitation, its measurement and its effect on resolving power.



The careful study of the whole of this part is strongly recommended to amateur telescope users. It will remove many misconceptions and will help them to realize the limitations of their observations. One observer, for example, may describe a comet as having a bright tail but no nucleus; another may describe the same comet as having a nucleus but a scarcely perceptible tail. The two observations are not necessarily inconsistent, but are the result of using telescopes with different apertures and different magnifications. A common misconception is that under conditions of poor definition, it is advantageous to reduce the aperture. An image that is more agreeable to the eye is obtained, but the gain is purely illusory. There is no gain in resolving power and the advantage of the full aperture in the moments of better seeing is lost.

The second part contains a good discussion of the principal aberrations of an optical system, illustrated by numerical examples. The nature of the several aberrations is explained in a very clear manner and their order of magnitude is estimated, using only elementary mathematics. The drawings of focal and extra-focal images, affected by various aberrations, will be found useful in examining any particular telescope for the presence of these aberrations.

The third part is concerned with different types of reflecting and refracting telescopes, and with the design of object glasses and eyepieces. The Newtonian and Cassegrain forms of the reflecting telescope are first discussed; their aberrations are estimated and their limitations are emphasized. These may be termed the classical types of reflector. Alternative designs have been proposed, with the view of obtaining a larger field of good definition. The Schwarzschild, Chrétien, Couder and Schmidt types of reflecting telescope are described and discussed.

A general outline is given of the methods used by the optical computer to reduce aberrations by the combination of two lenses of different types of glass, and several of the principal types of objective are described in some detail. A chapter is devoted to the more common types of oculars and their aberrations.

In the fourth part are described various types of mountings and of miscellaneous auxiliary apparatus; methods of testing and adjusting telescopes; the manufacture of optical glass; the processes for silvering mirrors; the flexure of mirrors and the methods of mounting so as to minimize the effects of flexure; and thermal phenomena, causing variations of focal length and of surface figure. The whole of this part is full of practical information for the telescope user. The adjustment of the Newtonian and Cassegrain reflectors is explained. The testing of an objective

for relative tilt of the components, for centring and for tilt of the objective as a whole is described in detail; the method of testing the squaring-on of the photographic plate is also described. A full account is given both of the Hartmann test and of the knife-edge test of Foucault. The method of computing the results of the Hartmann test to show the zonal aberrations and the astigmatic defect is illustrated by the actual figures for the Forcalquier mirror. The result of the Hartmann test is often summed up by a numerical figure, called the Hartmann criterion, which is the weighted mean of the angular aberrations, the weight for each zone being proportional to its distance from the axis. The Hartmann criterion depends upon the origin chosen for the longitudinal aberrations; the origin that gives the smallest value to the criterion is chosen, though this is not necessarily reached in the plane of the circle of least zonal aberration. Moreover, the authors point out that the criterion can only have a significance in relation to the theoretical resolving power of the objective, which depends on its diameter, and, further, that two objectives of the same diameter may have errors of different type and distribution, giving the same value of the criterion, although the images produced by one may be better than those given by the other. In short, though the test gives full information about the defects of figure, the criterion in itself is of relatively small importance.

It is of interest to note the authors' specification for a satisfactory objective: (1) The radius of the circle of least aberration must be comparable to that of the theoretical diffraction image and, in the mean, the reduced transverse aberrations must be smaller than unity; (2) the greatest defect of the surface from tautochronism must not exceed a quarter wave-length and for most of the surface it should be appreciably smaller.

The final part gives a historical account of the invention and evolution of the telescope. The invention of the telescope is often attributed to Hans Lipperhey, a spectacle-maker of Middelburg, in the year 1608. The authors assign the invention to Giambattista della Porta, of Murano near Venice, in the year 1580. Their account of the invention is fully documented, and it seems reasonably certain that, even if della Porta was not actually the inventor, Lipperhey ought not to receive the credit.

Every practical astronomer, amateur and professional, should read this book; many portions of it will be found to deserve careful study. I would urge all who can do so to purchase it; for so comprehensive a work, the price (with the present value of the franc) is very moderate. The expenditure will be found to be a good investment.

H. SPENCER JONES.



## The Technique of Biography

(1) *Edison, his Life, his Work, his Genius*  
By W. A. Simonds. Pp. 364 + 12 plates. (London :  
George Allen and Unwin, Ltd., 1935.) 10s. 6d. net.

(2) *Partners in Progress*  
By Esse V. Hathaway. Pp. vii + 303 + 12 plates.  
(New York and London : McGraw-Hill Book Co.,  
Inc., 1935.) 15s. net.

(3) *Outposts of Science :*  
*a Journey to the Workshops of our Leading Men*  
*of Science.* By B. Jaffe. Pp. xxvi + 547 + 32  
plates. (New York : Simon and Schuster, Inc.,  
1935.) 3.75 dollars.

THE technique of biography has sometimes seemed to change rapidly in a changing world. The god-like and disembodied abstractions of one phase vanished before the painfully concrete and over-bodied victims of the 'de-bunker', now happily retiring from his brief tenure of the stage. But one aim of the biographer has never, in any worthy practice of the art, varied or failed. The merely superficial account of what a man did never was real biography; the mainspring of action, the 'why' rather than the 'what' and the 'how', must always be the centre of interest in any work of value. The three works before us are all mainly biographical in intent, and must be tested principally for depth of penetration. One of them passes the test triumphantly, the other two are, relatively, insignificant and superficial.

(1) Thomas Alva Edison has always been something of a puzzle to the student of science and technology in the industrial revolution. His career belonged to the 'log-cabin to White House' category, yet no account of his life seemed to recognize that his mainspring of action had not been identified. Every schoolboy was thrilled by the story of his violently episodic progress, his staccato and his sostenuto, his plunges from one subject to another, his living of laborious days and nights in the glamour of wizardry at Menlo Park. But why did he do this and thus, was the glamour real or artificial, was it a spontaneous and so to speak accidental growth, or was it as well engineered as the material products round which it grew? Mr. Simonds, in "Edison, his Life, his Work, his Genius", supplies new factual material and re-presents the old, but of the essence of the man, his genius in the real sense, we feel that we have learnt no more. The restless versatility, the dæmonic energy, are as vividly before us as ever,

but why did the man do these things? Was he impelled by an altruistic desire to benefit his kind, was he in search of wealth and power for himself, was the need to "bat the other fellow"—a succession of other fellows—"in the eye" an important element in the good he undoubtedly did for humanity at large?

The questions remain unanswered; Mr. Simonds gives us a good record of fact, but despite the promise implied in his preface he never attempts analysis. He gives us reason to suppose that the first hypothesis is sound, he supplies some evidence for the others, but we suspect his own hypothesis to be merely that Edison did it all because he couldn't help it. We lay down the book with the same feeling of disappointment as with every other life of Edison.

(2) Miss Hathaway does no more for Edison in the score of pages she can spare for him in her verbal picture gallery of "Partners in Progress". The sitters are a well-chosen galaxy from the last twenty-five centuries, but if Mr. Simonds gives us his one sitter in plain black and white, Miss Hathaway presents hers in chromo-lithograph. We just don't believe that Hippocrates was as purple as he is painted; he was probably a grim forthright G.P. without time for rhetoric and romanticism, and he would almost certainly have shared our objection to Miss Hathaway's parsimony with predicates; he might have said with us that what he wanted was verb, not sap. As a cataloguer Miss Hathaway shows talent; her grouping of twenty-five biographies is logical if a trifle obvious. But she adds nothing of value to the already familiar; she pads out inordinately, and her style is maddening.

(3) These two authors might have been more welcome had they not arrived in the company of Bernard Jaffe. "Outposts of Science" is as definitely about people as are the other two works, but there is just enough vivid portraiture to make the *dramatis personæ* fully alive, mainly lovable, occasionally laughable, always humanly understandable. The real dramatic material is the spirit of investigation; the characters in this thrilling presentation of the search for truth are nicely subordinated to their work, their achievements, and partial failures. The major themes are, appropriately, the inner compulsion and the rules of the great game of research, a game in which individual motives are scarcely ever single, but in which single-mindedness is the common dominant.



Boswell's Johnson is as much Boswell as Johnson. Every biography is an autobiography. So in reading the five hundred pages from which the author has apparently excluded himself, we learn to hold in high regard the modest investigator of investigators who tells us in a dozen introductory pages how he made this fine book and what he learnt in the making of it. His four years labour was well spent, and he has done a greater and more difficult service than if he had devoted himself to the physical sciences in which he began his career. One feels that even the star at the eyepiece end of the Mount Wilson 60-inch, of which he tells us in these pages, could scarcely fail to be held by his unrolling of a great scenario.

It is perhaps in part an accident that to a

physicist this physicist's account of biological research is more enthralling than his account of physical researches, but it is probably not an accident that the book opens with a chapter in which the story of *Drosophila* is told in a manner which makes this chapter on genetics the most fascinating part of a fascinating whole.

There are many good research workers, there are many good teachers, but there are distressingly few interpreters of Mr. Jaffe's calibre to carry on the vitally important task of explaining the aims, the methods, and the essential achievements of science to the intelligent public. We trust that he will continue his admirable work; he will do well indeed if he does as well as in his survey of the "Outposts of Science".

## Biochemical Progress

### Annual Review of Biochemistry

Edited by James Murray Luck. Vol. 5. Pp. ix+640. (Stanford University P.O., Calif.: Annual Review of Biochemistry, Ltd.; London: H. K. Lewis and Co., Ltd., 1936.) 5 dollars.

IT is true to say that these annual reports are now eagerly awaited. This year they appeared somewhat later, due it would appear largely to their international character, which is more than ever marked. As evidence of the spread of research institutions of the first class all over the geographical world, it is interesting to note reports from Pretoria, Honolulu, Leningrad, as well as from all parts of the United States and the older European centres. There are twenty-six different reports varying in length and in the ease with which they can be read by the general student who is not an expert in the particular field. In some sections the work is largely pioneer and is still to be correlated; in others a particular stage has been completed and a problem largely solved in preparation for the next step forward.

Gradually more light is being thrown on biological oxidations and reductions. For some of these it has long been known that a co-enzyme is an essential unit in a complex system of reaction components. It is now largely established that such compounds are composed of adenine, phosphoric acid and a sugar ribose, the point of attachment of which to the adenine has now been determined.

Ascorbic acid, the vitamin, is the subject of intense study. Three principal methods are now

available for its synthesis, and a number of closely related analogues are available for the investigation of the correlation between constitution and physiological activity. There is evidence that ascorbic acid inhibits the action of certain enzymes unless iron is also present. Such enzymes would appear to contain —SS— compounds in their protein complex which have to be made into —SH compounds for the enzyme to become active. Addition of ferrous ions increases the specificity range of papain and enables the enzyme to hydrolyse peptone. A clue is being obtained which points to the existence of active groupings of elements in the enzymes.

Individual reports by the leading experts deal with the sugars, fats and proteins, either from the point of view of their structure or metabolism, and progress with the hormones and vitamins is fully chronicled; there are signs that the former are now becoming the more fashionable subjects of research. The progress made with the investigation of the structure of the oestrogenic compounds is remarkable and is leading to expansion in many directions as, for example, in regard to the factors involved in the secretion of milk for which lactogenic preparations, which appear to contain a chemical unity prolactin, have been made. Methods of assay of these substances are also having to be developed.

In addition to insulin, many of the hormones are now being manufactured on the commercial scale, so quick has been their application.

All the time, the animal and the plant world are being investigated for rare or new substances—



two new nitrogen-containing extractives have been found in the lower vertebrates, namely, a betaine, homarine, in lobster muscle, and a guanidine derivative, asterubin, in star-fish. More attention is being paid to bacteria, and there are reports on metabolism, soil microbiology and the biochemistry of the fungi.

We have refrained from listing the separate reports or their authors, but we would wish to endorse the thanks conveyed to the contributors by the editors in their preface. It is of great value to the worker to have these judicial summaries by experts made available so promptly each year.

## Solubility

### Solubility of Non-Electrolytes

By Prof. Joel H. Hildebrand. (American Chemical Society Monograph Series, No. 17.) Second edition. Pp. 203. (New York: Reinhold Publishing Corporation; London: Chapman and Hall, Ltd., 1936.) 22s. 6d. net.

IT is not often that a reviewer, who has read through the first edition of a book, finds it worth while to do more than glance through a second edition, in order to discover and review the new sections that have been introduced. Prof. Hildebrand's book is an exception, since the reviewer has taken the opportunity to renew his acquaintance with the earlier as well as the later text, and has found this to be a most interesting experience, since the book is full of matter which is not dealt with adequately (and indeed appears to have been largely overlooked) in the ordinary text-books of physical chemistry.

The book has a strict thermodynamic background, which sometimes makes it rather hard for the ordinary chemist to read, and it is not always easy to bear in mind the significance of the symbols which are carried forward from page to page; but for the most part the conclusions are also stated in general terms, so that the significance of the deductions is easily seen and can readily be applied to concrete cases. The author is, however, now inclined to be sceptical of his former deduction

(following Dolezalek) that negative deviations from Raoult's law, which lead in extreme cases to the formation of two liquid layers, can be explained by the association of one of the liquids, since the degree of association required is often fantastic, and unsupported by collateral experimental evidence.

One of the first novelties to be introduced is the author's own conception of 'regular solutions', in which the identity of molecular size and molecular attraction of an ideal solution is not required, but in which "thermal agitation is able to overcome any tendency towards molecular orientation, combination or association, and to give the same completely random distribution as exists in ideal solutions". Under this heading, an account is given of Menke's work in Debye's laboratory on the structure of liquids. The forces between polar molecules are discussed on the basis of London's formula for the interaction of dipoles, and those between non-polar molecules on the basis of Lennard-Jones's theory of force-fields. Other novelties include Langmuir's theory of interfacial energies, Bernal and Fowler's investigation of the structure of water, and Butler's work on metallic solutions.

It is remarkable that the new edition actually occupies three pages less than the old one. This result is surely almost without precedent, and is one on which the author deserves to be congratulated heartily.

### L'Espèce

Par Prof. L. Cuénot. (Encyclopédie scientifique: Bibliothèque de biologie générale.) Pp. ix+310. (Paris: Gaston Doin et Cie, 1936.) 30 francs.

THIS book provides a very helpful account of certain aspects of the species problem. Both the meaning of the concept of species, and the process of specification, are well handled, as is the question of isolation. The examples are, throughout, varied and well chosen.

The author wisely gives a preliminary survey of the genetic phenomena relevant to his purpose, together with a satisfactory description of meiosis.

Unfortunately, the general treatment is much hampered by omitting the concept of the gene-complex, and a discussion of polymorphism and of the effects of fluctuation in numbers should have been included in a work of this kind. Likewise some reference should have been made to the various problems of relative growth, and the idea should have been developed that the evolution of rare and abundant species is likely to follow different lines.

However, this is quite a stimulating book, and it is provided with a good glossary, bibliography and index.

E. B. F.



**Tables annuelles de constantes et données numériques de chimie, physique, biologie et technologie** (Annual Tables of Constants and Numerical Data; Chemical, Physical, Biological and Technological). Données numériques sur l'effet Raman: spectres, intensités, modes de vibration (Numerical Data on the Raman Effect: Spectra, Intensities, Vibration Patterns). Par Dr. M. Magat. Années: 1931 à 1934. Pp. 112. (Paris: Gauthier-Villars; New York: McGraw-Hill Book Co., Inc., 1936.)

THIS is principally a collection of data obtained on the Raman effect between 1931 and 1934. The substances whose spectra are described are grouped according to their chemical constitution, one fifth of the space being devoted to inorganic compounds and four fifths to organic compounds. In making the compilation, Dr. Magat has attempted to assess the relative reliability of the work of different authors where more than one investigation has been made of a particular substance, and, where necessary and possible, has given mean wave-numbers. He has also made an individual contribution of considerable value in making an attempt to correlate intensity data. It is a pity that so little attention is usually paid to accurate measurement of intensities when the original plates of the spectra are obtained. The methods of photographic photometry are not unduly difficult, and in the present case the technique is often simplified by the fact that the spectrum is comprised within a small wave-length range. There is little doubt that much of the work described here will have to be repeated ultimately on this account, when it becomes necessary to compare it with the rapidly developing theory of polyatomic molecules.

There is an appendix on the modes of vibration of polyatomic molecules, and two lists of papers—in addition to those in the text—one on the theory of the Raman effect and the other on some of its applications. The apparent completeness of the data, many of the sources being inaccessible to the ordinary worker, and the excellent way in which they are reproduced, combine to make the book indispensable for anyone interested in this field.

### **The Making of Modern Turkey, from Byzantium to Angora**

By Sir Harry Luke. Pp. viii+246+1 plate. (London: Macmillan and Co., Ltd., 1936.) 10s. 6d. net.

SIR HARRY LUKE's personal acquaintance with Turkey began so long ago as 1904, and at one point or another he has been in touch with the Turk ever since that date. In consequence he speaks with authority and understanding of the ideals and aspirations which inspired the political and social movements of the present century and have transformed Turkey from the titular seat of an international spiritual hegemony, as was claimed, into a nationalist State. His purpose is not to write a history of the Turks, but to analyse the forces and the elements which, partly rooted in Byzantium, partly arising out of the consequences of the conversion of the Turks to Islam, made the country in the end "the Sick Man of Europe", and in the inevitable

disintegration of an international society, left nationalism and a dictator as apparently the only way open to reform.

Sir Harry Luke's critical judgment places recent developments in Turkey in their true historical perspective, and his book is indispensable to anyone who seeks to understand the play of race, language and politics in modern Turkish social development.

### **Handbuch der Vererbungswissenschaft**

Herausgegeben von E. Baur und M. Hartmann. Band 3: Genetik und Tierzüchtung. Von C. Kronacher. Pp. vii+280. (Berlin: Gebrüder Borntraeger, 1934.) 37.50 gold marks.

THIS handbook of animal breeding is a valuable summary of practical results in the improvement of domestic animals, including rabbits and some birds as well as horses, cattle, sheep, pigs and goats. Such questions as twinning in cattle are dealt with and two pairs of identical twins are described. Various interspecific crosses are discussed, as well as the inheritance of numerous abnormalities in all domestic breeds. The considerable amount of knowledge of serology in the different groups is also summarized. Emphasis is laid on the inheritance of qualities of practical value, such as milk yield in cows, wool characters and fertility in sheep. Such a summary should be of much value to all veterinarians and practical breeders. The book ends with a short index and a full bibliography occupying 87 pages.

### **An Enquiry into Prognosis in the Neuroses**

By Dr. T. A. Ross. Pp. vii+194. (Cambridge: At the University Press, 1936.) 10s. 6d. net.

THIS is an account of the results of treatment at the Cassel Hospital for Functional Nervous Disorders. The account covers twelve hundred patients. About 40 per cent of the patients reported themselves well at the end of three years, 34 per cent at the end of five years. We do not like to think that the nursing staff were meant to be neutral. An understanding nurse can do so much to help a patient; the doctor need not think he is a little tin god who gets all the patient's confidence. Nurses trained on psychological lines can be so understanding. The common-sense attitude adopted towards the much over-rated placebo, occupation therapy, is welcome.

### **Heredity and the Ascent of Man**

By Dr. C. C. Hurst. Pp. ix+138. (Cambridge: At the University Press, 1935.) 3s. 6d. net.

DR. HURST's little volume is less stereotyped and more discursive than the usual elementary book on this subject. His nine chapters begin with "The Mystery of Life" and the gene, ending on the experimental creation of new species, the ascent of man and the future of man and mind. The gene is regarded as the origin of life, and the evolution of man and his civilization are briefly traced. While highly speculative in places, yet Dr. Hurst succeeds in bringing out many of the salient recent facts of genetics.



## Chemistry and Food Science

IN the opening paper of a symposium on "Chemistry and Food Science" in Section B (Chemistry), held at the Blackpool meeting of the British Association, Dr. Leslie Harris, of the Cambridge Nutritional Laboratory, spoke of a 'food cycle', analogous to the 'nitrogen cycle' of the chemist. To explain what was meant by the food cycle, he said that food in the first place must be collected or gathered; then it may undergo some manufacturing process; next it may be transported (by sea, rail or road); after which it may be preserved or stored in the cold; before at last it is prepared for the table and eaten. To complete the 'food cycle', it has to be remembered that food, or some part of it, is ultimately converted into manure, and so fertilization is brought into the picture—and with fertilization goes food production, the raising of crops and the rearing of farm animals. In each of these stages of the food cycle, the work of the chemist has been of service to the community, and in the discussion each stage was in turn dealt with by an expert. It might be thought that the logical order is to discuss first food manufacture, and then transport and storage and finally nutrition. On the other hand, all these complicated processes are of no avail, if the final product fails to nourish—so that nutrition must be the final criterion, and may be given pride of place.

On the purely chemical side, as Dr. Harris pointed out, a great body of knowledge has been won in the science of food and nutrition. For example, what were formerly mysterious and intangible 'antiscorbutic' or 'antirachitic' properties in foodstuffs have been shown to be due to 'vitamins', still unidentified and given only vague descriptive letters, C, D, etc. Recently, the chemist has been able to reach one of his final goals by determining the structural formulæ of the vitamins (or five of the better known of them, at least), and in more than one instance he has even synthesized them in the laboratory. The consequences of such discoveries have not been insignificant. For example, the pharmacologist or clinician is now able to prescribe an exact dose consisting of a given number of International Units of an accurately standardized synthetic vitamin. But perhaps more important is the fact that the science of nutrition is now placed on a rational, logical basis instead of being an arbitrary, empirical and rule-of-thumb art. We can now speak with certainty and precision about matters which before, since they lacked formal proof, were open to dispute or disbelief.

### THE SCIENCE OF NUTRITION

The next point raised was that it is a mistake to consider food and nutritional science too exclusively from the *chemical* angle. Nutrition is a *biological* process, and therefore can only be adequately studied by the combined methods of biochemistry and biophysics, of physiology and pathology, etc. No progress would have been possible for the pure chemist in his effort to solve nutritional problems without the aid of biological technique, such as animal-feeding tests, biological assays, etc. This is the justification for the existence of that highly trained specialist, the nutritionist—who, to be competent, must needs use the methods not only of chemistry and physics but also those of various biological sciences. In addition, we are beginning to realize that nutrition as a social science is inextricably bound up also with agriculture, and no less with economics.

### PREVALENCE OF MALNUTRITION

In conclusion, Dr. Harris said that as a main function of the British Association is to examine "the services of science to the community", the present problem is to inquire how far the science of food and nutrition has served the needs of the people and, more important, how much room there still is for improvement. What constitutes an adequate diet, and how far is it attained in practice? For the present purpose it is not necessary to consider the nutritional needs of the human individual from the more technical aspect—that is, the requirement for given *food constituents*, as fats, proteins, vitamins, etc. It is sufficient to point to the common *errors of diet* as met with in Great Britain, for example, inadequacy of such 'protective foods' as milk, fruit and vegetables.

How can the position as it exists in Britain at the present time be summed up? It is true that people are better nourished than they were (few are now unable to obtain sufficient energy or crude protein), but much remains to be done to furnish a sufficient supply of those accessory factors which are essential for health and optimum growth. In the past, it has been difficult to assess at all accurately the prevalence of malnutrition because of the lack of definite standards of reference: average weights and heights for different age groups are available, but these are not the optima to be striven for. But recently progress in biochemical and other methods has provided specific



diagnostic tests for partial deficiencies, and these are now being applied to random groups of the population and might with advantage be utilized on a large scale. Recent inquiries from various angles (for example, Sir J. B. Orr's from the economic side, and a number of surveys from the clinical side) are beginning to make it possible to assess fairly accurately the prevalence of specific disorders of malnutrition in Great Britain to-day.

It is no longer disputed that malnutrition (or 'sub-optimum nutrition') is widespread. It is due to some extent to ignorance, but much more to economic causes—there is still 'starvation in the midst of plenty'; such are the official conclusions of authoritative bodies which have been called upon to give their verdict, such as the International Committees recently appointed by the League of Nations, and by the International Labour Office.

Scientific evidence of malnutrition, presumptive or direct, has been obtained along several different lines: (1) economic (that is, insufficiency of money spent on food), (2) dietetic (inadequacy of food eaten), (3) medical (existence of disorders of deficiency), (4) sociological (comparison of the health standards of poorly-fed and better-fed social groups), and (5) experimental (improvement in health observed in controlled tests when the inadequate food is suitably augmented).

### THE PREPARATION OF FOOD

The discussion of the scientific aspect of the preparation of food was very appropriately entrusted to Dr. L. H. Lampitt, head of the research department of an important catering firm.

Dr. Lampitt said that there have been at least five factors stimulating scientific investigations of food. These are—fear of food shortage, fear of war, national economic policies, commercial competition, and one general factor—the desire of man to search into the unknown.

"The coining of the word vitamin," claimed Dr. Lampitt, "has made the English stomach-conscious in a new way, and while I personally cannot see that any nation gains much by that neurotic attention to food which is obvious in certain classes in more than one foreign country, yet possibly an intelligent interest in food can be stimulated which will react to the betterment of the health of our people. One sometimes feels that the vitamin cult has perhaps blinded some of its votaries to the need of calories . . . and perhaps the inorganic salts will receive their due recognition in the near future."

Moreover, as Dr. Lampitt emphasized, people are apt to forget that palatability is a first essential in food, and that proper cooking, in its way, may be as important as a knowledge of calories and vitamins and inorganic salts. Mass production of food, in canning and preserving, and in restaurants, has necessitated the application of science by commercial firms to maintain the quality of food and to enable it to be kept for long periods of time. Thus it is comparatively simple for a chef to make a mayonnaise sauce; but its production in hundreds of gallons, so that the product will remain in good condition, no matter how badly treated by the retailer, and afterwards in the home, involves a whole series of problems which the chemist alone can solve. Mass production also introduces another factor, in the form of metallic contamination. None the less, the unfounded scaremongering about the contamination of food from aluminium cooking-vessels is altogether to be deprecated. Bacterial contamination is another matter, and is one of the most difficult and insistent problems in food industry. But thanks to the help of legislation and scientific investigations, the standard of purity of food in Great Britain is higher, Dr. Lampitt claims, than in many other countries which, in contrast with our own, have the most complete bureaucratic control.

### FOOD PRESERVATION AND TRANSPORT

Numerous interesting points were briefly touched on in a paper by Dr. Franklin Kidd, head of the Low Temperature Research Station at Cambridge, which was read in his absence by Dr. Thomas Moran. For example, on the practical side, in the work on proteins, two problems have been solved. In the first place, it has been shown how even the toughest meats from old animals can be rendered tender by hanging for the right time at the right temperature. Conditions are now also understood for avoiding that *hardening* which may occur during preservation in a frozen condition. An important result of this discovery has been that summer catches of choice halibut from far northern waters may now be taken to any region of the earth and eaten at any season. With quick freezing and thawing, and holding at extremely low temperature, the herring gluts of to-day can be preserved and 'spread'. In these matters, as Dr. Kidd concluded, we are at the beginning of great changes in the structure and organization of the fish trade in all countries.

An important aspect of modern food science relates to the conditions of food transport, and these were discussed by Mr. T. Herbert, of the L.M.S. Railway Company. As he pointed out, improvements in refrigeration and chilling



processes have created entirely new branches of overseas trade. At home, improved containers have been installed on the railways, and more compact and efficient freezing plant has been evolved. As a result the consumer has been able to receive quicker deliveries, fresher food and greater variety. A vivid impression was conveyed to the audience of the different problems which have already been solved by showing them lantern slides illustrating the imposing provision made on board ship and on rail for the transport of such commodities as meat, bananas, etc.

### SOCIAL IMPLICATIONS

That topics concerning nutrition and malnutrition are still liable to be controversial issues was apparent with the opening of the general discussion by the president of the Association, Sir Josiah Stamp, who pleaded for scientific definition of the terms used and statistical treatment of conclusions, and emphasized that these questions have social and even political implications. How, he asked, can one define the "amount of money needed for an optimum diet" when a French housewife is able to manage on so much less than her English counterpart, or how is one to define the "amount of money available for food" when it depends on how much of it is spent on beer!

### FOOD SCIENCE AND AGRICULTURE

Prof. H. G. Denham, who followed, spoke of the benefits which scientific research has rendered to agriculture in New Zealand, and Prof. W. J. Young, of Melbourne, paid a similar tribute on behalf of Australia. In New Zealand the use of superphosphate has enabled the farmer to put a cow on every acre instead of only one cow on three or four acres. As a result of the drop in its price, the consumption of butter has been greatly increased. In the same way, the consumption of milk might be raised with marked effects for good on many sections of the community. Another contribution of the chemist to agriculture and to food science is the discovery that borax cures a disease of Cox's orange apples. Another is that cobalt, not iron, is needed to secure New Zealand sheep against certain common infectious diseases. Both Prof. Denham and Prof. Young united in expressing their obligation to the work of the Low Temperature Research Station at Cambridge.

The value and indispensability of the contribution of the analytical chemist to food science was the theme chosen by Dr. G. Roche Lynch, president of the Society of Public Analysts and other Analytical Chemists. As he pointed out, much of our "newer knowledge of nutrition" has its origin in the work of the public analyst in controlling the adulteration of food.

## Positive Economics of the Fungi

THE emphasis of the study of economic mycology is so much upon the negative side, the effect of fungi as producers of disease, that it is very stimulating to have the presidential address to Section K (Botany) of the British Association, delivered on September 10, deal with the beneficial activities of these organisms. Mr. J. Ramsbottom has collected very numerous examples where fungi are of positive value to the community, and his paper makes fascinating reading.

Perhaps the most obvious use of fungi is as articles of food. In addition to the common mushroom, blewits (*Tricholoma personatum*) and species of the genus *Boletus* (*B. edulis* and *B. scaber*) are eaten in Great Britain; but Mr. Ramsbottom also mentioned the use of *Pholiota aegerita* and *Polyporus tuberaster*, of literary lore, the Canadian *Grifolia* (*Polyporus*) *Tuckahoe*, the Indian bread of America (*Poria cocos*), the blackfellow's bread of Australia (*Polyporus mylittae*) and various tropical species of the genus *Lentinus*. Three species of the larger fungi are cultivated by man,

namely, the field mushroom, the shiitake (*Cortinellus Shiitake*) and *Volvaria volvacea*. A historical review of the development of mushroom culture finds a natural place in Mr. Ramsbottom's paper, and a consideration of modern methods of pure culture also appears therein. Production of the shiitake has little horticultural similarity to mushroom growing. A pile of logs is sprinkled with powdered wood from previously infected material, or covered with straw mats bearing spores. The cultivation of *Volvaria volvacea* is less precise, for heaps of rice straw, chopped banana leaves, or other vegetable refuse, are merely watered with rice-wash or sugar-cane juice, and usually bear within a fortnight. There is an extensive cultivation of this fungus within the tropics.

Truffles (*Tuber* spp.) still occur in Great Britain, and Mr. Ramsbottom's paper contains an implicit invitation for field mycologists to follow the example of C. E. Broome, who, in the middle of last century, always used a rake upon his fungus forays, and found truffles from very numerous localities.



A whimsical reference to the criminal use of poisonous fungi led to a consideration of the medicinal value of certain species. *Lycoperdon Bovista* has been used in the past for stanching wounds, ergot of rye (*Claviceps purpurea*) holds the seal of the British Pharmacopœia, and many other examples of more homely uses of fungal remedies are given. *Cordyceps sinensis*, a parasite of caterpillars, is much used in China, being sold along with the caterpillar, and tied with red silk.

Perhaps few dentists or fly fishermen would recognize the soft flesh of *Fomes fomentarius* as the amadou of their craft, and relatively few photographers have experienced the use of the inky juice of *Coprinus comatus* as a retouching medium. Hottentot and Egyptian ladies used fungus spores as face powder, and one wonders why their modern sisters have not made greater use of the delicate shades of spore colour for this purpose. Wood attacked by fungi is not necessarily worthless. The green colour of oak or birch attacked by *Chlorosplenium aeruginosum* is the 'green wood' used in the manufacture of Tunbridge ware, whilst 'brown oak' of commerce is the result of inoculation with *Fistulina hepatica*. A most fascinating use of a mould, *Mucor racemosus*, is described from Chiloe Island and eastern Patagonia, for there the wood of such trees as *Eucryphia cordifolia*, *Weinmannia trichosperma* and species of *Nothofagus*, is converted to a palatable food for cattle by the agency of the fungus and associated bacteria.

No account of the uses of fungi would be complete without some reference to the symbiotic mycorrhiza of orchid plants. The work of Noel Bernard showed that inoculation with a fungus was necessary for the germination of orchid seeds, and gave abundant growth where previously had been great waste of seed. Although the work of B. L. Knudson has shown that the seed can germinate under aseptic conditions, if supplied directly with glucose, the symbiotic method of Bernard is still used extensively in some countries.

A very large part of Mr. Ramsbottom's address dealt, very naturally, with fermentative changes brought about by fungi. As an introduction to this section, he quoted the discovery of nineteen different enzymes—"apparently sufficient for any purpose here below"—from the fungus *Aspergillus Oryzae*. Compressed yeast, which is now used extensively in bread manufacture, has evolved gradually from the older preparations, as leavens, barns and more liquid ferments. Wines are still made chiefly with naturally occurring yeasts, usually allied to *Saccharomyces ellipsoideus*; but various strains of *S. cerevisiae* are maintained in pure culture for all the more distinctive brands of beer. A point of general mycological interest

is the discovery by K. Kruis and J. Satava that there is an alternation of generations in yeasts; *Torula* and other non-sporing forms are regarded as haploid phases.

The world's coal resources must come to an end sooner or later, and it is very satisfying to have the assurance that suitable methods for the production of power alcohol could be brought into operation on a large scale, as soon as international interest should demand. Fungal organisms can also be employed for the conversion of starch to sugar in malting operations, and give better results than the use of enzymes derived from the germinating grain.

Mr. Ramsbottom had many interesting facts to relate about the production of fermented foods and drinks. The reader cannot but revel in the international nature of his discourse, for he described the preparation of *shoyu koji*, from soy beans in Japan, China, Java and other countries, *tamari*, *miso*, *to-fu*, from the same parts, *saké*, a beverage made from rice in Japan, and the ripening of various kinds of cheese in all parts of the world, and probably dating back to Neolithic times. There is also detailed mention of Russian *kvass*, Mexican *pulque*, *laette* in Scandinavia, the old English ginger-beer plant, *kephir* and *koumiss*, beverages made from fermented milk in central Asia, *leben*, a similar drink of Egypt, and *mazu* of the Armenians. The accounts of cheese-ripening are particularly interesting, and many practical problems are described. One cannot but sympathize, for example, with the up-to-date farmer who pulled down his old wooden dairy shelves, and replaced them with tile and slate, only to find that he had also parted with the "esteemed special quality" of his Stilton cheeses—the wooden shelves had been the unsuspected culture medium for the specific organism concerned.

The work originated by Pasteur led to a new era in the production of organic compounds, and since the time when Van Tieghem, Pasteur's pupil, first studied the formation of gallic acid from tannin, many compounds have been produced mycologically. Glycerol, which is a very important compound in many industries, can be produced if sugar is fermented in the presence of alkaline salts. W. Connstein and K. Lüdecke, under the stress of war conditions in 1914, showed that disodium sulphite was much more suitable than the commoner alkaline salts; it could be added in large quantities without detriment to the yeast, and kept out other contaminating organisms. Commercial diastase, oxalic and citric acids, gluconic acid, and an imposing host of organic compounds, some of them never previously prepared in the laboratory, have been made by the action of fungi. Exhaustion of our coal reserves



need have no terrors, for in addition to power alcohol, dyestuffs can be made with the aid of fungal organisms.  $\alpha$ -Hydroxyanthroquinone pigments can be produced through the agency of certain species of the genus *Helminthosporium*. Ergosterol, fats and proteins must also be added to the list of mycologically producible substances, and the discovery by Chapman that a species of *Oidium*, found to be blocking sewer channels, could produce a thick film on nutrient medium, which had the odour and flavour of cream cheese, illustrates the romantic possibilities of science.

There is a great deal in Mr. Ramsbottom's address which can be used to render the acquirement of knowledge by the student a pleasant

experience. The subject-matter is about candy, cheese, 'Marmite', coffee, mushrooms, baking and brewing—instances of common experience; but the discourse gave sufficient detail to make it of interest to the technician also. The dominant impression was one of confidence in the future. Natural mineral resources are now being exploited at an enormous rate, to produce power, dyestuffs and various chemicals; but many of these needs could also be met by the gentle ministrations of fungi. Perhaps the large number of substances already produced by these organisms might be taken as earnest that man need not fear the exhaustion of Nature's experiment with carboniferous conservation.

## Genetics and Ecology in Relation to Selection

ONE of the most striking features of post-War biology has been the reanimation of Darwinism on a genotypic, instead of a phenotypic, basis. That such an attitude to evolutionary theory derives strong support from modern genetic and ecological work is undoubtedly the chief fact which emerged from the discussion on selection held on September 10 by Section D (Zoology) of the British Association at the recent Blackpool meeting. This occupied the first morning, and immediately followed Dr. J. S. Huxley's presidential address to the Section, which itself provided a comprehensive introduction to the subject. For his review of "Natural Selection and Evolutionary Progress" was a remarkable achievement, including almost everything that could and should be said in a general survey of selection.

In recent years experiment has largely replaced observation in the study of evolution. It is now plain that selection can operate only on genotypically controlled variability. Consequently, the effects of mutation, which is the initiation of a heritable variation, demand careful study. That these are nearly always disadvantageous need, however, cause us no surprise, for any organism must represent a system carefully balanced and adjusted to its environment; so that any random change within it is immensely more likely to impair than to improve its efficiency. Yet occasional mutations have actually been observed which might be of advantage at least in special circumstances: like that mentioned by Dr. Huxley, in which a variety of tobacco failed to flower until the ratio of light to darkness was altered to correspond with what would prevail in a semi-tropical summer, when it proved superior to the normal form. But the relative viability of

the genes may be most favourably compared in crowded cultures, when it can be studied as a deviation from expectation in Mendelian ratios. Dr. Timoféef-Ressovsky, who has elaborated this technique, pointed out that such tests also demonstrate that genes have different survival values in different degrees of crowding. For this work he has employed populations of *Drosophila*, and his method has provided an experimental basis for the study of selection in the laboratory.

Using the same genus, Dr. C. Gordon has now supplied proof of selective elimination in Nature. He finds that the number of autosomal recessives is very significantly in excess of the number of recessive sex-linked genes per length of chromatin—a discovery to be correlated with the fact that selection can operate on the former only when the genes in question are present in double dose, but on the latter, in every individual of the heterogametic sex in which they occur. Dr. Gordon has also demonstrated the reality of selection in Nature by releasing, and afterwards studying, a balanced population of *Drosophila melanogaster*. This consisted of normal and 'ebony' flies in a known ratio, set free in England, where the species is not indigenous. The latter is a dark mutant form, mono-factorial and recessive. It proved to be progressively eliminated in the open.

Selection, however, operates not merely to reject one character and conserve another: it may also alter the effects of the genes, but not the genes themselves. This view, the evolutionary implications of which have been developed only in recent years, follows naturally from the consideration that genetic factors interact with one another to produce the characters for which they are responsible. Thus mutations which are



pathological in one gene-complex may be harmless or even advantageous in another, and such effects are open to the influence of selection. This concept, ably elaborated in Dr. Huxley's address, was illustrated by Mr. E. B. Ford by an example drawn from work on *Gammarus chevreuxi*. A gene which changed the eye-colour from black to red at one mutation, changed it to brownish when it mutated in another stock. A mating between the two showed that the same locus was concerned. Furthermore, successive back-crossings of each type of red into the other stock reversed their effects, demonstrating that the phenotypic difference was due to the action of the total gene-complex, not to mutation to another allelomorph at the same locus.

The effects of the genes, then, are susceptible of modification by selection, and Mr. Ford pointed out that the evolution of polymorphic mimics can be explained by no other means. It is often found that two forms of mimetic butterflies, each highly adapted in a number of distinct characters, are controlled by a single factor-pair. The allelomorph difference concerned must have originated spontaneously by mutation, but we cannot suppose that selection has had to wait for the fortuitous occurrence of a change producing all the characters required. Such would seem an almost impossible event even in a single instance, yet the condition is common. The alternative explanation of the occurrence of parallel variation in model and mimic is disposed of by the superficiality of the resemblances between them. Thus Mr. Ford has found that the red pigment produced by the mimetic forms of *Papilio polytes* is chemically different from that of the models, though this is

well known to be an instance in which the polymorphism concerned is under simple Mendelian control.

Furthermore, the study of mimetic insects has clearly demonstrated the reality of selection as an agent in stabilizing the population. Prof. G. D. Hale Carpenter, who discussed the forms of *Pseudacraea eurytus*, which mimics various species of *Bematistes*, has collected this butterfly on an island in Lake Victoria in which the proportion of models to mimics varied in different years. He found that when the models were the commoner (70 per cent of the association), intermediates between the different forms of *P. eurytus* were rare (4 per cent or less); but when the mimics were in excess, such intermediates were quite frequent (11-30 per cent).

Finally, Darwin's view of sexual selection has evoked much criticism. It is rightly felt that his analysis of this subject is one of the least satisfactory steps in his argument. However, Mr. F. C. Minns provided evidence of sexual selection in budgerigars. He further pointed out that in some forms the process must favour vigour and activity in the male and the reverse in the female, a condition proved in *Drosophila*.

It was the duty of Prof. H. J. Muller to summarize the whole subject, and he performed this difficult task with success. There can be no doubt about the value of a carefully planned discussion such as this, illuminating, as it did, a single problem from widely different angles. Each of the speakers has himself worked on the particular aspect of selection which he developed, and took the opportunity to bring forward recently ascertained or unrecorded facts.

## Obituary

### Dr. W. H. Harrison

WE regret to record the very sudden death, on August 18, of William Hudson Harrison, late of the Indian Agricultural Service, at his home near Leeds. Harrison was born in 1876. He graduated with honours in chemistry at the Yorkshire College in 1897, having been highly distinguished as a student and personally beloved by all. After graduation he was appointed chemist and manager at Knostrop Sewerage Works, Leeds, which post he held for nine years, receiving the warmest appreciation for his work both from the Leeds authorities and from the Royal Commission on sewage disposal.

In 1906 Harrison was appointed agricultural chemist to the Government of Madras, India. Here he commenced work by carrying out some valuable soil surveys, and then went on to a study of rice cultiva-

tion as practised in India under swamp conditions. He discovered the most obscure phenomena, and proceeded to elucidate them step by step. His work was highly original and practical and is assuredly a classic in this field. His papers are a record of his resource and genius. For his earlier papers on this subject he was awarded the D.Sc. degree of the University of Manchester.

Harrison's extensive work on swamp soils can only be referred to here in mere outline. His preliminary observations showed that the anaerobic fermentation of soil organic matter and green manure in these submerged soils produced large quantities of methane and nitrogen and relatively small amounts of carbon dioxide and hydrogen. On the other hand, anaerobic fermentation of green manure without soil to hold up the gas produced much carbon dioxide and



hydrogen in the first phase and carbon dioxide and methane in the second phase. Only a small amount of gaseous nitrogen was formed. Other experiments showed that by a secondary reaction under swamp soil conditions, carbon dioxide and hydrogen are recombined by bacterial agencies with the formation of organic matter and even methane. Hence the important conclusion was reached that the gases actually found in swamp soils are a residue of the gases produced in the primary fermentation, thus providing a rational explanation for the peculiar composition of the soil gas.

The gas evolved from the surface of swamp soils was found to consist mainly of oxygen and nitrogen. This gas is entirely distinct from the gases in the soil, and the soil gases do not normally escape from the surface. The evolution of oxygen at the surface was shown to be the work of a mixed film composed of certain bacteria, diatoms and algæ. The bacteria were isolated and characterized and shown to have the power of oxidizing methane and hydrogen. The photosynthetic utilization of carbon dioxide with liberation of oxygen by the film was proved, and it was shown that the development of oxygen was dependent upon the supply of methane and carbon dioxide from the soil gases.

From these and other inquiries, Harrison demonstrated that an important indirect manurial effect of green manure is to aerate the soil water in this type of cultivation. Comparing cropped and uncropped soil, it was found, among other interesting facts, that cropping greatly increased the formation of gaseous nitrogen, especially during the later stages of growth. Evidence from numerous experiments showed that the extra nitrogen formed in cropped soils is derived from the fermentation of dead roots which accumulate as the plant grows. The nitrogen cycle did not seem favourable, and it is evident that Harrison was aiming at further work on this aspect of the subject, but at this stage he was appointed Imperial agricultural chemist and transferred to Pusa. The appointment was an honour and a call to greater responsibility. He had to abandon his work on rice, but he has left a contribution which is unique.

At Pusa, Harrison undertook inquiries into soil nitrates and phosphates and soil reaction. The work on the influence of calcium carbonate on the penetration of certain phosphatic manures into the soil yielded notable information. Eventually administrative duties filled more and more of his time. He was first appointed joint director of Pusa and later became head of the service as director and agricultural adviser to the Government of India, from which post he retired in 1931.

#### Dr. Panchanan Mitra

THE death occurred on July 25, after a short illness, of Dr. Panchanan Mitra, head of the Department of Anthropology of the University of Calcutta.

Panchanan Mitra, born in Calcutta on May 25, 1891, was a member of a family already distinguished

in the study of Indian history and culture. His grandfather, Raja Rajendra Lal Mitra, was the first Indian president of the Asiatic Society of Bengal. After a distinguished career at the University of Calcutta and four years as a lecturer in English, Panchanan Mitra in 1919 was awarded the Premchand Raichand Scholarship of his university for a thesis afterwards (1923) published under the title "Pre-historic India"; and in the same year was appointed to the staff of the Department of Anthropology, of which he became head on the retirement of Diwan Bahadur Dr. Anantha Krishna Iyer in 1932. In 1929, at the instance of Dr. Craighill Handy, he was appointed to a fellowship of the Bernice P. Bishop Museum, Honolulu, and travelled extensively in Polynesia, collecting evidence bearing upon the problem of the influence of Indian cultural traits on Polynesia. His results are now on the point of publication. A period spent at Yale University working with Dr. Clark Wissler on distributional studies resulted in "A History of American Anthropology" (Calcutta, 1931), for which he was awarded a Ph.D. In 1931 also he visited Spain and southern France as a member of the American School of Archæology in France. Two years later he presided over the Anthropological Section of the Indian Science Congress.

Dr. Mitra was not only himself a distinguished research worker, but he was also an organizer of research. He was responsible for the close conjunction of research in the laboratory and in the field, which is now an important feature in the work of his Department. His premature death is a great loss to anthropological studies in India.

#### Prof. Eugène Lagrange

EUGÈNE LAGRANGE, seismologist and emeritus professor of physics at the École militaire at Brussels, died in that city on June 15 (*Boll. Ital. Soc. Sism.*, 34, 156; 1936). Born in 1855, he entered the École militaire in 1873 and, after passing through its course, was appointed first as assistant professor, and then as professor, of physics, an office that he held until his retirement in 1907. In 1898, he spent some time in Strassburg, in order to become acquainted with the use of seismological instruments. Through the generosity of M. Ernest Solvay, he was enabled to construct a seismological station at the Royal Observatory of Uccle, where he installed three horizontal pendulums of the Rebeur-Ehler type. His observations there were continued until the end of 1903, when M. Solvay presented the station to the Belgian Government. At the same time, two other stations were placed under his direction, one of them at a depth of more than half a mile in a disused passage of a coalmine, the principal object of which was to discover if any relation exists between microseismic movements and the emission of fire-damp. From 1908, Prof. Lagrange directed the well-known journal *Ciel et Terre*, until, in 1910, it was combined with the *Bulletin de la Société belge d'Astronomie*.



## Mr. Alan A. Blakeway

WE regret to record the death, at the age of thirty-eight years, of Mr. Alan Blakeway, director of the British School of Archaeology at Athens, which took place at Winchester after an operation on October 9.

Alan Albert Antisdell Blakeway was a son of the late Charles Edward Blakeway, Archdeacon of Stafford, and was educated at Shrewsbury School and Christ Church, Oxford. After taking first class honours in the school of *Literæ Humaniores*, he was for six years a master at Winchester, and then in 1931 was elected a fellow and tutor in ancient history of Corpus Christi College, Oxford. In May last, on the death of Humfry Payne, he accepted the directorship of the British School for the time being. His death took place on the eve of the opening of the exhibition at the Royal Academy of Arts, which celebrates the fiftieth anniversary of the School, and in the preparations for which both he and Payne had taken a very active part.

Blakeway had excavated on behalf of the School both at Perachora and in Crete, and he had for long been engaged in research on the commercial relations of Greece with Italy, Sicily and France in the eighth and seventh centuries B.C. The first fruits of his researches, which he had begun to publish in the *Annual* of the School and the *Journal of Hellenic Studies*, had already won recognition as of outstanding merit.

WE regret to announce the following deaths :

Dr. J. W. Folsom, senior entomologist in the United States Department of Agriculture, an authority on cotton insects, on September 24, aged sixty-five years.

Dr. George Forbes, F.R.S., formerly professor of natural philosophy in Anderson's College, Glasgow, on October 22, aged eighty-seven years.

Prof. F. Hendrickx, emeritus professor of veterinary medicine in the Belgian Veterinary School.

Dr. S. M. Kintner, vice-president in charge of engineering of the Westinghouse Electric and Manufacturing Company, formerly professor of electrical engineering in the University of Pittsburgh, an authority on radio engineering, on September 28, aged sixty-four years.

Prof. W. A. Parks, F.R.S., professor of geology in the University of Toronto, on October 3.

Dr. E. E. Prince, former Dominion Commissioner of Fisheries, Canada, an authority on the life-histories of marine food fishes, aged seventy-eight years.

Dr. Gustaf Schack-Sommer, a pioneer in the sugar-beet industry in Great Britain, aged eighty-two years.

Prof. G. Sergi, emeritus professor of anthropology in the University of Rome, aged ninety-five years.

Prof. W. J. Sollas, F.R.S., professor of geology in the University of Oxford, on October 20, aged eighty-seven years.

## News and Views

## Prof. A. R. Radcliffe-Brown

ALFRED REGINALD RADCLIFFE-BROWN, who has been appointed to the recently instituted professorship of social anthropology in the University of Oxford (see p. 772), was educated at the King Edward High School, Birmingham, and Trinity College, Cambridge, where he was elected to the Anthony Wilkin scholarship in ethnology, carrying out ethnographical investigations in the Andaman Islands. He was a fellow of Trinity College from 1908 until 1914, and a lecturer in ethnology in the University of London in 1909-10. After the Great War, Prof. Radcliffe-Brown held an educational post in Tonga for a time and was afterwards on the staff of the Transvaal Museum until he was appointed to the chair of social anthropology in the University of Cape Town in 1921. This he held until his appointment as professor of anthropology in the University of Sydney. Here, as at Cape Town, he was active in promoting ethnographical work in the field, and the present activity of anthropological studies in Australia is largely due to his enthusiasm and power of organization. In 1931 he left Australia to join the staff of the University of Chicago. Prof. Radcliffe-Brown was president of the Anthropological Section of the British Association at the centenary meeting in London in 1931, when he dealt in his presidential

address with the methods of investigation in social anthropology, of which he had already given a practical demonstration in "The Andaman Islanders", which is, up to the present, his most important and considerable contribution to anthropological literature.

## National Museum of Wales and Welsh Cultural Studies

IMPORTANT developments in policy and organization, made possible by an increased Treasury grant, were announced in the annual report of Council of the National Museum of Wales, which was presented at the court of governors held at Cardiff on October 23, when Mr. W. G. A. Ormsby-Gore, vice-president of Council, was in the chair. An immediate addition of £1,500 per annum, to be followed by two increments of £750 per annum, will raise the Treasury grant to £20,000 per annum in all by April 1, 1938. Of the additional income, the Council proposes to set aside part to form a fund for the purchase of collections of outstanding importance, otherwise beyond the normal resources of the Museum. Of even greater interest, however, is the second development, to which effect has already been given. The Sub-Department of Folk Culture and Industries within the Department of Archaeology has been advanced to the status of a full department. It will cover the



national ethnography and cultural history of Wales from the Act of Union of 1536 to the present day, with the proviso that the modern industrial civilization will not be covered, save to a limited degree. It will, therefore, concern itself with the trades and crafts, the ways of living and working, the domestic and industrial environment, and the clothes and customs of past generations of all ranks of the Welsh people. The enhanced status of this section of the National Museum is no more than due recognition of the value of a piece of work to which much time and research have been devoted by the responsible authorities, and from which important studies have already accrued. The collections at Cardiff illustrating the life and culture of the Welsh people—even more now that this opportunity for expansion is afforded them—provoke regret that no similar unitary collection deals in like manner with the folk history of England.

#### Future of Liquid Fuel Production

SIR PHILIP DAWSON's presidential address to the Institute of Fuel on October 15 entitled "Road, Rail and Fuel" emphasized our dependence on imported liquid fuel, and especially motor spirit. He stated that in the present year, Germany will produce more than fifty per cent of her needs of light motor fuel. The use of Diesel fuel is increasing in all forms of transport. Discussing the relation of road and rail, he said that the former employs almost twice as many persons as the railways, and in ten years the number of railway employees has fallen by fourteen per cent. Sir Philip advocated an extension of railway electrification, but pointed out that this would involve a big reduction in the consumption of coal, even were the power generated from steam boilers. At the same meeting Dr. Franz Fischer, of the Kaiser Wilhelm Institut, Mulheim, delivered the Melchett Lecture to the Institute, taking as his subject the conversion of coal into liquid motor fuels and other products by way of carbon monoxide. Having indicated the advantages of beginning with a single pure gas such as carbon monoxide rather than raw coal, as in direct hydrogenation, Dr. Fischer traced the development of his work from 1921 until the present stage when large-scale plant is in use. Very extensive efforts were necessary in the search for a suitable catalyst and a method for adequately purifying the gaseous raw material. Hydrocarbons ranging from petrol to paraffin wax are obtained by this 'Kogasin' synthesis. Thus these researches have shown that from coal and water all necessary liquid fuels would be obtainable from coal even if mineral oils were entirely exhausted. Fischer's process offers the advantage over the process of direct hydrogenation, that high pressures are not used and that only plant of common materials, easy to fabricate, is required.

#### Electric Services in Buildings

MR. H. T. YOUNG, who is connected with the installation and contracting section of the electrical industry, gave his presidential address before the Institution of Electrical Engineers on October 22.

In the early days, electrical installations in buildings were for lighting and bells. Wood casing was used, and, so far as possible, it was concealed from view. Cables, wires and equipment were placed anywhere where they would be out of sight. Now new and larger buildings are being erected all over the country, and electrical contractors are having difficulty in doing their work satisfactorily under the new conditions. The steel and concrete buildings of to-day, if once completed, are almost impregnable to electric services. The item in electrical accounts entitled "cutting away and making good" averages about ten per cent of the cost of the whole installation. In new buildings which are planned and designed for electrical services, this item is much smaller and the time of building is accelerated; Mr. Young urged that channels, ducts and conduits for the reception of wires and cables should be considered in the future as an integral part of the building from the point of intake to the outlets. In the United States and Canada, underfloor duct systems have been adopted for more than ten years as standard practice in nearly every type of building, except private houses. The ducts are made of steel or fibre and are laid in the floor during construction. In Great Britain, a beginning of the duct system has been made. Three ducts are used, one for telephones and signalling wires, one for heating and power, and one for lighting.

MR. YOUNG showed lantern slides of installations in progress and completed where electrical engineers and architects have planned their work together. In particular, he mentioned the new buildings of the University of London, which he said are the most interesting buildings in the course of erection in the country to-day, and also seem to have the most complete electrical installation, as the lighting, space-heating, water-heating, and many other services are all electric. There is one flue only, and that is for a coal fire in an official's study. In blocks of flats in London, arrangements are now being made for the reception of sound and television services. These are taken from one central aerial system and distributed by cables to a terminal box in each flat. The tenant receives both services on his own equipment through a 'socket outlet' and plug attachment. A special type of cable is used for carrying the extremely high frequency currents used in television. The estimated total annual consumption of all-mains radio sets is 300 million units. This equals twice the estimated load in 1910 for lighting, heating and cooking. He mentioned that a large store in London (Selfridge's) has an annual consumption of electricity ( $7\frac{1}{2}$  million units) which equals that of places like Weymouth, Perth, or the whole of the Isle of Wight. There are other buildings in London, such as stores and hotels, which consume five million units per annum. He considers that none of these could be described as fully equipped electrically.

#### The Training of the Engineer

IN his inaugural address as president of the North-East Coast Institution of Engineers and



Shipbuilders on Friday, October 23, Prof. C. J. Hawkes took as his main theme "The Training of the Engineer" and, as a background, his work and experience in the revision of the engineering degree courses at the University of Durham lent an unusual interest and value to his remarks. Engineering is not a science but an art depending on science and, between the two, there are still many gaps, which the engineer has to bridge. His decisions have to be in a form capable of being translated into practice, and he has to be trained to make use of established scientific principles in conjunction with a knowledge of the needs of the world, of the natural forces to be contended with, of the properties of the materials to be used, of the capacities and limitations of those through whom the work has to be done and of the plant, tools, and machinery on which the processes depend. Prof. Hawkes indicated how the curricula at Durham have been revised to comply with these comprehensive demands. The more human aspects are provided for by weekly reports and discussions in college, and by the personal contact during the workshop training with men of all classes, perhaps the most broadening influence that could be found. By the limitation of available time, the graduate course is mainly confined to the study of scientific principles and their applications. Such subjects as economics, works organization and administration are considered preferably as post-graduate studies. Prof. Hawkes also took occasion to report the progress of research work at Armstrong College, which has been greatly fostered by the members of the Institution he was addressing.

#### Observatory for St. Albans High School for Girls

ON October 23, Sir Frank Dyson inaugurated at St. Albans High School for Girls the observatory recently bequeathed to the school by the late Dr. William Alfred Parr. Dr. Parr, a well-known amateur astronomer and past-president of the British Astronomical Association, resided in St. Albans during the last few years of his life, and had erected in his garden a small but well-equipped observatory, containing a four-inch clock-driven equatorial by Cooke, with a photo-visual object-glass, Evershed solar spectroscope and other accessories. The entire observatory, which is of wood, surmounted by a 10-foot revolving dome, was, with its small annexe, removed from Dr. Parr's garden during the summer, and re-erected in the school grounds near the new gymnasium, under the supervision of Dr. W. H. Steavenson. Following an address by Sir Frank to the staff and pupils, assembled in the latter building, the observatory was formally opened and dedicated with picturesque ceremony, the Dean of St. Albans, the senior science mistress and the head girl taking part.

#### Food and the Family Budget

THE Engineers' Study Group on Economics, which was formed towards the end of 1933 to investigate the economic and social problems presented by the co-existence of poverty and actual or potential

plenty, has now published its investigations on family budgets in a pamphlet entitled "Food and the Family Budget" (Engineers' Study Group, Hazlitt House, Southampton Buildings, W.C.2. 1s. 6d.). This investigation has been confined to conditions as they exist in Great Britain to-day. The problem is treated quantitatively, and an attempt is made to deduce some general minimum standard of living which would be both desirable and practicable. The method used was that of analysing and comparing published data on family budgets, at the same time taking into consideration modern trends in consumption and requirements indicated by scientific research. The total budget required to provide the minimum standard desirable was found for a "statistical average family" of 3.72 persons to be about £6 per week (equivalent to about 63s. per week for each wage earner) and of this sum about 37s. a week would be required for expenditure on food. The suggested food budget is shown to be compatible with (a) the dietetic requirements laid down by the British Medical Association Committee on Nutrition; (b) actual national consumption; and (c) the increased consumption of home-grown foodstuffs that would raise the dietetic standard to a level adumbrated by Sir John Orr. There is little doubt, it is stated, that a large part of the population is suffering from lack of nutritious foodstuffs, particularly fresh dairy produce, fruit and vegetables.

#### Noise on the Road

THE Departmental Committee which was set up in 1934 by the Minister of Transport, under the chairmanship first of Sir Henry Fowler and afterwards of Dr. G. W. C. Kaye, to study the question of motor-vehicle noises, has issued its second interim report (London: H.M. Stationery Office. 1s. net). The report elaborates and extends the first report of the Committee, which dealt with new vehicles including motor-cars, sports-cars, motor-cycles and goods- and passenger-carrying vehicles. It appears from the report that a consensus of opinion considered that a loudness of ninety British standard phons represents in general a transition point between tolerably noisy vehicles and unduly noisy ones. Two types of tests are therefore proposed by the Committee: (a) normal-running tests in which a vehicle running under full throttle at 30 m.p.h. must not generate an overall noise exceeding 90 phons at 18 feet lateral distance; (b) racing-engine tests in which a stationary vehicle the engine of which is racing at maximum-power speed must not generate an overall noise exceeding 90 phons at 25 feet behind the open end of the exhaust pipe. A temporary tolerance limit is suggested for motor-cycles and commercial vehicles. In the meantime, the Minister has received an assurance from the manufacturers of motor-cycles and sports-cars, which are among the chief offenders on the road, that no new vehicle shall in future leave their works the noise of which can be regarded as offensive. The Ministry of Transport is proposing to set up six noise-testing stations to assist the industry in this laudable object. Meanwhile, work is



proceeding on the production of a simplified objective noise meter so as to facilitate its production in greater numbers. Detailed results of the tests, which were carried out by the National Physical Laboratory, are given in the report.

#### Recent Acquisitions at the Natural History Museum

THE Museum has received as a permanent loan from His Majesty the King a fine series of elephant tusks. The series comprises the record pair of Indian tusks, three pairs and a single large tusk of the African species, and an ornamented tusk of the Malayan elephant. The Indian tusks, which are figured in Rowland Ward's "Records of Big Game", are of exceptional size for Indian ivory, measuring 8 ft. 9 in. and 8 ft. 6½ in. in length and weighing 161 lb. and 160 lb. respectively. Good Indian tusks rarely exceed 6-7 ft. in length or weigh more than 80-100 lb. The Trustees of the American Museum of Natural History, New York, have handed over to the National collection the type specimens of fifteen races of British and Irish birds, described by the late Dr. E. Hartert and Mr. H. F. Witherby. These types formed part of the famous Rothschild collection which was purchased by the American Museum in 1932. Through the generosity of Mr. E. C. Stuart Baker, the Museum has received the largest collection of birds' eggs ever presented to the British Museum. This great collection consists of approximately 50,000 eggs belonging to some 1,960 different species of birds found in the Indian Empire. Very many of these eggs were not previously represented in the national collection and in a considerable number of cases Baker's specimens are the only ones known. A collection of more than 6,000 invertebrates, chiefly Brachiopoda and Trilobita, including 40 new species, as well as type and figured specimens, collected by Mr. B. B. Bancroft with great exactness as to horizon and locality, from the Ordovician of the Welsh Borderland and the Lake District, has been purchased for the Department of Geology. The Mineral Department has received from the Director of the Geological Survey of Nigeria as a donation a piece, besides several fragments, of the meteoric stone which fell near Udei station, Benue river, Nigeria, in 1927. The meteorite is of unusual interest because it belongs to the rare pallasite group of stony-irons containing olivine.

THE Department of Botany has received from Mr. C. J. Brooks his fern herbarium, containing about 2,650 specimens. Mr. Brooks was employed as a chemist in the gold-mining industry in Sarawak and later in Sumatra, where he collected insects and ferns. He discovered many new species in the mountains of Borneo and Sumatra, including Gunong Dempo. He also visited Celebes and Amboina. In the latter island he made a very complete collection and ascended the volcano Salahoetoe. Mr. Brooks's plants were mostly worked out by Capt. C. R. W. K. van Alderwerelt van Rosenburgh at Buitenzorg, and many are types or paratypes not otherwise represented in Europe. He was also in touch with Prof.

E. B. Copeland and the late Prince Roland Bonaparte, and obtained some specimens by exchange. Especially notable are a set of Schlechter's New Guinea ferns and some from Papua collected by the Rev. Copland King. His herbarium is the most valuable acquisition that the fern collections have had for many years, the more so as it comes from a region which was previously somewhat scantily represented. The Oxford University Exploration Club has presented the botanical collections made by Mr. H. G. Ververs on the recent expedition to Greenland. This comprises more than five hundred numbers. Dr. G. N. Humphreys of the Mount Everest (1936) Expedition has sent to the Museum a collection of 88 flowering plants which he made at the higher camps used by that Expedition. Considering the conditions under which Dr. Humphreys worked, the plants are very well collected and dried, and he appears to have obtained a good representation of the alpine flora. The Department has particularly fine collections from Nepal, and Dr. Humphreys' specimens will add further to the importance of this Himalayan material. A number of the species represented reach the altitudinal limit of flowering-plant vegetation, and it is particularly valuable to have the precise altitude at which each specimen was collected.

#### Colonial Territories and Economic Opportunity

THE Advisory Committee of the National Executive of the Labour Party has prepared a pamphlet on "The Demand for Colonial Territories and Equality of Economic Opportunity" in which the position of the three 'dissatisfied' Powers—Germany, Italy and Japan—is examined (Labour Party, Transport House, Smith Square, London, S.W.1. 4d.). In analysing access to raw materials, the division of the world, recently adopted by the *Economist*, into the British Empire, the French Empire, the Dutch Empire, the U.S.A., the U.S.S.R., and the rest of the world, is used. The general conclusion is reached that colonies are of some, but not of great, economic importance. Only in the case of rubber are the colonial possessions of a Great Power of dominant importance. It is held that the abolition of discrimination rather than the exchange of territories should be the objective. To this end, the Labour Party should advocate the bringing of Colonial possessions, such as those of Britain in Africa, under the mandates system—approximately of the present B Class of mandates. The pamphlet is full of information and deserves close study.

#### Teaching Electric Cookery in Switzerland

In the *Electrical Age* of October, a magazine published by the Electrical Association for Women, an interesting summary is given of Swiss methods of teaching electrical cooking in schools. Swiss manufacturers supply special electric cookers for use in school kitchens. These are made to stand away from the wall so that access can be obtained from all sides. The oven is placed on one side instead of being put under the hot plates as in the ordinary domestic cooker. This facilitates access to it and at



the same time provides standing place for cooking utensils on the top of the oven. The arrangements are such that the pupils can be conveniently divided into four groups. Each group is self-contained and has charge of a cooker with oven, table and washing-up arrangements, and a cupboard for utensils and crockery. The items of equipment are arranged as close together as possible and in the order in which they are required. In order to teach economy, the pupils are required to reckon up the total cost in materials and electrical consumption of all food prepared. A separate meter is usually installed in the circuit supplying each cooker. Although rarely used in schools, descriptions are given of the tilting cauldron and the tilting oven often used in hotels and institutions. The cauldrons, instead of having a tap for withdrawing the contents, are arranged to tilt and pour out the contents over a wide lip. They are mounted on trunnions and worked by a worm gear so that the tipping is done gradually without the risk of spilling. They can be kept clean as easily as a basin, and the heat control is such that even milk cannot boil over.

#### Agricultural and Horticultural Pests

MUCH recent research into the incidence and overwintering of the potato blight fungus (*Phytophthora infestans*) has made it necessary for the Ministry of Agriculture to revise its leaflet upon this subject. The new Advisory Leaflet, No. 271, shows that the fungus overwinters upon infected tubers, and there are usually sufficient of these left from previous crops, or thrown out from storage pits, to begin fresh infection in the spring. Control by spraying and dusting is described, and other methods include the removal and destruction of haulm before digging the crop, and the disposal of blighted tubers. Advisory Leaflet No. 273 replaces leaflet No. 195, and deals with American gooseberry mildew (*Sphaerotheca mors-uvæ*). The subject-matter has been brought up to date. A short Advisory Leaflet (No. 182) deals with spurrey (*Spergula arvensis*) as an agricultural weed. Spraying with 5 per cent solution of copper sulphate, or 7-10 per cent sulphuric acid, are recommended for control of the weed amongst cereal crops, in addition to the application of lime, and other methods.

#### Medallions of Manganese Steel

WHEN King Edward, as Prince of Wales, visited the Hecla Works of Hadfields, Ltd., some years ago, he cast a medallion portrait of himself in manganese steel. A similar medallion, 20 inches in diameter, was recently cast showing the head and shoulders of General the Right Hon. J. C. Smuts, P.C., and both are now on view at the Johannesburg Empire Exhibition, of which General Smuts is honorary president. The manganese steel of which these medallions are made is run into the moulds at a temperature of about 1,450° C., but despite this high temperature, and owing to the specially developed moulding sand employed, the definition of the features is remarkable, each detail being reproduced as clearly as in a photograph.

#### Faraday House Journal

WITH the opening of the Michaelmas term at Faraday House Electrical Engineering College, *Faraday House Journal* makes its reappearance and, in addition to the usual personal, social and collegiate items, the present number contains several short papers of note. The principal, Dr. A. Russell, writing under the title "Unfettered Mathematics in Engineering", continues his articles on capacitance coefficients, and here shows that the capacitance of a system of two external spheres can be expressed in terms of certain spherical condensers, the values of which can readily be found. In a paper "On a Natural System of Absolute Physical Measurement", Sir Ambrose Fleming puts the case for, and gives data relative to, a system based on the rest mass of the nucleus of the hydrogen atom and the wave-lengths and periodic times of certain of its radiations. "Fluorescence under Ultra-Violet Light" by Dr. W. R. C. Coode-Adams and "Perspective" by the Rev. L. Van Vestrout complete this section of the contents and their titles sufficiently indicate the nature of these two papers.

#### Bureau international des Poids et Mesures

DR. CHARLES-EDOUARD GUILLAUME, director of the Bureau international des Poids et Mesures, is retiring after fifty-three years in the service of metrology. The permanent administrative committee of the International Committee of Weights and Measures, which consists of Prof. V. Volterra of Rome (president), Prof. B. Cabrera of Madrid (secretary), Prof. P. Janet of Paris, Prof. P. Zeeman of Amsterdam, and Dr. C. E. Guillaume, has nominated M. Albert Pérard, assistant-director of the Bureau, to succeed Dr. Guillaume. M. Pérard, like his predecessor, has spent all his life at the Bureau; he is best known for his work on the metrology of the interference of light. The Bureau, the oldest of the international scientific organizations, is at the Pavillon de Breteuil, Sèvres, Seine-et-Oise; since the signature of the Convention of the Metre in 1875, it has been under the direction in turn of G. Govi, O. J. Broch, J. R. Benoît and Dr. Guillaume.

#### New Midwives' Service

A CIRCULAR on the Midwives Act, which has recently become law, has been issued by the Minister of Health (Circular 1569. London: H.M. Stationery Office. 6d. net). The Act marks an important advance in the policy of improving the public health services of Great Britain, and should do much to improve the maternity services, and secure a reduction in the present rate of maternal mortality. The Act aims at providing every prospective mother whose baby will be borne at home with the services of a trained midwife for her confinement and fourteen days thereafter. The new arrangements should also do much to improve the status and prospects of midwives who enter the new service. The Circular, which is addressed to the local authorities administering the Act, contains a memorandum fully explaining the provisions of the Act.



### Leonard Darwin Scholarship of the Eugenics Society

THE Eugenics Society has established a second Leonard Darwin scholarship, which is to be devoted to the investigation of racial crossing. The first holder is J. C. Trevor, a graduate of Oxford in anthropology, who has spent the last two years studying mixtures of negro and white stocks in the United States, with the aid of a Commonwealth fellowship. He has collected ethnological material in the Virgin Islands and in East Africa, and with Dr. Dudley Buxton has made an investigation of English medieval skulls. He has also a collection of biometric material on West African and American negro crania. Mr. Trevor will devote a year to a survey of the literature on the subject of inter-racial crossing.

### Another New Star in Aquila

THE Swedish observer, Mr. Nils Tamm, who discovered a nova of magnitude 8 in Aquila last month, has now detected another of these bodies in the same constellation. The latest nova was announced on October 20 as having been found on a plate taken on October 7, when the magnitude is stated to have been 7.0. Dr. W. H. Steavenson, who gives the position of the nova for 1936.0 as R.A.  $19^{\text{h}} 23^{\text{m}} 28.16^{\text{s}}$ , North Decl.  $7^{\circ} 28' 32.5''$ , finds the magnitude to be about 8.0, with little fading between October 21 and 25. He reports the colour as being fiery red. In the spectrum the red line of hydrogen ( $\text{H}\alpha$ ) is very bright and prominent, and contributes a large proportion of the total visual light of the nova. Tamm's earlier nova is still of about the eighth magnitude, after undergoing some marked fluctuations since its discovery. The two novæ can just be seen simultaneously in a good prism binocular, being only a little more than six degrees apart.

### The Night Sky in November

At the beginning of the month, the duration of night (defined as the interval from sunset to the following sunrise) is 14.4 hours, and at the end of the month 15.9 hours in the latitude of London. The moon is new on November  $14^{\text{d}} 4.7^{\text{h}}$  and full on November  $28^{\text{d}} 16.2^{\text{h}}$  U.T. Occultations of stars brighter than magnitude 5 occur on November 28–29, when  $\alpha$  Tauri reappears at  $17^{\text{h}} 30.6^{\text{m}}$  and  $\tau$  Tauri disappears at  $23^{\text{h}} 48.4^{\text{m}}$  and reappears at  $1^{\text{h}} 0.2^{\text{m}}$ . The planet Venus sets this month in the early evening, and at sunset is low in the south-west. Jupiter is in the same region of the sky, and on the evening of November 12 will be found about  $2^{\circ}$  above Venus. The near approach of these two bright objects (actual conjunction takes place on November  $13^{\text{d}} 12^{\text{h}}$ ) will be well worth looking for at nightfall on November 12 and following with telescopic aid about midday on November 13. Mars is a morning star of magnitude about +1.8. Saturn is above the horizon during the first part of the night; on November 15 it sets just before  $1^{\text{h}}$ . Watch may be kept on November 15–16 for a possible display of the Leonid meteors. This shower, the radiant point of which is at R.A.  $10^{\text{h}} 0^{\text{m}}$ , Dec. +  $22^{\circ}$ , is generally visible every November, but at epochs of every 33 years it yields, with some

exceptions, an unusually brilliant display. The last great shower was due in 1932, but in Great Britain it failed to come up to expectations, though at one station in the United States as many as 240 meteors were observed in an hour. November 19–20 is the date of maximum of the Andromedids, a shower associated with the lost comet of Biela; the radiant of the shower is not far from the star  $\gamma$  Andromedæ. (Near  $\nu$  Andromedæ may be seen, with the naked eye, a tiny, faint hazy patch which is the Andromeda nebula, distant 870,000 light years.) The light variations of Algol ( $\beta$  Persei) can be observed at about the following times: November  $8^{\text{d}} 2^{\text{h}}$ ,  $10^{\text{d}} 23^{\text{h}}$ ,  $13^{\text{d}} 19^{\text{h}}$ ,  $28^{\text{d}} 4^{\text{h}}$  and December  $1^{\text{d}} 0^{\text{h}}$ . In mid-November at about  $22^{\text{h}}$ , the constellations Cassiopeia, Perseus, Andromeda, Aries and Cetus are on or near the meridian, but the eastern half of the sky, rich in first magnitude stars and led by the Pleiades, will probably claim the observer's attention.

### Announcements

THE Right Hon. Lord Rutherford will deliver the twelfth annual Norman Lockyer Lecture of the British Science Guild at the Goldsmiths' Hall, Foster Lane, London, E.C.2, on November 12 at 4.30 p.m. The title of Lord Rutherford's lecture will be "Science in Development". This is the last occasion upon which the Norman Lockyer Lecture will be arranged by the British Science Guild as an independent body. In future the lecture will be carried on under the auspices of the British Association. Tickets for Lord Rutherford's lecture are obtainable, free of charge, on application to the Secretary, British Science Guild, 535–7 Abbey House, Victoria Street, London, S.W.1.

SIR THOMAS HOLLAND will deliver the Huxley Lecture at the Imperial College of Science and Technology on May 4, 1937, at 5.30 p.m. The subject of Sir Thomas's lecture will be "The Permanence of Oceanic Depressions and Continental Elevations".

PROF. S. CHAPMAN, chief professor of mathematics in the Imperial College of Science, has been elected a member of the Kaiserlich Deutsche Akademie der Naturforscher, Halle, in recognition of his researches in terrestrial magnetism.

THE Chadwick Gold Medal and Prize for excellence in municipal engineering and hygiene was presented to Mr. E. A. Drew, of University College, London, on October 27.

At the annual statutory meeting of the Royal Society of Edinburgh held on October 26, the following Council was elected: *President*: Prof. D'Arcy Wentworth Thompson; *Vice-Presidents*: Principal O. Charnock Bradley; Prof. P. T. Herring; the Marquis of Linlithgow; Prof. E. B. Bailey; Prof. F. A. E. Crew; and Lieut.-Col. A. G. McKendrick; *General Secretary*: Prof. James P. Kendall; *Secretaries to Ordinary Meetings*: Dr. A. C. Aitken and Dr. C. H. O'Donoghue; *Treasurer*: Dr. James



Watt; *Curator of Library and Museum*: Dr. Leonard Dobbin; *Councillors*: Principal J. C. Smail; Sir Harold J. Stiles; Prof. J. Walton; Prof. Edwin Bramwell; Prof. T. H. Bryce; Prof. I. de Burgh Daly; Mr. J. A. Inglis; Prof. A. D. Peacock; Dr. J. E. Mackenzie; Prof. Sydney Smith; Prof. Ralph Stockman; and Dr. E. MacLagan Wedderburn.

A BRONZE bust of Dr. Emile Roux was recently unveiled at Angoulême, where addresses were delivered by Prof. Marchoux, representing the Paris Academy of Medicine, and Dr. Louis Martin, Roux's successor at the Pasteur Institute.

A PAN-RUSSIAN scientific institute for the study of the bacteriophage has been erected at Tiflis, and will be opened next year under the direction of Prof. F. d'Hérelle.

At the ninety-fourth Congress of the Society of German Men of Science and Physicians, recently held at Dresden, a German Society of Hygiene was founded under the presidency of Prof. Hans Reiter, president of the Health Office of the Reich.

THE Argentine Government has formed a national committee of intellectual co-operation with the object of promoting intellectual co-operation with different countries in science, literature, art, education, etc. The committee will enter into relations with the International Institute of Intellectual Co-operation in Paris and the International Office of Education at Geneva.

MESSRS. JAMES TREGASKIS AND SON, of 66 Great Russell Street, London, W.C.1, in their Caxton Head Catalogue, No. 1023, are offering for sale some interesting Newton papers. This includes John Flamsteed's "Historia Cœlestis", a collection relating to the "Historia Cœlestis" published by Newton and Halley without the consent of the author; a letter by Newton to Sir Richard Onslow; Newton's signature on an oblong vellum document; a letter from Menshikoff to Newton concerning the former's fellowship of the Royal Society, together with three autographed drafts of Newton's reply; a note on the calculus by Newton; several letters on the calculus; and a letter to Newton from John T. Desaguliers, inventor of the planetarium.

THE Imperial Council of Agricultural Research, Simla, announces that there is a surplus stock of certain agricultural and veterinary publications for free disposal (packing and carriage to be paid by the indenter). The following are listed: Handbooks of Commercial Products (17 different volumes); Catalogue of Indian Insects (parts 1-22, part 11 excepted); Proceedings of the Board of Agriculture in India (1906-29—series incomplete). The number of copies available is limited, but in the case of the Commercial Handbooks is quite considerable. Application for any of these publications should be made to the Manager of Publications, Civil Lines, Delhi, on or before November 30.

ERRATUM. In NATURE of October 3, p. 589, in the letter entitled "A New Strigeid Parasite of the Rare Genus *Cyathocotyle*", for "*Cyathocotyle calvusi*" read "*Cyathocotyle calvi*".

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

An assistant engineer in the Roads Department of the Ministry of Transport—The Establishment Officer, Ministry of Transport, Whitehall Gardens, London, S.W.1 (October 31).

An assistant (Grade II) (physics or engineering) in the Signals Experimental Establishment, Woolwich Common, S.E.18—The Superintendent (November 2).

An assistant lecturer in mechanical engineering, and a workshop instructor in Coventry Technical College—The Director of Education, Council House, Coventry (November 6).

An assistant physicist in the Radiotherapy Department of the Middlesex Hospital Medical School, W.1—The Dean (November 9).

An assistant (man) in the Technical Education Branch and a woman organizer of instruction in domestic subjects in the Education Department of the West Riding of Yorkshire—The Education Officer, County Hall, Wakefield (November 9).

A University reader in mechanical engineering in King's College, London—The Academic Registrar, University of London, W.C.1 (November 10).

An Imperial mycologist at the Imperial Institute of Agricultural Research, Pusa, Bihar, India—The High Commissioner for India, General Department, India House, Aldwych, London, W.C.2 (November 10).

A metallurgical inspector in the Indian Stores Department—The High Commissioner for India, General Department, India House, Aldwych, London, W.C.2 (November 13).

A principal of Twickenham Technical Institute—H. M. Walton, 10 Great George Street, Westminster, S.W.1 (November 14).

A technical officer (ref. A. 263) and assistants (Grade III) at the Royal Aircraft Establishment, South Farnborough, Hants—The Chief Superintendent (November 14).

A lecturer in experimental zoology in the University of Edinburgh—The Secretary (November 21).

A St. Mungo professor of pathology in the University of Glasgow—The Secretary to the University Court (November 26).

A principal of the Farm School and Officer-in-Charge of the School Farm and Experimental Station in the Department of Agriculture, Peradeniya, Ceylon—The Director of Recruitment (Colonial Service), 2 Richmond Terrace, Whitehall, S.W.1 (November 30).

An assistant research chemist at the British Drug Houses, Ltd., Graham Street, City Road, N.1—The Secretary.

An executive engineer in the Public Works Department of the Government of Sierra Leone—The Crown Agents for the Colonies, 4 Millbank, London, S.W.1 (quote M/4572).

A reader in bacteriology in the Department of Pathology, University of Oxford—The Professor of Pathology.



## Letters to the Editor

*The Editor does not hold himself responsible for opinions expressed by his correspondents. He cannot undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. No notice is taken of anonymous communications.*

NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 764.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

### The Hydrogen Bond and the Structure of Proteins

IN a theory put forward in these columns in March last<sup>1</sup>, it was suggested that the molecule of simple native protein may contain closed polypeptides: that the polypeptides, open or closed, fall into rings: and that the ring system is such as to allow the possi-

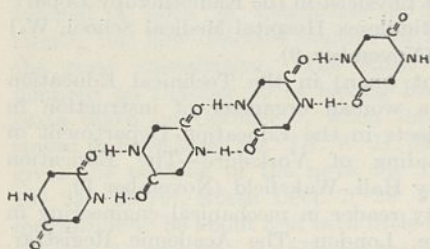


FIG. 1.

bility of a regular and orderly arrangement of hundreds of amino and imino acid residues which, to some extent at least, is independent of the particular residues in the molecule. These suggestions, as was clear from the

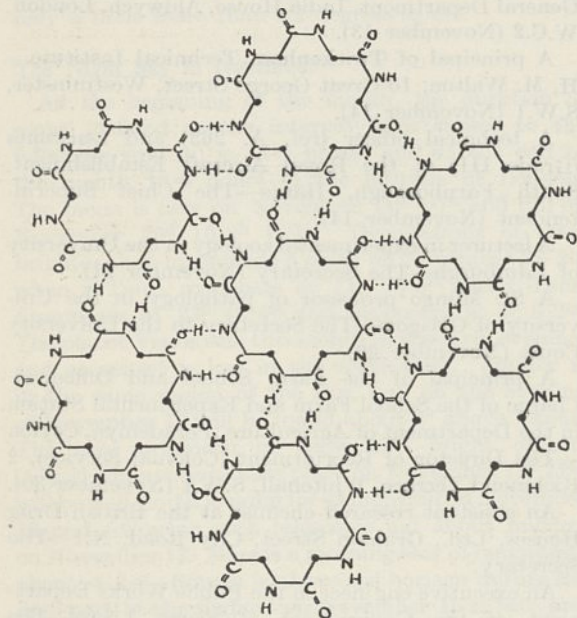


FIG. 2.

outset, can be given precise formulation in more than one way. Two in particular seemed worthy of detailed consideration.

In the previous communication the formulation

was in terms of the cyclization of polypeptides and the polymerization of diketopiperazines and other

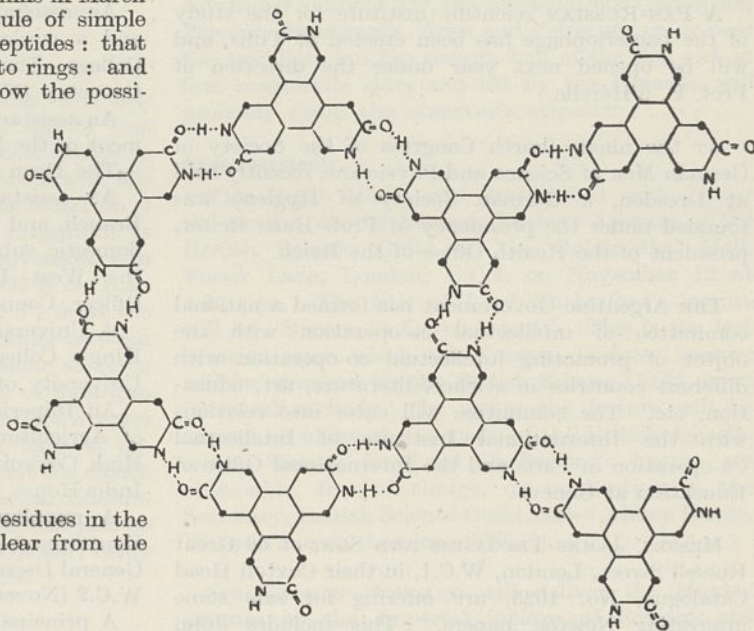
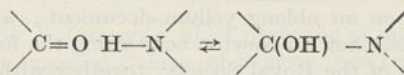


FIG. 3.

closed polypeptides by means of the intra- and inter-molecular lactam-lactim transformation



This postulate, that polypeptides cyclize and polymerize by means of this transformation into laminar molecules, carried with it the deduction that lamina may be linked to lamina by hydroxyl bonds<sup>2</sup>, a conclusion in good accord with many facts as to the behaviour of proteins, for example, capacity for hydration<sup>3</sup>.

In the present communication, a correlative interpretation in terms of hydrogen bonds<sup>4</sup>—which have a close relationship to hydroxyl bonds—is presented for consideration.

The suggestion that hydrogen bonds play a part in the structure of the protein molecule was put forward by Jordan Lloyd in 1932 and 1933<sup>5</sup>, and afterwards by many writers, in particular Mirsky and Pauling<sup>6</sup> who, in a paper of great interest, have shown that it throws considerable light upon the phenomena of denaturation and flocculation of proteins. This postulate can be developed very much on the same lines as the lactam-lactim postulate. Using the hydrogen bond as the mechanism whereby



closed polypeptides may polymerize, we can build a linear polymer from substituted diketopiperazines (Fig. 1). Similarly, the hexapeptide anhydride can build a surface polymer (Fig. 2). Mixed polymers may also be constructed. Hydrogen bond polymerization (like lactam-lactim polymerization) thus allows the construction of laminar molecules of considerable extent having characteristic densities and characteristic lacunae. The laminae need not be plane. The use of hydrogen bonds also for intra-molecular links in polypeptides is under consideration.

In putting forward the two postulates we would stress the fact that there is no conflict between them. Indeed the formation of a hydrogen bond may be an intermediate step in the lactam-lactim transformation. Further, the hydrogen bond can be the mechanism of polymerization not only of polypeptides such as those shown in Fig. 2 but also of the cyclized polypeptides which are derived from the earlier postulate, for example, of cyclol 6, as shown in Fig. 3. It may also be pointed out that these postulates yield deductions which lend themselves to testing by experimental methods. As an example we take the deduction that individual protein films have characteristic lacunae—and so characteristic permeabilities—and characteristic densities.

D. M. WRINCH.

Oxford.

D. JORDAN LLOYD.

<sup>1</sup> Wrinch, *NATURE*, **137**, 411 (1936). Also *ibid.*, **138**, 241 (1936).

<sup>2</sup> Bernal and Megaw, *Proc. Roy. Soc., A*, **151**, 384 (1935).

<sup>3</sup> Jordan Lloyd, *Biol. Rev.*, **8**, 463 (1933).

<sup>4</sup> Latimer and Rodebush, *J. Amer. Chem. Soc.*, **42**, 141 (1920); Pauling, *Proc. Nat. Acad. Sci.*, **14**, 359 (1928); Sidgwick, "The Electronic Theory of Valency" (Oxford, 1929).

<sup>5</sup> Jordan Lloyd, *Biol. Rev.*, **7**, 254 (1932). Jordan Lloyd and Marriott, *Trans. Far. Soc.*, **29**, 1228 (1933).

<sup>6</sup> *Proc. Nat. Acad. Sci.*, **22**, 439 (1936).

### Reaction Kinetics and the Walden Inversion

DESPITE forty years of research, much mystery still surrounds the conditions determining the occurrence or non-occurrence of the Walden inversion. This is partly due to the difficulty of relating rotation to configuration; but it is due even more to the evident circumstance that these conditions must be intimately connected with the mechanism of substitution: it is only in comparatively recent years that the mechanism of aliphatic substitution has been fruitfully studied. In this field, mechanism has revealed itself principally through the examination of reaction kinetics; and by this means mechanism has been brought into intelligible relation with the structures of reactants and the conditions of reaction. For details we may refer to an early note in *NATURE*<sup>1</sup>, and to a number of papers on the subject which have since appeared mainly in the *Journal of the Chemical Society*. It is an obvious sequel to apply the same weapon, the study of kinetics, in attacking the problem of the Walden inversion; for it should certainly be possible to trace a connexion between inversion and kinetics, and thus, with the aid of the knowledge already gained, to relate inversion to mechanism and its determining factors, structure and conditions.

This was our point of view a year ago when we commenced this method of approach. It is now no longer hypothetical that kinetics is able to link inversion with mechanism of substitution, and thus with structure and conditions.

It is not the purpose of this note to summarize interim results, the presentation of which would require too much space: our primary object is to

direct attention to a highly effective method of investigating this problem. It seems appropriate, however, to give in outline a single illustration of the type of observation which in our view supplies the missing link in the argument connecting the occurrence of inversion with structure and conditions.

The hydrolysis of optically active  $\alpha$ -bromopropionic acid was studied by E. Fischer<sup>2</sup>, who obtained lactic acids of opposite sign of rotation according to whether he used silver carbonate or potassium hydroxide; much discussion has been based on this contrast, especially since in the case of some other halogeno-acids the two reagents give products having the same sign of rotation. Now Fischer was not in a position to know what we were able to predict from the electrical properties of the groups concerned, namely, that the  $\alpha$ -bromopropionate ion is a critical structure for hydrolysis: the rates of halogen-ionization and of bimolecular replacement being comparable, it is possible to make either the unimolecular or the bimolecular mechanism dominant by changing the concentrations. He could not know either that in his hydrolysis with potassium hydroxide he was working in the range of the bimolecular mechanism, which, with moderate dilution, would have given place to the unimolecular mechanism; or that unimolecular hydrolysis would have given the opposite result, and, therefore, the same result as silver carbonate. In the scheme

$l$ - $\alpha$ -Bromopropionic acid (as anion)  $\left\{ \begin{array}{l} \text{Unimolecular } l\text{-Lactic acid (S}_N1\text{)} \\ \text{Bimolecular } d\text{-Lactic acid (S}_N2\text{)} \end{array} \right.$

the prefixes refer to configuration, signs of rotation being in this case oppositely related.

The principles underlying the dependence of inversion (including racemization) on the kinetics of substitution were considered in a previous paper<sup>3</sup>. The hydrolysis of  $\alpha$ -halogeno-acids is one of the cases in which the two mechanisms,  $S_N2$  and  $S_N1$ , lead to stereochemically different forms, and the identity or non-identity of the hydroxy-acids obtained with the aid of silver oxide and potassium hydroxide depends jointly on the constitution of the halogeno-compound and on the mechanism of the substitution. Several experimental studies of the nature illustrated have now been completed and will shortly be published, together with a general survey of the relevant theoretical principles.

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W. A. COWDREY.  
E. D. HUGHES.  
C. K. INGOLD.

<sup>1</sup> *NATURE*, **132**, 933 (1933).

<sup>2</sup> *Ber.*, **40**, 489 (1907).

<sup>3</sup> *J. Chem. Soc.*, p. 244 (1935).

### Linkage in Man

SINCE hæmophilia and colour-blindness are both sex-linked conditions, the genes determining them may be expected to show linkage. That is to say, if a hæmophilic is colour-blind the majority of his hæmophilic relatives should be colour-blind, and the majority of his non-hæmophilic relatives should not be so. Similarly, if a non-hæmophilic brother of a hæmophilic is colour-blind, a majority of his hæmophilic brothers and other relatives should not be colour-blind; a majority of his non-hæmophilic brothers should be colour-blind, while most of his sisters should be transmitters of hæmophilia or colour-blindness, but not of both or neither.



To the two existing pedigrees showing both of these diseases we have added four more. The existence of linkage is established. The probability that our results are due to chance is less than  $4 \times 10^{-6}$ . For example, in one pedigree the three living hæmophilic relatives of a colour-blind hæmophilic, namely, a brother, a first cousin twice removed, and a second cousin once removed, were also colour-blind, while five male relatives who might have been, but were not, hæmophilic, had normal vision.

In the six pedigrees there was one case of crossing-over, a colour-blind hæmophilic having a colour-blind non-hæmophilic brother. There had been 28½ opportunities of crossing-over, so the frequency of crossing-over (after allowing for certain small corrections) is as likely to be below as above 5 per cent.

A full account will be published elsewhere. We have to thank a number of colleagues, and particularly Drs. Birch, Macfarlane, Madlener, Riddell and Wright, and the Medical Research Council, for their assistance. We should like particularly to acknowledge the cordial co-operation of many members of the families concerned.

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Galton Laboratory and  
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Oct. 15.

### Distortion of Iron and Molybdenum

THE recent communication in NATURE by Túry and Krausz<sup>1</sup> may be helpful regarding work on the plastic distortion of metals and, in particular, on the nature of the yield point. In their letter, Fig. 1, No. 2, shows a load-extension curve for molybdenum wire after a certain treatment and involving the use of nitrogen at 1,300° C. for 20 sec. This curve closely resembles the well-known load-extension curve for iron and soft steel, apart from a horizontal portion at the top of the curve. Fig. 1, No. 1, shows a curve for wire treated in hydrogen only, but no such yield point is shown in this case. The shape of the curves may be partly due to the different treatments affecting the crystal size, and it would be useful to know the size of the crystals in the wire and to know the behaviour of iron wire after similar treatments. In this connexion, data<sup>2</sup> given by Arrowsmith for 'Armco' iron show that for material in which the crystal width was approximately 0.11 mm. did not have a marked yield point, but for a crystal width of approximately 0.07 mm. there was a considerable yield. Curves given by Edwards and Pfeil<sup>3</sup> suggest that for aggregates of iron crystals the marked yield may not occur when the crystals are wider than approximately 0.25 mm. or 0.4 mm.

In iron and soft steel, the remarkable yield is associated with the Piobert effect<sup>4</sup> (also known as Lüders' lines) which has also been reported, but much less frequently, as occurring in non-ferrous metals (for example, in aluminium and copper, but I believe that the distortion may be rather different in such cases because of the absence of the marked yield, though possibly related). It has been attributed to the presence of a second constituent in the structure and, on the Continent, to the presence of thin films of cementite at the boundaries of the ferrite crystals forming a strong network of cementite. The network was assumed to take the applied load for stresses

up to the yield point, at which it broke down, thus releasing the load on to the weaker and more ductile crystals of ferrite which, as a result, extended immediately.

This I believe to be unlikely for several reasons<sup>5</sup> and that, so far as is known, it seems probable that the yield in aggregates of iron crystals (Piobert effect) is due primarily to the mode of distortion of the single iron crystal together with small crystal size, and that the effect may occur in aggregates of crystals of other metals provided that the mode of distortion of the single crystal of the metal resembles that of iron, and that the crystals be very small. (Crystal size may be of great importance. Thompson and Millington<sup>6</sup> attributed the distortion associated with the marked yield to certain kinds of motion in the body-centred cubic crystal, but it may occur in metals of dissimilar lattice because of the apparently unknown influence of crystal size.) Further, the effect shows a ready response of the aggregate of iron crystals to distort in a general way according to the internal distribution of stress, and it seems that the *transmission* (which results in the yielding) of the distortion throughout the aggregate is facilitated by the large number of planes in the body-centred cubic latticed crystals of iron on which slip may occur, and also, if body-centred cubic crystals can distort on planes (those of maximum shear stress) other than crystal planes<sup>7</sup>, and again by crystal size.

This *transmission*, without 'jamming' as it were, would happen, presumably, if the crystal size be not too big or if the capability of the individual crystals to collaborate with the influence of the general stress distribution be relatively unlimited. (Of the possible slip-planes in iron there appear to be at least three types, {110}, {112} and {123}, and the number of types appears generally to be more than for other metals, whilst for  $\beta$ -brass the types appear to be {110} and {112}. By symmetry, there are a large number of planes, some of which will be possible slip-planes in virtue of their proximity to the planes of maximum shear stress.)

A thorough investigation of the distortion associated with the Piobert effect in soft steel, using X-ray diffraction methods, is in progress here and, as yet, reveals distortion in the crystals, but without the appearance of 'preferred' orientation of crystal planes, and suggesting that the distortion within the aggregate is complex. Present work also consists in examining the properties of aggregates of very small crystals. C. F. Elam (Mrs. G. H. Tipper) concludes that there is no material difference between facts ascertained about the distortion of single crystals of iron and  $\beta$ -brass<sup>7</sup>. Attempts were made here during the summer of last year to produce the Piobert effect in aggregates of body-centred cubic latticed crystals of  $\beta$ -brass, but the desired smallness of crystal size could not be produced, which was unfortunate; so work on molybdenum, rather than tungsten (both of similar lattice as the brass), has already been started.

E. W. FELL.

Metallurgical Laboratories,  
University, Manchester.  
Sept. 28.

<sup>1</sup> NATURE, 133, 331 (August 22, 1936).

<sup>2</sup> J. Iron and Steel Inst., 110, 317 (1924).

<sup>3</sup> J. Iron and Steel Inst., 112, 98, Fig. 9 (1925).

<sup>4</sup> E. W. Fell, "The Piobert Effect in Iron and Soft Steel", J. Iron and Steel Inst., 132, 75 (1935).

<sup>5</sup> J. Iron and Steel Inst., 133, 389P (1935).

<sup>6</sup> J. Iron and Steel Inst., 103, 82 (1924).

<sup>7</sup> "The Distortion of  $\beta$ -Brass and Iron Crystals", Proc. Roy. Soc., A, 153, 273 (1936).



### Simultaneous Transmission and Reception of Radio Waves

We have succeeded in operating a valve receiver  $R_1$  and a valve transmitter  $T_1$  both working on the same antenna, and during their operation, receiving through  $R_1$  another distant transmitter  $T_2$ , working on exactly the same frequency as  $T_1$ . This has been done by a device making use of simultaneous modulation of  $T_1$  and  $R_1$ .

The frequencies used are about 11 megacycles per sec. for the carrier waves of  $T_1$  and  $T_2$ , and 750 cycles/sec. for modulation. We have also worked with lower frequencies, for example, a carrier wave of 1 megacycle/sec. and modulation frequencies of 50–16,000 cycles/sec.



FIG. 1.

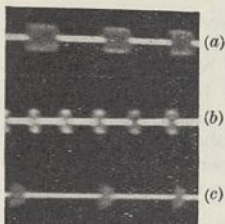


FIG. 2.

A special wave-form of modulation other than the common sinusoidal wave has been advantageously used for this purpose. This wave-form as well as the transmitted groups of waves can be observed during actual work, by a cathode ray oscillograph. Fig. 1 is from a photograph of such a wave-form used for modulation (frequency 750 cycles/sec.) Fig. 2a shows a pattern of transmitted groups of waves of a frequency one megacycle/sec. modulated by 750 cycles/sec.; Fig. 2b is the same pattern as Fig. 2a modulated at double frequency, that is, 1,500 cycles/sec.; Fig. 2c is the same pattern as Fig. 2a, but using for the transmitting

valve a high negative grid-bias near to the point at which the modulated transmitter  $T_1$  stops oscillation.

Owing to the development of short-wave technique, this problem of simultaneous transmission and reception may form the basis of many future scientific and technical applications.

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FARIS MINAW.

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Egyptian University,  
Cairo.  
Aug. 18.

### A Cosmic Cyclotron as a Cosmic Ray Generator?

MANY hypotheses have been propounded regarding the origin of cosmic radiation, but none of them seems to be able to account for the enormous energies found. In this note I shall try to show that a double star may constitute a gigantic cyclotron, which can give rays with energies of the right order of magnitude.

Let us assume that a charged particle (for example, an electron) moves in the magnetic equatorial plane of a star. If the field is  $H$  (equal to a constant multiplied by  $R^{-3}$ ), the particle moves in a small circle with radius  $\rho$  which has a precessional movement around the star in a circle with radius  $R$  (Fig. 1). The angular velocity of the precession is

$$\omega = \frac{3}{2} v \frac{\rho}{R^2},$$

where  $v$  is the velocity of the particle. If  $v$  is very near  $c$ , the velocity of light, we have  $\rho = V/300H$ ,

if  $eV$  is the energy of the particle in electron volts. Then we get:

$$\omega = \frac{c}{200 R^2} \frac{V}{H} \quad \dots (1)$$

We now assume that a planet, or a second star, rotates around the first star, with the same angular velocity  $\omega$ . Then an electric field  $F$  (deriving from a difference of potential between the stars or from the rotation) can constantly increase the energy of the particle in the same way as a rotating electric field accelerates ions in a cyclotron. When the energy of the particle increases,  $R$  is diminished and the particle seems to be in a rather stable equilibrium in relation to the rotating system.

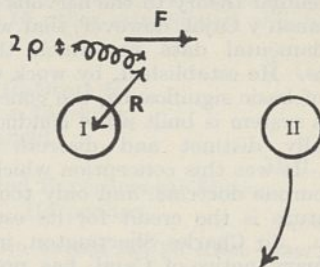


FIG. 1.

The maximum energy of the particle can be calculated from (1). If  $R$  is  $7 \times 10^{10}$  cm. (about the radius of our sun) and  $H$  is 50 gauss (about the magnetic field at the surface of the sun), and further,  $\omega = 0.5 \times 10^{-4}$  sec. $^{-1}$  (a reasonable value for the rotation of a double star), we get

$$V \sim 10^{11} \text{ electron volts,}$$

which is of the order of magnitude of the energy of the bursts.

HANNES ALFVÉN.

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University, Uppsala.  
Oct. 4.

### Wilhelm von Waldeyer

IN the note on Wilhelm von Waldeyer in *NATURE* of October 3, p. 579, there appears the statement that this German anatomist was the first to describe the neurone theory. Most discoveries have been based on the work of previous investigators, and there is much useless discussion on priority concerning almost every great contribution to pure or applied science. In the present instance, however, a survey of the relevant literature readily shows that Waldeyer's only significant contribution to the neurone theory with which his name is so often linked was the introduction of the term 'neurone'.

The doctrine that the nervous system is formed of cells is a corollary of the cellular theory of Schwann and Schleiden. Leeuwenhoek and Malpighi saw cells ('globuli') in the cerebral cortex and, so early as 1741, Swedenborg, in his "*Oeconomia Regni Animalis*", described the cortical cells and their supposed functional importance in a manner surprisingly similar to the views which are now held. Waller's work (1850) on the degeneration of nerve fibres showed the trophic influence of the nerve cell on the fibre. Deiters, in 1865, showed that each nerve cell possessed an axis cylinder and dendrites. His



(1886) established the fact that nerve cells are derived from columnar ectodermal cells and are, therefore, almost certainly autonomous cellular elements themselves. He wrote: "Als festehendes Princip vertrete ich dabei den Satz: dass jede Nervenfasern aus einer einzigen Zelle als Ausläufer hervorgeht. Diese ist ihr genetisches, ihr nutritives und ihr funktionelles Centrum; alle anderen Verbindungen der Faser sind entweder nur mittelbare oder sie sind secundär entstanden."

Golgi's introduction (1873) of the method of silver impregnation provided an elegant technique for the study of the nervous system and, although Golgi himself mixed considerable *a priori* reasoning with his objective findings, Forel, of Zurich, used Golgi's results as the basis of a vigorous appeal for the application of the cellular theory to the nervous system.

It is to Ramon y Cajal, however, that we owe most of the fundamental data on which the neurone doctrine rests. He established, by work which must for ever be of basic significance, the conception that "the nervous system is built up of conductive chains of individually distinct and discrete conducting nerve-cells". It was this conception which Waldeyer called the neurone doctrine, and only too frequently in the literature is the credit for its establishment given to him. Sir Charles Sherrington, in his Royal Society obituary notice of Cajal, has presented the real position admirably. He writes: "The doctrine was his chief life-work and he felt it his due that it should be recognised as his. In his Memoirs, in each edition, he reverted to it: 'that which, and all that, Waldeyer did was to publish in a weekly newspaper a résumé of my research and to invent the word *neurone*'. Cajal had reason to feel hurt; the injustice is unaccountable. Not at any time had the researches of Waldeyer touched the subject. He had not contributed either to the discoveries or to the generalisation."

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### The Red Blood Corpuscles of Primitive Mammals

ALTHOUGH the investigations of Weidenreich, Lohner, and Jordan, and the more recent studies of Arey and Ponder have led to considerable discussion concerning the actual form of the red corpuscles in the circulating blood of the Eutheria, it has long been recognized and generally accepted as an established fact that the mature erythrocytes are non-nucleated in all groups of the Mammalia.

Whilst subscribing to this view, Rogers<sup>1</sup> has brought forward the suggestion that at least two mammals (llama and echidna) possess red blood corpuscles which do not conform to this condition in their adult stages.

Rogers's statement, made in the course of a discussion on the transport system in the vertebrates, that "In all the mammals, with the possible exceptions of Llama and Echidna, they (that is, the erythrocytes) are non-nucleated", led me to prepare and examine a series of blood smears from the primitive Prototheria. These animals, confined entirely to the Australian region, are represented by a single living order, the Monotremata, including the duck-bill or platypus (*Ornithorhynchus anatinus*) and the spiny anteater or echidna (*Tachyglossus aculeatus*).

I am not in a position to offer any personal observations on the blood of the llama, but an abstract in French by Robert Tissot, of Biffi's paper "Alcune osservazioni sul sangue del lama", states that "Les erythrocytes du lama sont elliptiques et biconvexes; leur forme est donc celle des verres de lunettes pour presbytes; ils ne sont pas nucléés".

The red blood corpuscles of platypus and echidna are typically mammalian in form, being non-nucleated, biconcave discs. An examination of the mature erythrocytes from the blood of echidna clearly disproves Rogers's contention that the red corpuscles of this primitive mammal were possibly exceptional in regard to their structure. The suggestion that these corpuscles might prove to be nucleated is, therefore, without foundation.

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Sept. 22.

<sup>1</sup> Rogers, "Textbook of Comparative Physiology" (New York, 1927), p. 118.

### Analysis of Tissues for Metallic Content

REFERENCE was made in a previous letter<sup>1</sup> to the occurrence of nickel and cobalt in a number of plant and animal tissues and in some New Zealand soils, and also to the vital part cobalt has been found by workers in Australia to play in the lives of sheep. The location and function of cobalt in sheep were not known, and efforts have been directed to discover in which tissues of the sheep cobalt is normally present.

Ordinary direct spectrographic analysis of tissues by the oxy-coal gas flame method gave no indication of cobalt or nickel, and experiments were made on quantities of 50–100 gm. of wet tissues, using chemical methods to extract and partially to separate the metals before analysing them spectrographically. The results obtained indicate that this method has wider applications and will give new information regarding the relations between healthy life and the mineral content of the soluble (chemically active) and insoluble (physically active) parts of tissues. Experiments made with sheep's liver, spleen and heart, show that hydrochloric acid of about normal strength, acting at room temperature for 18–24 hours, extracts the alkalis, magnesium, zinc, manganese, nickel, etc., with only a small portion of organic matter, and that calcium, copper and iron are only partially extracted from the much larger part of the tissue which remains.

The best procedure found so far has been to digest 100 gm. coarsely cut tissue with a mixture of 100 c.c. of water and 15 c.c. of strong hydrochloric acid. Filter next day, evaporate to low volume and add successive quantities of 2 c.c. nitric acid and some hydrochloric acid, so long as any marked action is apparent: keep the hydrochloric acid in excess at the end to expel the nitric acid, dilute and filter. A mixture (about 1 drop for healthy to 10 drops for diseased livers) of resinous and oily compounds remains on the paper; the former retains traces of copper, silver, etc., and a small precipitate sometimes separates from the filtrate on cooling, which may contain lead and calcium. The liquid is diluted to about 80 c.c., making it weakly acid, and is precipitated, filtered, etc., successively with (1) hydrogen sulphide, (2) ammonium acetate after oxidizing iron, (3) hydrogen sulphide, that is, in acetic acid, and



(4) after adding hydrochloric acid, with potassium ferrocyanide. All the reagents used can be obtained free from metallic impurities.

As examples of the results obtained, calcium was reduced in sheep's liver (all tissues being dried on filter paper to remove oil) from 0.10 to 0.04 per cent; copper from 0.05 to 0.035 per cent; and iron from 0.03 to less than 0.008 per cent. In sheep's spleen the calcium was reduced from 0.09 to 0.03 per cent and iron from 0.15 to 0.05 per cent, but the percentage of copper was slightly higher in the residue than in the dried spleen.

Further analysis by the flame method proves that precipitate (1) contains most of the copper, silver and some lead, (2) iron phosphate, (3) zinc and cadmium sulphides and (4) manganese, nickel, cobalt, caesium (sometimes present) and some rubidium as ferrocyanides. Healthy liver contains much more zinc than appears to be realized; nickel was easily detected in it, but of cobalt there has only been the slightest evidence of its strongest line. The spleen and heart also contain zinc and minute traces of nickel, and traces of cadmium were found in one sheep's liver and in a salmon's liver which also contained zinc and nickel. Arc or spark spectra of these precipitates would probably reveal the presence of other trace metals. The 'ashing' of tissues is often a very slow process, and some metals such as zinc, cadmium and the alkalis volatilize in varying degrees. These results are given tentatively as indications of the merits of the method and of the uses to which it may be applied.

Sheep diseases are very serious matters also in parts of Great Britain and are under investigation. Mr. J. B. E. Patterson, of Dartington Hall, Devon, recently sent me samples of the livers of four sheep which had died from one of these diseases, and evidence of changes in the mineral content as compared with normal livers has been obtained. There are indications too of a faulty metabolism resulting in the accumulation of oil, or compounds containing oil, in the liver to such an extent as to affect its normal working.

Many questions present themselves: for example, (1) effects of age on the composition of extract and residue; (2) changes caused by diseases, such as cancer; (3) changes due to imperfect feeding; (4) the effects of 'drugs', etc.; but the facilities at my command—a (spectroscopic) laboratory 14 ft. × 7 ft., furnished only with gas service—will not enable me to go far in answering them. This letter will serve, perhaps, to attract attention to what I believe to be a new and useful line of attack.

HUGH RAMAGE.

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Oct. 12.

<sup>1</sup> NATURE, 137, 67 (1936).

#### Relation of so-called *Streptococcus apis* to certain Lactic Acid Streptococci

ONE of us has previously reported the isolation, from larvae affected with European foul brood, of strains of *Str. apis* identical in every respect except that of gelatinolysis and caseolysis<sup>1</sup>. It has now been found that these two *Str. apis* strains are indistinguishable morphologically, culturally and biochemically from the well-recognized dairy types *Str. glycerinaceus* and *Str. liquefaciens*, the former being

a non-proteolytic variant of the latter<sup>2,3</sup>. Thus all four types occur as diplococci and occasionally as short chains. They grow well in litmus milk at 15° and at 45° (the proteolytic *Str. apis* causing a breakdown of the casein similar to that produced by *Str. liquefaciens*); ferment glucose, fructose, lactose, galactose, maltose, mannose, sucrose and salacin strongly; glycerol, dextrin and trehalose slightly; but not arabinose, inulin, starch, xylose, inositol, adonitol or erythritol. Sorbitol and mannitol are usually, and raffinose not usually, fermented. Aesculin is fermented to give a positive reaction with ferric chloride. In glucose broth a final pH of 4.1–4.2 is obtained. All four types also grow in bile salt lactose broth, and resist heating at 60° for 15 minutes in milk at pH 6.6.

The question of nomenclature and the relation of these types to other streptococci will be dealt with later.

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H. L. A. TARR.

Rothamsted Experimental Station,  
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<sup>1</sup> H. L. A. TARR, NATURE, 137, 151 (1936). *Ann. Appl. Biol.*, 23, 558 (1936).

<sup>2</sup> S. Orla-Jensen, "The Lactic Acid Bacteria" (1919).

<sup>3</sup> J. G. Davis, *Proc. Soc. Agric. Bact.* (1936).

#### A New Microcolorimetric Apparatus and a Method for Determination of Total Blood Volume

IT is a matter of importance in physiology to construct an apparatus by which it is possible to determine the concentration of very weak dye-solutions in small quantities, without any decrease in its layer-thickness. In my apparatus a capillary tube is used with a volume of 10 cubic millimetres and a length of 20 millimetres. In this capillary tube is placed the dye-solution, the concentration of which is to be determined. The tube is covered with a black paper-hull to keep out the light from the side. The tube is hung vertically by a holder of simple construction on the object stage. This dye-solution is enlarged by the microscope, from which the eyepiece has been removed. In its place there is a prism-system, which is similar to the upper part of a Duboscq colorimeter. The prism cuts off the rays in one half of the field of vision. Under the other half of this prism is fastened a wedge in order to compare the concentrations of the dye solutions. This wedge can be moved horizontally by a screw in front of a scale. Under the wedge is a light-filter, a diaphragm and an illuminating mirror from which the rays are directed through the filter, diaphragm and wedge to the other half of the eyepiece; the scale is determined by the aid of dye solutions of defined concentration. The unknown dye solution is put into the capillary tube. The wedge is screwed until there is an equalization of colour intensity and so the concentration of dye solution can be easily calculated. In this way one can estimate the colour concentration of dye solution between 1:10,000–1:100,000. It can be used also for determination of weaker and stronger dye solutions by changing the length of the capillary tube.

This method was used for the estimation of the total blood volume of white rats. For the determination, Congo Red was used. The blood volume of forty



normal white rats of the same breed was estimated. 25-50 cubic mm. of blood is necessary for the estimation. The process is similar to Went and Drinker's method, but in the colorimetry there is an essential difference. As a result of this investigation it was found that the total blood volume per 100 gm. body weight is  $4.19 \pm 0.6$  cubic centimetre on the average. Other control experiments are in progress.

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### Mock Suns observed at Nanda Devi in Garhwal

DURING the recent British American Himalayan Expedition, from an altitude of about 21,000 ft. on Nanda Devi in Garhwal, we saw at 3.30 p.m. on August 20 a particularly fine display of parhelia, or 'mock suns'. The two lateral images and the lower one were especially bright, and were arranged as usual on a broad halo of light. The weather was cold at the time, unusually so even at that altitude for the monsoon period, 20° F. being recorded on the mountainside that same evening. We had on several previous occasions seen solar haloes, as we approached Nanda Devi via the Rishiganga gorge, but no certain appearance of 'mock suns', and the weather following the occurrence of these haloes had been fair and not particularly cold.

The afternoon of August 20, however, preceded by about thirty hours the worst blizzard we experienced during the course of the expedition. This

blizzard, accompanied by a violent wind from the east—a southerly monsoon wind, we believe, deflected off the neighbouring great south face of Nanda Devi—held us in our tents at 21,300 ft. (Camp III) for about thirty hours, the minimum temperature on this occasion being recorded at 12° F.

I am well acquainted with the phenomenon of 'mock suns' in the Arctic, but I am unaware that it has been recorded previously from such low latitudes as those of the Himalaya, in this instance lat. 30° 22'. Its occurrence during the monsoon period, and at the altitude observed, would appear to indicate exceptionally low temperatures in the upper atmosphere. But 1936 will long be remembered in India for its unusually intense and prolonged monsoon.

It may also be of interest to record that on August 29, from the summit of Nanda Devi (25,645 ft.), Mr. H. W. Tilman and I looked through a still and clear atmosphere (the air temperature was 19° F. at 3 p.m.) towards the great 70-mile circuit of mountains of the rim of the Nanda Devi basin. The latter, as well as features beyond, were partially obscured by rising columns of cumulus cloud of very beautiful form. We learnt later that, while we were bathed in sunshine throughout the day, the districts to the south and west beyond the "rim" were experiencing disastrous floods, Mussoorie receiving as much as 19 inches of rain in the course of that day.

Clare College,  
Cambridge.  
Oct. 12.

N. E. ODELL.

### Points from Foregoing Letters

USING a hydrogen bond as the mechanism whereby 'laminar' protein molecules are formed from closed polypeptides, Dr. D. M. Wrinch and Dr. D. Jordan Lloyd elaborate possible structural formulæ and deduces that individual protein films must possess characteristic permeabilities and densities.

The optical rotation of lactic acid obtained from *l*-α-bromopropionic acid may be either left-handed like that of the parent compound, or may show inversion to right-handed rotation; this depends on whether the conditions are such as to favour a uni- or bimolecular reaction, as shown by the rate at which the change takes place. W. A. Cowdrey, Dr. E. D. Hughes and Prof. C. K. Ingold mention this as a particular instance of the general importance of paying attention to the rate of reaction in connexion with the Walden inversion.

From an investigation of the pedigree of four more families in which both colour blindness and hæmophilia occur, Dr. Julia Bell and Prof. J. B. S. Haldane conclude that these conditions, which are sex-linked, are also linked (and therefore transmitted) together. In the six pedigrees studied there was only one case of crossing-over, a colour-blind hæmophilic having a colour-blind non-hæmophilic brother.

The cause of the distortion associated with the remarkable yield in iron and soft steel is discussed by Dr. E. W. Fell. He considers it probably due to the mode of distortion of single iron crystals (multiplicity of slip-planes) and to small crystal size. This facilitates transmission of the distortion throughout the aggregate of crystals. Attempts to confirm this by producing similar effects in β-brass and molybdenum are described.

By means of a device making use of simultaneous modulation of a valve transmitter and a valve receiver, H. Antoun and F. Minaw have succeeded in carrying out simultaneous transmission and reception of radio waves. They submit a photograph showing a special wave form of modulation and another showing patterns of transmitted groups of waves.

How a double star may act as an enormous 'cyclotron' and accelerate charged particles moving in the electric field derived from a difference of potential between the stars or from their rotation, is described by Prof. H. Alfvén, who calculates that the particles can in this way obtain energies such as are found in cosmic rays.

Following upon Rogers's suggestion that the red blood corpuscles of echidna might prove to be nucleated, Prof. E. A. Briggs has examined a series of blood smears from the primitive Prototheria, platypus and echidna. The erythrocytes are typically mammalian in form, being non-nucleated biconcave disks.

In view of the importance of small amounts of certain metals for the health of animals, H. Ramage describes a method of extraction of the 'soluble' mineral constituents by means of dilute hydrochloric acid, and gives the percentage of calcium and iron found by this method in the liver and spleen of sheep.

An experimental arrangement for determining the concentration of weak coloured solutions in small amounts of the liquid (one drop or less) is described by Dr. J. Ch. Somogyi. The method has been used in estimating the total blood volume of white rats.



## Research Items

### Boat Construction in Ancient Scandinavia and Oceania

MR. JAMES HORNELL, following up previous studies of similarities in the methods of boat construction in ancient Scandinavia and Oceania, directs attention in *Man* of September to the character of a boat from Botel Tobago, a small island off the coast of Formosa, now in the Hamburg Museum of Ethnology. This bears out a statement made in general terms by J. W. Davidson that the Botel Tobago boats were almost an exact counterpart of the boats constructed in the Solomon Islands as to form, method of construction and ornamentation. They are, in fact, of the Solomon Island *mon* type, and with the Moluccan *orembai* belong to the same class of naval design. The greater crudity of the *mon* and the *orembai* is probably due to degradation. The boat is equal ended, each end being sharp and rising in a gracefully abrupt fashion, and terminating in an acuminate point. The greatest beam is amidship, and the gunwale assumes a broadly lanceolate shape. The base of the hull consists of a narrow salient keel spliced to a narrow curved stern post. On each side of the keel are three wide strakes. The two lower run horizontally, and are shorter than the third, of which the terminal sections form the up-curved end-pieces. Each half end-piece is cut from the solid. The planks are held together initially by means of wooden dowel pins inserted into opposed edges. The dowel attachment is reinforced by lashings. Three sets of cleats, shaped out in the planking, give attachments for a transverse frame, a triangular bulkhead board, and the tie of the converging sides at each end. Probably there were paddling thwarts, though none is now present. The method of lashing the hull planking is more nearly related to that of the Scandinavian type than in either the *mon* or the *orembai*; and the presence of keel and stem posts is another approximation to the later Viking boats, which is not present in the round-bottomed *orembai* and *mon*. The striking resemblances to the Scandinavian boats raises interesting questions as to distribution and diffusion of design.

### Yavapai Indians

A FURTHER study of Yuman peoples has been added to the series which is now nearing completion in Mr. E. W. Gifford's investigation of the culture of the north-eastern and western Yavapai (*Univ. California Pub. Amer. Archeol. and Ethnol.*, 34, 4). The Yavapai were unique among the Yuman groups in inhabiting a vast territory, embracing some 20,000 square miles and roughly 200 miles in east-west dimensions and 100 miles in north-south dimensions. This country afforded a wide variety of territory, ranging from the low country of the confluence of the Gila and Colorado Rivers to the high ground of central Arizona; and therefore affords an exceptional opportunity for studying the adaptability of a hunting and gathering people to various environments. These adaptations must have been made within a few centuries, as the country is dotted with the settlements of an earlier Puebloid population. Evidently they adopted little of the cultural habits of their agricultural predecessors. They were nomadic; and their country was sparsely

occupied, each group wandering over its territory in search of the ripening plants and the animals on which it subsisted. This is indicated by the table of seasonal occupations given by one of the informants. The Yavapai have much in common linguistically and culturally with their northern neighbours, possibly owing to a not very distant origin from a common stock, as they themselves assert. The Western Yavapai appear to have absorbed certain elements of Yuma-Mohave culture and rejected others. The Navaho traded with the North-eastern Yavapai, bringing woven blankets, shell-beads and turquoise on donkeys. Occasionally the Yavapai visited the Navaho country with buckskin, mountain lion skins, and mescal, sometimes speaking Navaho themselves, sometimes using Tonto Apache as interpreters. The Yavapai afford an unusual opportunity for appraising the influence of two environments, one geographical and one social.

### Prehistoric Relics in Malta

A STRIKING feature of the annual report of the Museum Department of Malta for 1935-36 is the number of discoveries of prehistoric relics of human beings and animals made on the island. Twelve rock-tomb burials were accidentally met with, and are described briefly, and prehistoric cave-dwellings and a neolithic site (at Kalet Marku) were excavated. The remains of prehistoric animals are equally interesting and impressive: elephants, tortoises, a frog or toad, extinct birds, and a new species of otter and others from one Pleistocene fissure, and from another, *Elephas falconeri*, *E. melitensis* and *Hippopotamus pentlandi*. These represent only a small part of the remains discovered and described during the year.

### Food Production and Nutrition

"STATISTICS of Food Production, Consumption and Prices" is the title of the fourth volume dealing with food and nutrition issued by the League of Nations (*The Problem of Nutrition*, vol. 4. London: Allen and Unwin. 3s.). It is a preliminary study by the International Institute of Agriculture, Rome, of the available statistical material on the production, consumption and prices of the chief protective and other foodstuffs, for example, milk and dairy products, meat, eggs and poultry, fruit and vegetables, cereals and sugar. Half the volume is devoted to an analytical examination of the situation in the limited number of countries for which data exist. The remainder of the volume gives statistical tables relating to production and consumption, with wholesale and retail price indexes. The financial assistance rendered to agriculture in some of the principal agricultural countries is also dealt with. The information collected illustrates the incompleteness of the data available in respect of most of the foodstuffs considered.

### Geckos of Japan

THE first of a series of papers to be published upon the lizards of Japan deals with the geckos (Yaichiro Okada, *Sci. Rep. Tokyo Bunrika Daigaku*, 2, 233; 1936). Fourteen species are here recorded, described and illustrated. They belong to seven genera, all



found in tropical and subtropical regions. But of the fourteen species, only seven are regarded as endemic, the remainder having a wide distribution embracing South China, the Malay Peninsula, and the Philippines. Such distribution is easily accounted for by the ease with which the species, attached to vegetation or some object, are transported by Nature or by man. Yet in spite of the possibilities none has succeeded in establishing itself in the Arctic region.

#### Environment of Marquesan Insects

THE insect fauna of the Marquesas Islands has been extensively investigated under the auspices of the Pacific Entomological Survey, the central organization of which is at Honolulu. In Bulletin 139 (1936) of the Bernice P. Bishop Museum (forming Pacific Entomological Survey, Publication 9), Mr. A. M. Adamson gives an interesting account of the topography, geology, flora, etc., of the islands, which serves as a background, or basis, for the discussion of their faunistic relations. The islands are the most remote from a 'continental' region of any archipelago in the world, the coast of Mexico being nearly 3,000 miles away and Fiji about 2,700 miles. Their total area is only about 400 square miles; their general altitude is but little more than 4,000 ft. and the coasts are almost entirely unprotected by coral reefs. The greater part of the endemic fauna is now restricted to the higher altitudes, where the climate is very moist and the temperature temperate, rather than tropical. The specific endemism of the flora is much lower than that of Hawaii, with which it has affinities: on the whole, the flora is most nearly related to that of the Society Islands. Three vertical zones of plant distribution can be distinguished, the uppermost, or rain forest, containing the chief food plants of the indigenous insects. The native flora below 1,000 ft. has been replaced in large measure by immigrants and to a certain extent up to 2,500 ft. also. It is evident that the changes being brought out by colonization, either directly or indirectly, are already very marked, and the present survey is a timely one. Probably many species of insects have been already lost, and many more will disappear in the not-distant future.

#### Hormones and Horticulture

A USEFUL résumé of present-day knowledge of plant hormones, or growth-regulating substances, is given by Dr. M. A. H. Tincker (*J. Roy. Hort. Soc.*, 61, Pt. 9; Sept. 1936). The history of investigation in this subject goes back to Darwin, and the work of Rothert and Fitting, of Boysen-Jensen, and later of Loeb and Went, established the idea of chemical 'messengers' or regulators, as a feature of plant physiology. Much of the earlier work dealt with the bending of coleoptiles of cereal seedlings, but the findings of Went, that a root-forming substance was produced by leaves, initiated a new line of horticultural inquiry. Later investigations showed that the growth-promoting substance was an organic acid. It was produced by a wide variety of plants, and was even found in such products as rice polishings, wheat-germ oil and pollen. The active substance is  $\beta$ -indolylacetic acid, and it can be synthesized *in vitro*. Perhaps the most valuable line of future horticultural work is that suggested by Hitchcock and Zimmerman, who have used root-producing hormones in the propagation of difficult cuttings such as maple and apple.

#### A New Disease of Stocks

A PAPER by Mr. W. M. Ware (*Gard. Chron.*, Sept. 26, 1936) announces the appearance of a new disease of cultivated Stock plants (*Matthiola* spp.). It is caused by a fungus belonging to the genus *Alternaria*, but its exact specific relations have not yet been determined. The fungus can flourish when conditions are good for the growth of Stocks, and it appeared first in a greenhouse where a crop was being raised through the winter. Extensive spots, either somewhat dry, or bearing a copious fructification of spores, appear on the lower leaves of hybrid strains, the Ten Weeks Stocks being apparently immune or highly resistant. Control by removal of diseased leaves proved laborious and only partly effective, whilst fructifications actually appear amongst sulphur dust. The problem of eradication is still further complicated, for it is imperative that the fungus be controlled in its early stages, before the leaves which must be included with the marketable bloom are infected.

#### A Catalogue of Earthquake Epicentres

IN the University Observatory at Oxford, two card catalogues of epicentres are kept, one arranged in order of latitude, the other in that of longitude, with the dates on which the corresponding foci have been in action since the year 1913. Both catalogues are in constant use at the Observatory, and Miss Ethel F. Bellamy has done good service to seismology by reproducing the former in her "Index Catalogue of Epicentres for 1913-1930" (Isle of Wight: County Press, Newport, 40 pp.; 1936). Miss Bellamy's "Catalogue of Earthquakes 1925-1930", an abbreviation of the "International Seismological Summary", was published a year ago, and all who have worked with it must have appreciated its accuracy. Her new work, which must have been equally laborious, she regards as a geographical index to the Summary. It is divided into four parts. In the first, the epicentres in north latitude and east longitude are arranged in increasing order of latitude, and, when several epicentres lie on the same parallel, in increasing order of longitude. The other parts are similarly arranged for the remaining quadrants. The dates on which earthquakes have occurred beneath each epicentre are entered according to the year, month and day, those in which earthquakes possessed deep foci being printed in italics. The positions of the epicentres are plotted on an equal area projection map of the world, a map that shows very clearly the concentration of activity in the Mediterranean area, the East Indian Archipelago and the margins of the Pacific Ocean. A similar map represents the distribution of seismological stations throughout the world, their clustering in Europe and Japan and their sparseness in Africa, Central Asia and the East Indies and neighbouring islands. This distribution may be in part responsible for the much greater number of earthquakes recorded in the north-east quadrant and in the zone between the parallels of 35° and 45° of north latitude.

#### Railway Signals for Fogs

IN the October issue of the *Journal of Scientific Instruments*, Mr. A. E. Tattersall describes two forms of signal lamps which, while not so effective as those he described in the same journal a year ago, require less power and will do something towards securing greater safety in running during fogs. Both are operated by wires from the signal box placing the



necessary coloured glasses before the lamp, which is about 11 ft. above the rails. Both secure a parallel beam of light by reflecting the light of an electric lamp with a concentrated source of 5–10 watts at a spherical mirror the spherical aberration of which is compensated by a glass lining. Any special form of distribution of the issuing light beam is secured by the form of the glass front of the box in which the lamp is housed.

#### X-Ray Method for determining Electronic Charge

THE absolute wave-length of X-rays is now known from ruled grating measurements with a high degree of accuracy. A precise determination of the angle of diffraction from a crystal leads to a value for the crystal spacing, and by using the crystal density, to a value for the absolute atomic masses and for the electronic charge. A new measurement by J. W. M. Du Mond and V. L. Bollman (*Phys. Rev.*, 50, 524) overcomes the objection which has been made to this method that the density is determined for a large crystal while the X-ray reflection involves only the surface layers. The crystals used in the work were very finely powdered calcite in which the depth of penetration of the rays embraces the whole fragment. The density was determined on the same powder specimen. The value obtained for  $e$  was  $4.799 \pm 0.007$  E.S.U.

#### Excitation of Nuclei by Proton Bombardment

L. R. HAFSTAD, N. P. Heydenburg and M. A. Tuve (*Phys. Rev.*, 50, 504) have been able to study in detail the yield of alpha- and gamma-rays from fluorine and lithium as a function of the energy of the bombarding protons. The tube and the Van de Graaff type generator are improved versions of those used in former experiments, and the voltage was measured by a galvanometer and high resistance. The alpha-particle emission from lithium had to be studied with a thick lithium target, and unambiguous results on the excitation function were not obtained. In the gamma-ray excitation of lithium, a resonance-voltage at 440 kv. was observed, and the half-width of this resonance was estimated as 11 kv. In the excitation of fluorine, resonance levels were found at 328 kv., 892 kv. and 942 kv., with half-widths of 4, 10, 15 kv. respectively. The width of the lithium excitation region is probably connected with the time of relaxation of an excited level in  $^6\text{Be}$ , and a discussion of the probable mechanism of this relaxation is given.

#### Phosphatase of Cows' Milk

THERE is already strong evidence that the phosphatase of cows' milk arises directly from the secretory cells of the mammary gland. This is confirmed by S. J. Folley and H. D. Kay (*Enzymologia*, 1, 48; 1936) as the result of the study of the phosphomono-esterase content of the milk of sixty-six Dairy Shorthorn cows in relation to the progress of lactation. They find that the advance of lactation is accompanied by regular changes in the concentration of the phosphomono-esterase, the output of the enzyme in the milk rising to a maximum at about 180 days post-partum, whereas no such regular changes in enzyme content occur in the blood serum as lactation progresses. The results suggest that the rate of secretion, or it may be unavoidable loss of phosphatase in the milk, is in general inversely related to the functional efficiency of the mammary gland. It is therefore considered highly probable that the enzyme comes from and is continually being synthesized by the secreting cells of this gland.

#### Absolute Activity of Choline Esterase

THE enzyme choline esterase arouses interest not only because of its function in the body of destroying the acetylcholine by means of which so many nerves produce their effect; it is reversibly and specifically poisoned by a group of synthetic urethanes allied to eserine. L. H. Easson and E. Stedman (*Proc. Roy. Soc.*, B, 121, 142; 1936) have reached various interesting conclusions as the result of a quantitative study of the activity of this enzyme under different conditions. They assume that the substances which inhibit the enzyme act by combining with it in the same way as the choline esters, and thus blocking the active groups. They assume that the combination between enzyme and inhibitor is governed by the laws of mass action. The experimental data agree well with these assumptions. The authors have thus calculated the number of active groups in their enzyme preparations and have come to the conclusion that each active group hydrolyses about 3,500 molecules of butyryl choline per second, or 1,490 molecules of acetylcholine. This conclusion may be compared with various calculations of the rate of working of each molecule of an enzyme. The new method of reasoning gives results that refer to active groups rather than molecules, but they are of the same order of magnitude as those obtained for molecules of invertase. Some enzymes work more quickly than this, others work more slowly. The calculations are complicated by the fact that the inhibitor substances are themselves slowly destroyed by the enzyme.

#### A Catalogue of Stellar Proper Motions

A KNOWLEDGE of stellar proper motions—the small progressive angular changes of the relative positions of stars—is of basic importance to astronomy. In the first place, proper motions provide data for the study of the spatial movement of individual stars, for 'star-streaming', and for the motion of the solar system; secondly, they enter into any work involving the reduction of measures for star places on photographic plates, such as astrographic chart work and the determination of the parallaxes of stars. Proper motions may be derived from a comparison, after a sufficient lapse of time, of the positions of stars as given in various catalogues, based on meridian observations, or from photographs taken with a fairly long time-interval (say, thirty years) between them. In 1923, Dr. Richard Schorr, director of the Hamburg Observatory at Bergedorf, published a catalogue of proper motions including more than 21,000 stars, compiled from various sources. He has now published a new edition of this work (*Bergedorfer Eigenbewegungs-Lexikon*, 1 and 2) in which all proper motions available up to the end of the year 1935 are collected together from every available source. The new catalogue, which is conveniently arranged for reference in one degree zones of declination, contains no fewer than 94,731 stars, of which 60,642 are in the northern hemisphere. These tabulations, together with footnote references to the large number of proper motions published in the *Greenwich Astrographic Catalogue* (4, 5 and 6) and in the five catalogues by Schlesinger (*Yale Transactions*, 4, 5, 7, 9 and 10) provide a complete means of ascertaining in a few minutes whether a star has any measurable proper motion. The value of such a catalogue is obvious, and Dr. Schorr will deserve the thanks of astronomers for the compilation of this extensive work.



## International Commission on Large Dams

CONGRESS AT WASHINGTON

THE Second Congress of the International Commission on Large Dams was held in Washington, D.C., on September 7-12, concurrently with the meetings of the World Power Conference. The joint opening session of the Conference and Congress was held on September 7 in the Constitution Hall and a joint closing session on September 12 in the Government Auditorium. A further joint meeting was also held on September 11 when President Roosevelt addressed the delegates and welcomed the numerous visitors from abroad.

Apart from the joint sessions, the meetings of the Dams Congress were confined to the discussion of a limited number of technical questions. These questions, five in number, had been selected well in advance of the Congress, and more than sixty papers were presented for discussion. In addition, there had been appointed for each question a general reporter whose duty it had been to prepare a general report summarizing the various papers on each topic. Advance copies of most of the papers were available before the meeting, and were accompanied by summaries in English, French, German and Spanish. The five questions selected for discussion were special cements, design and waterproofing of shrinkage contraction and expansion joints, the facing of masonry and concrete dams, geotechnical studies of foundation materials, and the calculation of the stability of earth dams. Some twenty communications on miscellaneous topics were also presented, but were not discussed at the meetings.

The importance of the use of special cements for concrete dams and other large concrete structures, to which attention was directed at the first Congress held in Stockholm in 1933, was evidenced by the numerous papers from many countries which this subject attracted. Subsequent to the Stockholm Congress, an International Sub-Committee on Special Cements was set up by the International Commission on Large Dams, and national committees were also formed in many countries in collaboration with it.

The object of the work of the International Sub-Committee was to examine, and, so far as possible, obtain agreement, on methods for testing those properties of cements which assume special importance in large mass concrete structures; and to stimulate the interest of cement manufacturers in the production of cements specially suited for such types of construction. The properties demanded of such cements are: as low a heat of hydration as possible in order to reduce the temperatures attained in the concrete mass, a rather long setting time so as to enable large volumes of concrete to be placed without undue stiffening, good workability to facilitate placing without segregation or separation of water from the mixed concrete, a high ultimate concrete strength but only relatively low strengths at early ages, good resistance to the solvent action of percolating water, and no abnormal drying shrinkage. The necessity in modern dam construction for paying special attention to the properties of the cement used has its origin in the much increased rate at which large concrete dams are now built.

Two papers of particular importance were the interim report of the International Sub-Committee on Special Cements and the report from the U.S. Bureau of Reclamation. The former report, which was the result of experimental work carried out in a number of different countries, including Great Britain, tentatively recommended test methods for measuring the heat of hydration and solubility of cements; it also contained a description of the method used in Germany for comparing the drying shrinkage of cements and reports by Swedish investigators on the workability of concrete. The report from the U.S. Bureau of Reclamation prepared by Mr. J. L. Savage, chief designing engineer, was a document of more than two hundred pages containing a very valuable summary of investigations made in the United States on special cements, and of the experience gained with them in the construction of a number of large dams, including Boulder Dam on the Colorado River, Bonneville and Grand Coulee Dams on the Columbia River and Norris Dam in the Tennessee Valley.

In discussing the design and waterproofing of joints in mass concrete, a distinction was drawn between shrinkage joints, the function of which is limited to the construction period and to the earlier part of the operating period, and contraction and expansion joints which are intended to guard against movements occurring over the entire life of the dam. The general consensus of opinion was that contraction joints at intervals of 12-15 metres should be provided in all concrete gravity dams, but with respect to arch dams no general agreement as to their necessity or otherwise was reached. The various methods for sealing joints by the use of metal plates, of bitumen, rubber, and cement grouting were discussed in detail in several of the papers presented. The use of copper or stainless steel joints was preferred.

The reports submitted on the subject of facings for masonry and concrete dams dealt with the different methods which have been developed for reducing or preventing water percolation through the upstream face, and, when climatic conditions are severe, for protecting the face against damage by frost and by abrasion from floating ice and debris. The relative merits of masonry, cement mortar and rich concrete facings formed a controversial subject, some authors holding that under severe frost conditions not even a rich concrete can be expected to stand without damage, if it is exposed in a wet state, and that protection, as by a masonry facing, is necessary. Other contributors were not, however, in favour of masonry facing on account of the risk of the opening of joints owing to differences in thermal expansion between the face and the concrete behind. The use of metallic coverings or diaphragms, and of bituminous coatings suitably protected to obtain an impervious face, was also discussed. At a subsequent meeting of the Executive Committee of the International Commission on Large Dams, a resolution was passed that when suitable precautions are taken to obtain a resistant concrete face, no other protection is necessary.



Under the topic of geotechnical studies of foundation materials, most contributors dealt with the geological investigation of dam sites and the treatment of unfavourable conditions by grouting with cement, bitumen, clay and chemical consolidation processes. The discussion mainly centred round the best methods of sampling and coring in investigations of the foundations for proposed structures.

The discussion on the stability of earth dams was largely concerned with problems of design, foundations, construction, and resistance to earthquake shocks, and the stability of the slopes of dams.

Both before and after the Conference and Congress in Washington a series of study tours was organized to permit visitors to inspect hydro-electric power plants in the United States and Canada, and to visit some of the large dams recently constructed or now under construction. The visit to the Tennessee Valley authority was also of more than technical interest since it afforded an opportunity for the study of the application of hydro-electric power development in regional planning.

The longest tour, which attracted some two hundred visitors from abroad, including more than twenty

from Great Britain, was concerned with major constructional projects, largely in the field of dam construction and hydro-electric power development. Visitors on this tour were privileged first to visit Canada for the inspection of plants near Montreal and Ottawa and then to proceed to Niagara, Chicago and the west coast of the United States. Visits to the Fort Peck Dam on the upper reaches of the Missouri River in Northern Montana—to the Columbia and Skagit River developments in the State of Washington, to power development schemes in California, and to Boulder Dam, as well as to various laboratories in which research work bearing on problems of dam construction was being carried out, all combined to make a memorable tour.

Throughout the meetings at Washington and the subsequent tours in the United States, visitors were afforded widespread hospitality and help from their American hosts, to whom all owe a deep debt of gratitude. Special mention should also be made of the hospitality shown in Ottawa, Montreal and Niagara by the Canadian Government, and the provincial Governments of Quebec and Ontario.

F. M. LEA.

## International Congress of Experimental Cytology

### MEETING AT COPENHAGEN

THE fourth International Congress of Experimental Cytology was held in Copenhagen on August 10–15 under the presidency of Prof. T. Huzella, the office of local president being filled by Dr. Albert Fischer.

The opening meeting of the Congress took place in the Reception Hall of the Parliament, Christiansborg Castle, where the members were welcomed by the local president and by the rector of the University of Copenhagen, after which two short lectures were given, one by Dr. Alexis Carrel on "La Cytologie Nouvelle" and the other by Dr. August Krogh on "Modern Biology".

The ordinary sessions were held in the Physiological Institute, a modern and beautifully equipped building which was admirably adapted for the purpose. The proceedings of the Congress were not divided into concurrent sections, so that it was possible for a sufficiently robust member to attend all the papers if he so wished. The enormous variety in the subject-matter of the papers presented permitted of only the loosest classification in the programme, and, in this short account, it is impossible to mention more than a few of the communications, selected almost at random, to give some idea of the field of work covered by the Congress.

Two sessions were devoted to the physical chemistry of the cell. Dr. Edmund Mayer described a method for measuring the physical forces acting on growing cells in a semi-solid culture medium by placing small metal balls in the medium and measuring the magnetic force required to displace them. Prof. T. Peterfi described experiments in which the volume of an amoeba was measured at different stages in its life-cycle, by sucking the organism into a cylindrical micro-pipette.

One session dealt with histo-chemistry. Miss C. F. Fischmann gave an account of her work on the influence of vitamin D on ossification *in vitro*. Drs. P. Lamarque and J. Turchini described a new technique of historadiography whereby X-ray photographs of histological preparations can be made and examined microscopically.

During the session on cell respiration and metabolism, Dr. K. Linderström-Lang gave an account of his work on the distribution of proteolytic enzymes in the different portions of the glands of the stomach, and in certain other tissues, notably in growing root-tips. Dr. Albert Fischer described experiments on blood coagulation and the mechanism of cell nutrition. Messrs. F. Jacoby, O. A. Trowell and E. N. Willmer read a paper in which they showed, by photographs taken automatically at 6-minute intervals, that embryo tissue juice not only accelerates the migratory movement of tissue culture cells and increases the percentage of dividing cells but also shortens the duration of mitosis.

Papers on the experimental morphology of the cell occupied four sessions. Prof. W. von Möllendorf, in a communication illustrated by a fine film, described how the duration of various phases of mitosis can be altered under the influence of different ions. Dr. C. Robinow discussed the problem of cell boundaries and showed with the aid of lantern slides of singularly beautiful photomicrographs, that the boundaries are much more irregular and complicated than the ordinary impregnation methods indicate. Prof. T. Huzella described the effect of different vibrations on tissue growth *in vitro*. Dr. J. Hämmerling gave a paper on the influence of the nucleus on the development of the unicellular plant *Acetabularia*; he showed that if the proximal nuclear



region of one species were cut off and grafted on to the non-nuclear region of another species, the non-nuclear region assumed the specific characters of the nucleated graft, indicating that the specific characters are controlled by the nucleus. Dr. A. F. W. Hughes gave a communication on the influence of the circulation upon the vessels of the area vasculosa of the chicken's egg.

The last two sessions were devoted respectively to the experimental pathology of the cell and to the biological effect of radiation.

A large number of demonstrations were exhibited. Dr. Alexis Carrel and Colonel Lindbergh personally demonstrated their perfusion apparatus in operation. Of special interest were a number of lantern slides showing photomicrographs of histological sections of organs grown in the apparatus for different periods. Similar slides of control organs were shown for purposes of comparison, and there was surprisingly

little histological difference between the normal and explanted tissue.

The Congress was marked by the large number and high average standard of the cinema films exhibited. Many of the films were projected immediately after the communications which they illustrated, but the rest were shown on a special evening set apart for the purpose. An enthusiastic reception was given to the last films of the late Dr. Cinti, made in conjunction with and demonstrated by Dr. John Bland, in which tissue cultures of gliomata and of cells infected by psittacosis virus are shown.

The local committee deserves congratulation for its highly efficient organization, and the members of the Congress must have carried away with them delightful memories of the lavish hospitality with which they were entertained throughout their visit and of the surpassing excellence of Danish cookery.

## Physical Properties of Heather Honey

EVER since Major Hruschka, in Venice, discovered in 1865 the principle of honey extraction by the application of centrifugal force, in a rotary extractor, it became no longer necessary to destroy valuable combs in order to separate the honey from the wax. All the native honeys in Great Britain yield to this method of treatment, excepting that derived from the nectar of ling (*Calluna vulgaris*). Ling honey fails to flow from the combs in an ordinary extractor, and consequently the combs have to be crushed in a press to obtain extraction. Ling honey is rich golden brown in colour and shows a characteristic sparkle due to the presence of minute air bubbles. In the pure form it never granulates but remains as a gelatinous fluid which is more viscous than most other honeys. Its distinctive flavour and aroma also readily distinguish it from other honeys.

In the *Bee World* for August 1936, Mr. J. Pryce-Jones discusses certain of the physical properties of ling honey. Mr. Pryce-Jones has examined more than 250 samples of honeys from various parts of the world: 73 of these were ling honey in varying degrees of purity and 27 were samples of bell heather honey. All the samples of ling honey were thixotropic, but none of the bell heather samples, when free from ling honey, showed this feature. The degree of thixotropy in a sample of ling honey is closely related to its purity. Also the absence of thixotropy in a sample of honey may be taken as an indication that it contains less than 5 per cent of ling honey. The property of thixotropy may be illustrated by taking a small amount of finely divided clay and shaking it with five times its weight of water containing traces of common salt. If such a mixture be shaken in a narrow test tube it flows freely when the tube is inverted, but if it be left at rest after shaking it sets into a jelly. If the tube be shaken again the mixture flows once more but sets anew on standing. This property, which is one of certain colloids, is termed thixotropy.

Ling honey also shows another peculiar and related feature which Mr. Pryce-Jones terms elastic recoil, and he describes the apparatus used in its investigation. These two properties seem to be due to the

amount of colloidal material present in ling honey. Appreciable amounts of colloids can be precipitated by suitable reagents. Thixotropy and elastic recoil are eliminated by the removal of this precipitate, while the addition of the ling colloids to other honeys imparts to them these same two properties, which they did not previously exhibit. Certain other honeys, from Australia and New Zealand, also exhibit thixotropy but, so far as the author is aware, ling honey is unique in its physical properties among the honeys of Great Britain.

In the *Journal of the Ministry of Agriculture and Fisheries*, October 1936, Dr. G. W. Scott Blair and Mr. D. Morland contribute an article on practical tests for ling honey. They refer to the closely connected properties of structural viscosity and thixotropy in honeys of this kind. There is reason to believe that the sugar molecules tend to arrange themselves into a sort of structure like scaffolding around a building. When honey is stirred, or caused to flow, this structure is broken up and only becomes reformed gradually. A method devised by Scott Blair (*J. Phys. Chem.*, 39, 1935) is a convenient test for evidence of such a structure. A  $\frac{1}{4}$ -in. steel ball-bearing is dropped through a sample of honey, which has been allowed to stand overnight, contained in a 100 c.c. Nessler tube. The tube is marked with two lines about  $2\frac{1}{4}$  in. apart and the times at which the centre of the ball passes these two lines is noted. The honey is then stirred by a metal disk perforated with holes and mounted on a rod so that it just slides freely in the cylinder. The disk is pushed to the bottom of the cylinder and withdrawn twice; immediately after this a ball-bearing is dropped and the times noted as before. The 'thixotropy ratio' is obtained by dividing the time taken by a ball to fall between the two lines in the first test by that taken by the other ball in the second test. This simple method is well adapted for the judging of honey samples, since it allows of physical properties to be tested in a way capable of repetition, and so eliminating most of the personal factor that has hitherto prevailed.



## New Laboratories of the Mond Nickel Co., Ltd.

**A**T a reception which preceded the inspection on October 21 of the new Research and Development Department Laboratory erected by the Mond Nickel Co., Ltd., in Wiggin Street, Birmingham, Lord Weir referred to the great extension that has taken place in the use of nickel and its alloys during the last decade. Before 1914, most of the nickel produced in the world was utilized for armament purposes. As a result of the research and development work that has been carried out since that time, both by the International Nickel Co. and its associates, and by nickel users throughout the world, the metal now enters into a wide variety of alloys and is employed to an increasing extent in nearly every industry. In 1922, the world consumption of the metal was only eight thousand six hundred tons, but this rose to seventy-five thousand tons last year, most of it for uses unconnected with war.

The new laboratories, which are magnificently housed, are fit to take their place among the more important organizations of their kind in the world. The structure is of reinforced concrete, and consists of a basement and three floors on a site 186 ft.  $\times$  43 ft. The building is faced with red brick, and a feature of the front elevation is a curved window extending the full height of the building and lighting the main staircase in the centre of the block. It is a pleasing example of modern architecture.

The opportunity has been taken to display the decorative qualities of some of the Company's products, and nickel alloy metal work is extensively used; the nickel-silver balustrade to the main staircase is particularly effective.

A notable feature of the laboratory is that it is heated and ventilated by the introduction of fresh warm clean and filtered air from a modern air-conditioning plant. This not only avoids the inconvenience of radiators in the laboratory, but also keeps the building free from dust. The automatic control of temperature and humidity thus obtained, as well as the freedom from dust, has definite scientific

advantages, particularly in the corrosion laboratory, for the building is situated in the heart of industrial Birmingham where the atmosphere is at times very impure.

Service supplies of gas, water, electricity, etc., are led from the basement through enclosed longitudinal ducts and are distributed to the laboratories through channels in the walls and floors which are enclosed by flush-fitting panels. The benches are mainly tile-covered, and drainage channels are enclosed and hidden under the floor. The walls are finished in cream-coloured enamel and, being provided with big windows, make the rooms very light. The absence of pipes and fittings on the walls gives a general air of tidiness, which is further enhanced by the use of nickel alloy sink and other fittings. The general effect is rather that of a modern luxury bathroom than of a typical scientific laboratory.

A portion of the building is devoted to a large semi-technical laboratory, in which new processes can be studied on a larger scale, preliminary to their transfer to the works.

The general equipment of the laboratories is excellent, and the apparatus available for physical metallurgy is particularly to be commended. The wide variety of alloys of which nickel forms a component renders necessary a particularly wide range of testing appliances, and, except for an X-ray spectrometer, nothing of importance appears to have been omitted.

The laboratory is clearly designed principally for development work rather than pure scientific research; that is, it is intended to supply information, mainly obtained by known testing methods, to users of nickel alloys. For this purpose it is excellent, and it is doubtful if any better laboratory of the kind exists in Great Britain. There is, however, a certain rigidity about the lay-out of the building itself and of the apparatus which is perhaps not quite so desirable in a laboratory devoted to scientific research; but it is, perhaps, ungracious to criticize where there is so much to praise.

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## Development of the Scottish Highlands

**T**HE drastic depopulation of the Highlands, its causes and the possibilities of development form the subject of a broadsheet on the "State of the Highlands" which has recently been published by Political and Economic Planning. In 1931 the population of the Highland counties, which represent nearly 19 per cent of the area of Great Britain, was 356,615, or less than 1 per cent of Great Britain's population and 100,000 below the 1861 figure; nearly 40,000 of the shrinkage has occurred since 1921.

This depopulation is due partly to the poverty of the region in natural resources but also to political, social and economic handicaps. The Highlanders are extraordinarily poor. Crofting was

formerly an adjunct to fishing, which has now in almost every area been killed by the trawlers, with consequent impoverishment not merely through loss of income but also through a change-over to a less satisfactory diet in which tinned and packaged foods figure prominently at higher cost. Deer-stalking has lately suffered a heavy eclipse, and grouse-shooting and fishing, while bringing in a certain amount of income, do little to benefit the mass of the population. Except for hydro-electric power development in connexion with the aluminium industry in the Kinlochleven and Fort William area, the natural resources of the area have not proved suitable for exploitation.



A high proportion of the occupied population is notoriously poorly paid, and the age structure of the population is becoming increasingly unsatisfactory, the proportion of persons in the age groups up to forty-five years being lower than for Scotland as a whole, especially in the groups below thirty years, while in the age-groups sixty-five-eighty years it is more than fifty per cent above the average. The marriage rate is well below the Scottish average, but the mobility of the population is greater than is often supposed. Transport charges are a serious obstacle to development, and ferry and other tolls are notorious.

The greatest possibilities of development lie in tourist traffic. More and better-run hotels, improved train and bus services, the encouragement of walkers as well as road touring, and maintenance of more adequate information and propaganda services should assist to attract the necessary money from outside. The tourist industry would also stimulate such other industries as sea-fishing, the cultivation of fruit and vegetables, and local handicrafts. Afforestation linked up with timber-processing, quarrying and wool are other possibilities, all of which demand leadership. Orthodox methods are inapplicable to Highland conditions, and the establishment of a form of Development Board through Parliament may be ultimately required.

## Educational Topics and Events

ABERDEEN.—During the interregnum between the departure of Prof. James Ritchie to the University of Edinburgh and the arrival of a successor, the University Court has appointed Prof. Walter Garstang, formerly of the University of Leeds, to take charge of the Natural History Department in Aberdeen.

CAMBRIDGE.—The Managers of the Balfour Fund have made the following grants: to W. Graham-Smith, of Gonville and Caius College, £200 for an expedition to examine the Devonian fauna of Scaumenac Bay in Canada; to H. E. Hinton, of Fitzwilliam House, £200 for researches on the biology and distribution of the water-living insects of Lake Titicaca.

At Downing College, Sir Albert Seward, formerly Master of the College, has been elected into an honorary fellowship.

LONDON.—The following appointments have been made: Dr. W. G. Penney, Stokes student at Pembroke College, Cambridge, to be reader in mathematics in the Imperial College—Royal College of Science; Dr. Charles Reid, since 1933 lecturer in physiology at University College, London, to be reader in physiology at the London Hospital Medical College.

The title of professor of applied physical chemistry in the University has been conferred on Mr. G. I. Finch, in respect of the post held by him at the Imperial College—Royal College of Science. The title of emeritus professor of statistics in the University has been conferred on Prof. A. L. Bowley, on his retirement from the University chair of statistics at the London School of Economics.

The following awards have been made: George Smith studentship to T. J. B. Spencer (King's College); Graham scholarship in pathology to C. H. Gray; Loch exhibitions to Miss A. C. Anderson and Mrs. E. M. Pegram (London School of Economics); Metcalfe scholarship for women to Miss V. M. Rossiter; *proxime accessit*, Miss Adasia Steinberg; Metcalfe studentship for women to Miss G. H. Keir; Rogers prize to Dr. R. P. Kemp.

Dr. S. J. Davies, who has been University reader in mechanical engineering at King's College since 1926, has been appointed, as from January 1, 1937, to the University chair of mechanical engineering tenable at King's College.

MANCHESTER.—Prof. J. L. Stocks will vacate the Sir Samuel Hall chair of philosophy at the end of this term consequent on his appointment as vice-chancellor of the University of Liverpool.

The following resignations take effect from the beginning of the session: Dr. T. A. Bennet-Clark (lecturer in botany, appointed professor of botany at University College, Nottingham); Messrs. Frank Morton and L. W. Derry (demonstrators in applied chemistry in the Faculty of Technology).

The following appointments have been made as from the beginning of the session: Mr. A. C. Lovell, to be assistant lecturer in physics; Dr. R. F. Hunter, to be assistant lecturer in chemistry; Dr. V. J. Chapman, to be assistant lecturer in botany.

The Metallurgical Department has received a research grant from the International Tin Research and Development Council.

OXFORD.—Prof. A. R. Radcliffe-Brown has been appointed to the newly created chair of social anthropology as from January 1, 1937.

Prof. Frederick Soddy has intimated his desire to resign the Dr. Lee's professorship of inorganic and physical chemistry to which he was appointed in 1919.

In Convocation on October 27 the honorary degree of D.C.L. was conferred on President J. B. Conant, of Harvard University.

Congregation on October 20 accepted by 68 votes to 32 a scheme for altering the traditional rotation for the appointment of the vice-chancellor and giving the Chancellor wide powers of discretion. The aims of the scheme are to get younger men and longer term in office. Some of the promoters of it would have welcomed a permanent vice-chancellorship. Others, while preferring the present temporary appointment, would like to have it thrown open to any member of Congregation. The present feeling, however, is against these radical changes and in favour, merely, of making eligible for office any head of a college independent of his seniority. It is commonly agreed that the present vice-chancellor—the Master of Balliol—who happens to be one of the younger heads of a college, is the most successful one of recent years.

The numbers of those who took research degrees at Oxford in the past academic year have recently been published. They serve to show the main groups of subjects in which research is being carried out. They are—physical sciences: 45 B.Sc., 17 D.Phil.; biological sciences, 6 B.Sc., 6 D.Phil.; medicine, 2 B.Sc., 2 D.Phil.; social studies, 5 B.Litt., 4 D.Phil.; modern history, 12 B.Litt., 6 D.Phil.; all other subjects: 23 B.Litt., 4 D.Phil. Thirty-eight of the forty-five bachelors in the physical sciences are chemists.



## Science News a Century Ago

### Application of Statistics to Commerce

At a meeting of the Statistical Society held on November 2, 1836, a paper "On the Application of Statistical Facts to Statistical Science" was read by W. Atkinson. After some preliminary remarks on the expediency of occasionally deviating from the leading regulations of the Society which limited the duty of members to the mere collection of facts, forbidding the expression of opinion, the author proceeded to show "by a critical comparison of numerous passages from the principal writers on the cause of wealth, as Smith, Say, Ricardo, McCulloch, Scrope, etc., that their statements are involved in great confusion and contradiction; that up to the present time, we were most lamentably destitute of any certain knowledge in the great branch of statistical science which relates to commerce; and that in order that the principles of commercial economy may be established on a sure and certain foundation, they must be formed, not on *à priori* assumptions and definitions of vague abstractions, but upon positive facts to be observed, collected and arranged by the science of statistics". The paper led to an animated discussion as to whether statistics be, or not be a science, and also whether it should be an object of the Society not merely to collect statistical facts, but also to make inductions and draw conclusions from them. (*Athenæum*.)

### Geology of Asia Minor

On November 2, 1836, Hugh Edwin Strickland (1811-53) described to the Geological Society the general structure of Asia Minor, and in the course of his paper compared one region he had examined, with a part of France. Modern volcanic rocks, he said, were only observed in Catacecaumene in Lydia. The older cones, nearly thirty in number, were low and flat, and they were covered with vineyards producing the Catacecaumene wine celebrated from the time of Strabo to the present. There were great resemblances between this district and the volcanic districts in Central France. In both countries there are extensive lacustrine, tertiary deposits and volcanic cones extinct from the most remote historical antiquity.

### Gray on Museums of Natural History

THE *Analyst* (5, 273) contains an interesting communication by John Edward Gray, F.R.S. (1800-75), entitled "Some Remarks on Museums of Natural History". The notice is dated Blackheath, November 5, 1836. Since 1824, Gray had been assistant zoological keeper at the British Museum, and was evidently well acquainted with museums both at home and abroad. He had recently visited the museum at Newcastle-upon-Tyne, where he had been "especially gratified with the liberality of the subscribers in throwing the Museum open, without the necessity of an introduction, or any charge to their fellow-townsmen—a facility of access scarcely to be expected except in a national establishment like the British Museum". Of other museums in the country, some were open by an order from, or an introduction by, a subscriber. At Liverpool, Edinburgh, Glasgow and Worcester, visitors were charged a shilling. At Manchester, however, Gray found the regulations very stringent, a notice board stating that no gentleman residing within three miles of

Manchester, not being a subscriber, could be admitted, while servants and children were not allowed in. Commenting on this, Gray said, "I should have thought the admission of children, with a view of imparting a taste for the beauties of Nature in the rising generation would have been one of the ardent wishes of the subscribers". Referring to his visits abroad, he said he had "made notes of the various museums with the view of introducing into the British Museum any real improvement I might discover".

### The Doctrine of Homœopathy

At the Westminster Medical Society on November 5, 1836, Dr. Bureau read a paper on homœopathy. "The Doctor," said the *Athenæum*, "appeared to have had great facilities for observing the peculiar mode practised by Hahnemann, its founder, and to have embraced every opportunity to gain information from its various disciples on the continent. He entered into a minute detail of the principles of the doctrine, critically analysed their merits, reported the results of various practical experiments, and concluded with a strong declaration, condemnatory of the practise. A letter was read from Dr. Poyntz, the physician of the Hotel Dieu at Lyons, reporting the total failure of Dr. Gerrard, a celebrated homœopathist of that city, who had selected thirty-two cases to be treated in that institution, on Hahnemann's plan and, after a trial of seventeen days, he had been obliged to resign their charge to the medical officers of the hospital, having been in every case, unsuccessful".

### Statistics of Suicide at Aberdeen

THE *London Medical Gazette* of November 5, 1836, contains the following statistics of suicides at Aberdeen from 1826 until 1835 inclusive, drawn up by Dr. Francis Ogston. During this period, information was obtained about 52 persons who had seriously attempted suicide, of whom 38 had been successful. The number of attempts was the same in females as in males. The fatal cases among the former was 16 and among the latter 22. In men the actual were to the attempted suicides as 22 to 26, or as 1 to 1.18; in females as 16 to 26 or as 1 to 1.62. According to the census of 1830, when the population of Aberdeen was 58,019, there was one attempt annually in the ten year period in every 11,157.5 inhabitants. The age at which the greatest number of attempts was made was 21-25 years inclusive, and next in frequency the quinquennium 26-30 years. Among the men the greatest number of attempts was at 26-30 years, and among the women at 21-25 years. With one exception, after the age of thirty-five years, no ineffectual attempt was made. Attempts to take life by firearms (three cases) and by cutting instruments (six cases) were confined to males; poison and drowning being the modes most frequently chosen by females. With one exception, when corrosive sublimate was swallowed, the poison selected was laudanum. Of the 52 suicides, 19 were married, 2 were widows, 1 was a widower and 30 were single; 26 had no children and 16 had families, no information being available in 10. Suicides were most frequent in the last six months of the year, August standing highest with fifteen cases and May lowest with only two cases. As regards the habits of 30 in whom information was obtained, 20, or two thirds, were intoxicated and 10 sober; 17 had the character of habitual drunkards.



## Societies and Academies

## Paris

Academy of Sciences, October 5 (*C.R.*, 203, 593-636).

MARIN MOLLIARD: The experimental production of variegation in the radish in a confined atmosphere enriched in oxygen.

JACQUES DE LAPPARENT: The interpretation of radiograms of crystalline powders based on results obtained with argillaceous phyllites.

OTTOKAR BORŮVKA: Singular matrices.

ALEXANDRE OSTROWSKI: A transformation of the Liouville-Neumann series.

MAURICE GEVREY: Certain systems of partial differential equations with multiple imaginary characteristics.

PIERRE ERNEST MERCIER: The most general symmetrical suspension.

ANDRÉ COUDER: The photographic measurement of the atmospheric disturbance of stellar images.

RENÉ LUCAS: The diffusion of elastic waves in fluids.

EDMOND VAN AUBEL: Hall's phenomenon in antimony-tellurium and antimony-silver alloys.

MME. DOROTHY MOYLE NEEDHAM: The phosphorylation of cozymase. It is concluded that the phosphoryl compound of cozymase, a compound containing easily hydrolysable phosphorus, is formed in muscle extract as the result of a reaction with phosphopyruvic acid.

BERTRAND GOLDSCHMIDT: The coefficient of fractionation of radium and its isotopes in the crystallization of barium chlorate.

MARCEL PRETTRE: The inhibition by hydrogen of the chain reaction of mixtures of normal pentane and oxygen. Hydrogen hinders the oxidation and inflammation of pentane, whilst an inert gas, such as nitrogen, facilitates the combustion under the same conditions.

THADÉE URBANSKI and MARION SLON: The nitration of some normal paraffin hydrocarbons. The direct formation of nitro-paraffins has hitherto been possible only with hydrocarbons higher than pentane. The authors have obtained nitromethane and nitropropane by the direct action of  $N_2O_4$  upon the hydrocarbons.

GEORGES DUPONT and VICTOR DESREUX: Contribution to the study of  $\beta$ -myrcene. Hydrogenation by sodium and alcohol.

PIERRE LESAGE: A general review of ten years of culture on acquired and inherited precocity.

RAOUL LECOQ: Disturbance in the food balance by the introduction of uric acid or oxalic acid into the ration of the pigeon.

ALBERT BERTHELOT and MME. GERMAINE AMOUREUX: The tumours obtained by inoculating *Bacterium tumefaciens* aseptically into seedlings and young cultivated plants.

ALBERT PEYRON and HENRI LIMOUSIN: Polyembryony in tumours with multiple tissues of the testicle in man.

MAURICE CAULLERY: Remarks on the preceding communication.

GASTON RAMON, ANDRÉ BOIVIN and RÉMY RICHOU: The flocculating and immunizing properties of anatoxins purified by precipitation with trichloroacetic acid. The diphtheric and staphylococcal anatoxins can be purified by the trichloroacetic acid treatment without losing their immunizing properties.

## Copenhagen

Royal Danish Academy of Sciences and Letters, March 20.

JOHS. HJELMSLEV: (1) Projective triangle invariants. (2) Introduction to the general doctrine of congruence (third communication).

April 3.

AD. S. JENSEN: *Eriocheir sinensis* from southern Jutland. A review of the immigration of the Chinese mitten crab into Denmark.

April 17.

E. BILLMANN: An optically active deuteroamphane.

May 1.

J. N. BRØNSTED: Relation between heat and work. The thermodynamic postulate that heat cannot be transformed into work without a simultaneous occurrence of compensating changes in the surroundings should be modified into the claim of the general impossibility of a conversion of heat into work. This demonstration leads to a somewhat modified formulation of the fundamental thermodynamic laws.

HARALD BOHR: The theory of almost periodic functions (6). Picard's theorem.

May 15.

AUGUST KROGH: A new bottom-sampler for investigation of the microfauna of the sea bottom. With remarks on the quantity and significance of the benthonic microfauna.

G. HEVESY: Splitting of atomic nuclei under the influence of neutrons on rare earths. Neutrons are easily intercepted by most atomic nuclei, and the interception often leads to the formation of another element or of a heavier atom of the same element, a heavier isotope; both may be either radioactive or stable. The investigations of the influence of neutrons on rare earths carried out at the Institute for Theoretical Physics in collaboration with Dr. Levi showed that all rare earths are able to absorb neutrons. Under the influence of the neutrons a great number of radioactive isotopes, hitherto unknown, has arisen. The periodicity of these, and the intensity and hardness of the  $\beta$ -radiation emitted, have been investigated. The radioactivity of the rare earths can be utilized for the demonstration and quantitative analysis of these substances.

## Moscow

Academy of Sciences (*C.R.*, 3, No. 3; 1936).

G. FICHTENHOLZ: A generalization of the Stieltjes integral.

L. KANTOROVICH: General forms of certain classes of linear operations.

S. SOBOLEV: Correction to the paper "On some evaluations concerning the families of functions having derivatives with integrable squares" (*cf. C.R.*, 1, No. 7; 1936).

B. VULICH: Correction to the note "Some remarks to the theory of K-normed space" (*cf. C.R.*, 2, No. 2; 1936).

L. MANDELSTAM and M. LEONTOVICH: Supersonic absorption in fluids and certain optical phenomena connected with it.

J. LARIONOV and A. SEIDEL: Fluorescence of the salts of trivalent europium in aqueous solutions.



M. VEINGEROV: The limits of sensitivity of a radiometer based on the principle of a gas thermometer.

D. MIRLIS and P. REHBINDER: Kinetics of selective wetting and surface reactions on metals in presence of electrolytes (1).

W. I. VERNADSKY: Variations in the atomic weights of chemical elements on the earth.

M. ILJINSKIJ and W. AFREMOV: Inhibiting agencies in the chlorination of anthracene. Influence of the composition of the solvent on the course of the reaction.

P. KAPTEREV: Experiments in the revitalization of organisms from permanently frozen subsoil (see NATURE, Oct. 24, p. 714).

N. L. GURVIČ: The diversity of composition of essential oils in certain species of the Transcaucasian thyme.

### Rome

Royal National Academy of the Lincei  
(Atti, 3, 383-458; 1936).

G. CHECCHIA-RISPOLI: The Pliocene echinoderm fauna from the neighbourhood of Lentini (province of Syracuse).

U. BROGGI: Determinant functions.

B. SEGRE: Varieties of Veronese with two indices (2).

B. MANIÀ: Complete equations in the problems of Lagrange.

E. GUGINO: Single deduction of the dynamic equations of Maggi and of Appell (1). Dynamic equations of Euler-Lagrange according to G. Hamel (2).

C. JODI: Formula for the increase of a vibratory motion constrained by harmonic forces.

G. LAMPARIELLO: Application of the method of images to vortex motions.

C. TAGLIACCOZZO: Observation on the kinetostatics of elastic systems.

E. VOLTERRA: Plane elastic arcs (1). Differential equations of the deformations.

G. R. LEVI and A. BARONI: Carbon obtained by the dehydration of carbohydrates.

G. NATTA and M. BACCAREDDA: Examination of cellulose by means of electron rays.

P. PRINCIPI: The age of some formations of the Apennines.

M. MITOLO: Oxidation-reduction phenomena and states of functional activity of the neuraxis.

### Washington, D.C.

National Academy of Sciences (Proc., 22, 463-523, Aug. 15).

FRED M. UBER and T. H. GOODSPEED: Micro-incineration studies (3). Shrinkage phenomena during carbonization and ashing of wood. A hot-stage microscope was devised; an aluminium chamber, 25 mm.  $\times$  50 mm., was wound with resistance wire, and temperatures up to 650° C. were available. With this apparatus, sections of wood 5  $\mu$  thick were observed while incineration was proceeding.

W. A. SETCHELL and N. L. GARDNER: *Iridophycus* gen. nov. and its representation in South America.

FRANK H. CLARK: Linkage relations of hydrocephalus ( $hy_1$ ) in the house mouse, *Mus musculus*. No linkage was observed with 15 characters marking 14 of the 20 chromosomes of the mouse.

H. C. SHERMAN and H. L. CAMPBELL: A further study of regularity of nutritional response to chemical intake. Animals reared for eight generations on a

minimal adequate diet responded to enrichment of diet in calcium, vitamins A and G and protein by increased rate of growth and vitality.

JOHN M. IDE: The elastic properties of rocks: a correlation of theory and experiment. The modulus of rigidity and Poisson's ratio for a series of rock samples prepared by the Committee on Geophysical Research at Harvard were determined by dynamic methods (see NATURE, 137, 675; 1936). Elastic constants determined in the laboratory are compared with those derived from theoretical formulæ. Agreement is good for steel, copper and diabase; other materials showed varying discrepancies, suggesting that the rocks studied are imperfect elastic media. The theory of elasticity can be applied safely to the fine-grained igneous rocks presumed to underlie the oceans and continental granites; but not to surface rocks, whether sedimentary or granitic in character.

FRANCIS P. SHEPARD: The underlying causes of submarine canyons. Examination of recent data on these canyons leads to the following suggestions. Before the glacial period there were depressions on the continental slopes, due to various causes. Next, during the maximum of a glacial epoch, the sea was lowered some 3,000 ft. by ice formation, and these depressions were occupied by rivers which cut true river canyons through relatively recent sediments. With the melting of the ice, the sea rose, submerging these canyons, which are kept clear by mud flows and submarine currents.

C. A. G. WIERSMA and GEORGE MARMONT: Mechanism of inhibition of crayfish (*Cambarus clarkii*) muscle. Evidence was obtained of two inhibition mechanisms, one working directly on the contractile elements and the other influencing the action currents.

EMIL L. SMITH: Photosynthesis in relation to light and carbon dioxide. Experiments with a freshwater plant, *Cabomba*, in buffer solution exposed to light intensity range of 1 to 1,700, provided data from which curves relating photosynthesis to intensity were drawn. The results of other workers on limited intensity ranges fit the equation derived from this curve. Photosynthetic rate appears to the same function of both light intensity and carbon dioxide concentration.

KENNETH V. THIMANN: Physiology of the formation of nodules on legume roots. Experimentally it is found that nodules produce an auxin. Local application of auxin to young lateral roots of a legume inhibits their growth in length, but causes a swelling at their base due to increase in size of cortex cells. It is suggested that the nodule bacteria within the plant produce an auxin, which causes cell enlargement and also the early stages of a lateral root; growth of the latter is inhibited but cell enlargement continues, giving the characteristic nodule.

E. G. BORING and S. S. STEVENS: The nature of tonal brightness. Analysis of the frequency spectra of sounds emitted by cardboard sirens suggests that brightness is associated with the presence of higher harmonic partials and depends on the velocity of the air blast, but not on the ratio of size of hole in siren disk to size of interval between holes. Brightness is probably better regarded as density.

A. A. ABRAMOWITZ: The action of intermedin on crustacean melanophores and of the crustacean hormone on elasmobranch melanophores. Pituitary extract causes restoration of dark coloration in eyeless fiddler crabs, just as crustacean pigmentary hormone restores that of dogfish (*Mustelus*) from which the pituitary gland has been removed.



## Forthcoming Events

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

### Monday, November 2

- ROYAL GEOGRAPHICAL SOCIETY, at 3 and 8.30.—Hugh Rutledge: "The Mount Everest Expedition of 1936".  
LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE, at 6.—A course of lectures on "Current Problems of Business Administration" (succeeding lectures on November 9, 16, 23, 30, December 7, January 11, 18, 25, February 1, 8, and 15).\*

### Tuesday, November 3

- INSTITUTION OF CIVIL ENGINEERS, at 6.—Opening Meeting.

Sir Alexander Gibb: Presidential Address.

### Wednesday, November 4

- ROYAL SOCIETY OF ARTS, at 8.30.—Sir Henry McMahon: "180 Years of Pioneer Work by the Royal Society of Arts".

### Thursday, November 5

- ROYAL SOCIETY, at 4.30.—O. A. Saunders: "The Effect of Pressure upon Natural Convection in Air".  
R. A. Bagnold: "The Movement of Desert Sand".  
J. Smiles and H. Wrighton: "The Micrography of Metals in Ultra-violet Light".  
ROYAL COLLEGE OF PHYSICIANS, at 5.—Dr. J. D. Rolleston: "The History of Measles" (FitzPatrick Lecture).  
UNIVERSITY OF LEEDS, at 8.—Prof. D. T. Suzuki: "Buddhism in the Life and Thought of the Japanese People".\*  
CHADWICK PUBLIC LECTURE, at 8.15—(at the Royal Society of Arts, John Street, Adelphi, W.C.2).—Robert R. Hyde: "Industry's Contribution to Public Health: Firms' Voluntary Medical Services" (Malcolm Morris Memorial Lecture).\*

### Friday, November 6

- INSTITUTION OF MECHANICAL ENGINEERS, at 6.—Prof. Alfred Fowler, F.R.S.: "The Spectroscope and the Atom" (Thomas Hawksley Lecture).  
NORTH EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS, at 7.—Sir Frank Smith, F.R.S.: "Sir Charles Parsons and Steam" (Parsons Memorial Lecture).  
ROYAL INSTITUTION, at 9.—Prof. F. A. Paneth: "The Chemical Exploration of the Stratosphere".

## Official Publications Received

### Great Britain and Ireland

- Air Raid Precautions. Handbook No. 4: Decontamination of Materials. (Issued by the Home Office: Air Raid Precautions Department.) Pp. 69. (London: H.M. Stationery Office.) 6d. net. [710]  
London School of Hygiene and Tropical Medicine (University of London) incorporating the Ross Institute. Report to Subscribers by Sir Austen Chamberlain for the Year ending July 31st, 1936. Pp. 132. (London: London School of Hygiene and Tropical Medicine.) [710]  
Air Ministry: Aeronautical Research Committee: Reports and Memoranda. No. 1697 (2013): Full Scale Tests of Landing Flaps on a Percival "Gull". By J. E. Serby and P. A. Hufton. Pp. 8+2 plates. (London: H.M. Stationery Office.) 2s. net. [810]  
Department of Scientific and Industrial Research. Forest Products Research Records. No. 12 (Timber Series, No. 4): Seraya, Meranti and Lauan. By B. J. Rendle and S. H. Clarke. Pp. iv+10+1 plate. (London: H.M. Stationery Office.) 6d. net. [810]  
The Genetics of the Pig. By A. D. Buchanan Smith, O. J. Robison and D. M. Bryant. (Reprint from *Bibliographia Genetica*, XII.) Pp. 160. (Edinburgh: Institute of Animal Genetics.) 3s. 6d. [910]  
Smoke Abatement Exhibition. Handbook and Guide. Pp. 80. (Manchester: National Smoke Abatement Society.) [1010]  
The Strangeways Research Laboratory, Cambridge. Report for 1935. Pp. 28. (Cambridge: Strangeways Research Laboratory.) [1310]  
Annual Report of the Director of the Meteorological Office presented by the Meteorological Committee to the Air Council for the Year ended March 31, 1936. (M.O. 398.) Pp. 68. (London: H.M. Stationery Office.) 1s. net. [1510]

Report of the Council of the Natural History Society of Northumberland, Durham and Newcastle-upon-Tyne, intended to be presented at the Annual Meeting of the Society, 27th October 1936. Pp. 48. (Newcastle-upon-Tyne: Natural History Society of Northumberland.) [1510]

- Report of the Government Chemist upon the Work of the Government Laboratory for the Year ending 31st March 1936; with Appendices. Pp. 46. (London: H.M. Stationery Office.) 9d. net. [1610]  
The Scientific Proceedings of the Royal Dublin Society. Vol. 21 (N.S.), Nos. 35-41: Report of the Irish Radium Committee for the Year 1935: The Chemical Constituents of Lichens found in Ireland—*Buellia canescens*, Part 2, by P. A. Spillane, Dr. J. Keane and Dr. T. J. Nolan; The Glaciation of the Bantry Bay District, by A. Farrington; The Standardisation of Photo-Electric Cells for the Measurement of Energy, by H. H. Poole and W. R. G. Atkins; A Contribution to Knowledge of the Irish Fungi, by Dr. P. O'Connor; A Comparison of some Dutch and Irish Potato Mosaic Viruses, by Paul A. Murphy and L. B. Loughnane; A Study of the Aucuba or Yellow Mosaics of the Potato, by Phyllis E. M. Clinch, J. B. Loughnane and Paul A. Murphy. Pp. 317-448+plates 8-12. (Dublin: Hodges, Figgis and Co.; London: Williams and Norgate, Ltd.) 10s. [1510]  
Universities Bureau of the British Empire. Report of the Executive Council together with the Accounts of the Bureau for the Year 1st August 1935 to 31st July 1936. Pp. 22. (London: Universities Bureau of the British Empire.) [1610]  
Heriot-Watt College, Edinburgh. Report, Statistics, Prizes and Awards, 1935-36. Pp. 59. Calendar, Session 1936-1937. Pp. 371+14 plates. (Edinburgh: Heriot-Watt College.) [2010]

### Other Countries

- Proceedings of the United States National Museum. Vol. 83, No. 2995: Four New Species of Chalcidoidea Parasitic on Cactus Insects. By A. B. Gahan. Pp. 481-486. (Washington, D.C.: Government Printing Office.) [1210]  
Geological Survey of British Guiana. The Geology and Gold Deposits of the Potaro. By Dr. Gordon J. Williams; with Petrological Appendix by Dr. D. R. Grantham. Pp. iv+62. 72 cents. Geology and Gold Deposits of the Konawaruk. By S. Bracewell. Pp. iv+20+2 plates. 12 cents. 1934 Reports. Pp. viii+76+5 maps. 3 dollars. (Georgetown: Geological Survey.) [1210]  
The Constitution and Properties of Lapachol, Lomatol and other Hydroxynaphthoquinone Derivatives. Edited by Louis F. Fieser. Memorial Volume to Samuel C. Hooker, 1864-1935. Pp. vi+135. (Cambridge, Mass.: Converse Memorial Laboratory, Harvard University.) [1510]  
Proceedings of the United States National Museum. Vol. 83, No. 2992: California Crustacea of the Order Cumacea. By Carl Zimmer. Pp. 423-439. (Washington, D.C.: Government Printing Office.) [1510]  
U.S. Department of Agriculture: Bureau of Biological Survey. North American Fauna. No. 55: The Mammals and Life Zones of Oregon. By Vernon Bailey. Pp. 416+52 plates. (Washington, D.C.: Government Printing Office.) 75 cents. [1510]  
Proceedings of the Academy of Natural Sciences of Philadelphia, Vol. 88. *Bassaricyon pauli*, a New Species from Panama. By Robert K. Enders. Pp. 365-366. (Philadelphia: Academy of Natural Sciences.) [1510]  
U.S. Department of the Interior: Office of Education. Bulletin, 1935, No. 13: Statistics of the Education of Negroes, 1929-30 and 1931-32. By David T. Blose and Ambrose Caliver. Pp. iv+47. 10 cents. Bulletin, 1936, No. 3: Junior Colleges. By Walter J. Greenleaf. Pp. iv+86. 15 cents. Bulletin, 1936, No. 4: State Provisions for Equalizing the Cost of Public Education. By Timon Covert. Pp. v+49. 10 cents. Bulletin, 1936, No. 6: Safeguarding Democracy through Adult Civic Education. By J. W. Studebaker. Pp. iii+35. 5 cents. Bulletin, 1936, No. 18-3: Youth—Education for those out of School. By H. B. Swanson. Pp. vii+76. 10 cents. (Washington, D.C.: Government Printing Office.) [1510]  
U.S. Department of the Interior: Geological Survey. Professional Paper 186-A: New Upper Cretaceous Ostreidae from the Gulf Region. By Lloyd William Stephenson. (Shorter Contributions to General Geology, 1936.) Pp. ii+12+3 plates. 5 cents. Water-Supply Paper 678: Geology and Ground-Water Resources of Uvalde and Medina Counties, Texas. By Albert Nelson Sayre. Pp. v+146+11 plates. 35 cents. Water-Supply Paper 773-A: Geology and Ground-Water Resources of the Elizabeth City Area, North Carolina. By S. W. Lohman. (Contributions to the Hydrology of the United States, 1936.) Pp. iii+57+4 plates. 10 cents. Water-Supply Paper 773-B: Water Resources of the Edwards Limestone in the San Antonio Area, Texas. By Penn Livingston, A. N. Sayre and W. N. White. (Contributions to the Hydrology of the United States, 1936.) Pp. ii+59-113+plate 5. 10 cents. (Washington, D.C.: Government Printing Office.) [1510]  
Report of the Aeronautical Research Institute, Tōkyō Imperial University. No. 142: Sputtered Palladium Films, Part 1: Cracks and Crumpled caused by Organic Contaminations. By Sin Tanaka. Pp. 367-406+plates 8-28. 75 sen. No. 143: Buckling of a Rectangular Plate with Four Clamped Edges re-examined with an Improved Theory. By Katsutada Sezawa and Wataru Watanabe. Pp. 407-418. 20 sen. No. 144: Entropy Diagrams for Combustion Gases of Gas Oil. By Keikichi Tanaka, Seiichi Awano, Toyosaki Ōhino and Masami Kobayasi. Pp. 419-434+12 plates+12 tables. 2.35 yen. (Tōkyō: Kogyo Tosho Kabushiki Kaisha.) [1610]

### Catalogues

- Original Water Colour Drawings and a fine miniature by Engleheart: Early Vellum Deeds many with beautiful seals; Autograph Letters including some valuable Newton Papers. (Caxton Head Catalogue 1023.) Pp. 33. (London: James Tregaskis and Son.)  
Galvanometers. (Galvo 36.) Pp. 12. (Delft: P. J. Kipp en Zonen.)  
The Polarograph: an Automatically Operating Apparatus for Chemical Analysis. Pp. 32. (London: W. Edwards and Co.)



## Recent Scientific and Technical Books

Volumes marked with an asterisk (\*) have been received at "NATURE" Office

## Mathematics : Mechanics : Physics

**Bate, W. G.** A Concentric Algebra. Imp. 16mo. A First Year Course. Pp. iv+128. 2s. A Second Year Course. Pp. iv+127. 2s. A Third Year Course. Pp. v+146. 3s. (London: Sir Isaac Pitman and Sons, Ltd., 1936.)

**Berg, Ernst Julius.** Heaviside's Operational Calculus: as Applied to Engineering and Physics. (Electrical Engineering Texts.) Second edition. Ex. Cr. 8vo. Pp. xv+258. (New York and London: McGraw-Hill Book Co., Inc., 1936.) 18s.\*

**Champion, F. C., and Davy, N.** Properties of Matter. (The Student's Physics, Vol. 3.) Med. 8vo. Pp. xiv+296. (London, Glasgow and Bombay: Blackie and Son, Ltd., 1936.) 15s. net.\*

**Courant, R.** Differential and Integral Calculus. Translated by J. E. McShane. Vol. 2. Med. 8vo. Pp. x+682. (London, Glasgow and Bombay: Blackie and Son, Ltd., 1936.) 30s. net.\*

**Culver, Charles A.** A Textbook of Physics: for Students of Science and Engineering. Demy 8vo. Pp. x+816. (New York: The Macmillan Co., 1936.) 17s. net.\*

**Das, M. M.** Experimental Electricity. Part 2. Cr. 8vo. Pp. 101. (London: English Universities Press, Ltd., 1936.) 3s. 6d. net.

**Ewald, P. P., Pöschl, Th., and Prandtl, L.** The Physics of Solids and Fluids: with Recent Developments. Authorized translation by J. Dougall and W. M. Deans. Second edition. Med. 8vo. Pp. xiii+396+4 plates. (London, Glasgow and Bombay: Blackie and Son, Ltd., 1936.) 17s. 6d. net.\*

**Fischer, Johannes.** Einführung in die klassische Elektrodynamik. Sup. Roy. 8vo. Pp. viii+199. (Berlin: Julius Springer, 1936.) 13.80 gold marks.\*

**Frenkel, J.** Wave Mechanics: Elementary Theory. (International Series of Monographs on Physics.) Second edition. Roy. 8vo. Pp. x+312. (London: Oxford University Press, 1936.) 20s. net.\*

**Harman, H.** First Year Commercial Mathematics. Cr. 8vo. Pp. 192. (London: Sir Isaac Pitman and Sons, Ltd., 1936.) 2s. 6d.; with Answers, 3s. 6d.

**Hollmann, H. E.** Physik und Technik der ultrakurzen Wellen. Band 2: Die ultrakurzen Wellen in der Technik. Roy. 8vo. Pp. viii+306. (Berlin: Julius Springer, 1936.) 33 gold marks.\*

**Krbek, F. von.** Die Grundlagen der Quantenmechanik und ihre Mathematik. (Neue deutsche Forschungen, Abteilung Mathematik, Band 1.) Roy. 8vo. Pp. 63. (Berlin: Junker und Dünhaupt, 1936.) 3.20 gold marks.

**Lemon, Harvey Brace.** Cosmic Rays Thus Far. Demy 8vo. Pp. 128 (5 plates). (London: William Heinemann, Ltd., 1936.) 7s. 6d. net.\*

**Levy, H., and Roth, L.** Elements of Probability. Demy 8vo. Pp. x+200. (Oxford: Clarendon Press; London: Oxford University Press, 1936.) 15s. net.\*

**Mott, N. F., and Jones, H.** The Theory of the Properties of Metals and Alloys. (International Series of Monographs on Physics.) Roy. 8vo. Pp. xiii+326. (Oxford: Clarendon Press; London: Oxford University Press, 1936.) 25s. net.\*

**Myers, L. M.** Television Optics: an Introduction. Demy 8vo. Pp. x+338. (London: Sir Isaac Pitman and Sons, Ltd., 1936.) 30s. net.\*

**Poirée, J.** La mécanique à la portée de tous (cinématique, statique). Demy 8vo. Pp. xi+80. (Paris: Gauthier-Villars, 1936.) 20 francs.\*

**Rohr, Moritz von.** Abbe's Apochromats: In Commemoration of the Fiftieth Anniversary of their Announcement, July 9, 1886. Demy 8vo. Pp. 84. (Jena: Carl Zeiss, 1936.)\*

**Sarton, George.** The Study of the History of Mathematics. Demy 8vo. Pp. v+113. (Cambridge, Mass.: Harvard University Press; London: Oxford University Press, 1936.) 1.50 dollars.\*

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