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## National and Local Taxation in Relation to Education and Research.

PREOCCUPIED as they are with the advance of culture, learning and new knowledge, it is not surprising that the governing bodies of the various higher educational and research institutions, learned and other societies devoted to the same cause, find little time to spare for the consideration of such subjects as taxation and rating reform. In all probability few, if any of them, have yet given any thought to the possibility of the application to such institutions of the proposals outlined by the Chancellor of the Exchequer, in opening this year's budget, for giving relief to the productive industries of Great Britain, or envisaged the activities for which they are responsible as the most important productive industry of all.

It would be a pity, however, if no advantage were taken of the opportunity which presents itself in connexion with the rating reform proposals of the Chancellor, to press for the inclusion of all educational institutions, except those carried on for private profit, among those properties which are to be relieved altogether from the payment of rates. There is every reason for their inclusion. In the first place, educational progress is the decisive factor in industrial progress. The revival of agriculture and the basic industries of the country will ultimately depend even more upon the application of new knowledge and the intelligence of the persons engaged in them than upon the measure of relief proposed by the Government. Secondly, it would save trouble and expense to the Government, to local governments, and to the institutions themselves.

The case of University College, London, may be regarded as typical. At present this institution pays rates in respect of its buildings to two local bodies, the St. Pancras Borough and the Holborn Borough. These boroughs remit a proportion of the rates collected to the London County Council and other statutory authorities. The London County Council makes a contribution towards the upkeep of University College, and the Government assists it also out of the annual grant put at the disposal of the University Grants Committee. It seems fairly clear that it would simplify matters if the Government, now that it is committed to the principle of relief of rates, applied it to such educational institutions. It is not improbable that the Government would welcome representations made to it with this end in view, for it is very much in earnest in trying to eliminate unnecessary

administrative expense in connexion with national and local taxation.

Now that the whole system of rating and apportionment of rates in Great Britain is to be thoroughly overhauled, the time seems opportune not only to give direct relief to universities and kindred institutions as regards local rates, but also to ask that a rate be levied by local authorities to be applied definitely to their upkeep. At present all local authorities in England are left free to decide for themselves what they will contribute out of local revenues for this purpose, either directly in the form of a grant to a particular institution, or indirectly by means of scholarships and maintenance grants to students, or in both these ways. But they are also free to decide to make no definite contribution at all. It is difficult to defend such a system, more particularly as nowadays, in theory at least, university education is within the reach of all who are able to prove they would benefit by it. It is no longer the prerogative of one class. One way of financing the universities to enable them to meet their ever-increasing responsibilities to the nation would be for the central government to exact a *per capita* contribution for the purpose from every local rating authority in the country.

Another question in connexion with taxation which has not been given the prominence it deserves, is raised by the recent judgment of Mr. Justice Rowlatt, sitting in the King's Bench Division, on the appeal of the Geologists' Association against the decision of the Inland Revenue Commissioners regarding its liability to income tax. Apparently the Geologists' Association based its claim to exemption from income tax on the ground that it was just as entitled to be regarded as a charitable institution within the meaning of the statute of Elizabeth, the criterion in these matters as regards income tax, as any educational institution in the country. The submission of the Inland Revenue Commissioners in disallowing the claim was that in their opinion "the main function of the Association is the combination of members for scientific purposes and mutual improvement and the giving and receiving of instruction among themselves, and without questioning that the studies pursued by the members tend to the increase of knowledge and indirectly to the promotion of education generally, as well as other objects of public utility," they held that the Association is not a body of persons established for charitable purposes only.

Mr. Justice Rowlatt upheld that adverse decision, although he stated that it was a case in which the commissioners could have decided in favour of the Association on the ground "that after all these people arranged for visitors or outsiders being taken in, they amalgamated their library with the University library, and they admitted learned bodies to their membership." If any further endorsement of the views expressed by the Inland Revenue Commissioners and the learned judge on the useful public work performed by the learned societies were required, we have only to refer to the recently published report of the Research Co-ordination Sub-Committee of the Civil Research Committee, wherein it is stated "the great bulk of scientific papers has in the past been published in the Proceedings and Transactions of the various learned societies and in the Technical Journals, and the whole of it has been undertaken at the charge of individual workers banded together for that purpose."

The Government has in small measure acknowledged the nation's indebtedness to the learned societies by sanctioning a yearly Treasury grant in aid of scientific publications—it will be remembered this grant was increased from £1000 to £2500 in 1924—using the Royal Society as the agency of distribution to the others. It is somewhat ironical to find another Government body disallowing their claim to enjoy the privileges granted to other educational institutions on the grounds that their contributions to knowledge are made voluntarily and almost entirely at their own expense.

Were the learned societies extremely wealthy bodies so that the total amount of revenue involved were at all considerable in amount, were any special concessions granted to them at all likely to create a precedent for other claims, we could perhaps appreciate the anxiety of the Inland Revenue Department in the matter. The amount involved is, however, trifling, and we can think of no other bodies in the country, outside the learned societies, performing the same or similar functions. It is true that the existing definition of a 'charity' for income tax purposes is capable of various interpretations, but it is at least permissive, as the Royal Commission on the Income Tax which reported in 1920 took occasion to point out when suggesting the term 'charities' should be specifically re-defined by Parliament. If there is difficulty in finding a definition at once inclusive and exclusive, that is to say, inclusive of those bodies we have in mind, but exclusive of societies whose main function is propaganda of extremely dubious educational value, we suggest it might be overcome by a schedule to the existing Acts, which could be made subject to revision from time to time.

It may be, of course, that the practicability of this suggestion was already considered before it was decided to test the legality of two typical societies' claims for relief of income tax, up to the Court of Appeal, at the expense of the Treasury. If the next appeal from Mr. Justice Rowlatt's decision be unsuccessful, presumably recourse will have to be made to the House of Lords. The costs of this would have to be borne by the societies concerned, with any assistance which might be forthcoming from other interested bodies. It may eventually be desirable, therefore, for the societies to make representations to the Chancellor of the Exchequer, or direct to Parliament, in order that the onus of responsibility of finding a formula of exemption from income tax satisfactory to the societies and to the Inland Revenue Commissioners be put upon the Law Officers of the Crown.

There is one feature in the present action between the Crown and the learned societies on the subject of income tax exemption against which protest should be made. Up to the time the test cases were decided upon in 1926, these bodies had their claims for remission of income tax granted. Since that year the Inland Revenue Commissioners have refused to pass their claims for repayment, although the test cases have not yet reached the Court of Appeal. We should have imagined that, pending the decision of the Appeal Court, claims for repayment would have been passed in accordance with established custom.

## 'Lloyd's.'

*A History of Lloyd's: from the Founding of Lloyd's Coffee-house to the Present Day.* By Charles Wright and C. Ernest Fayle. Published for the Corporation of Lloyd's. Pp. xxi + 475 + 42 plates. (London: Macmillan and Co., Ltd., 1928.) 25*s.* net.

LLOYD'S is one of those institutions which was never really founded but grew into being, and it did not become a corporate body until it had been a power in the land for many years. The person from whom it takes its name had little or no knowledge of underwriting and had no direct connexion with that business: he was, in fact, the keeper of a coffee-house first in Tower Street and then, from 1691, in Lombard Street in the days when coffee-houses were becoming convenient places for business men to discuss their affairs over such refreshment as the houses provided. It was natural that persons of like interest should haunt the same place, and Lloyd's Coffee-house was patronised chiefly by the city merchants interested in marine affairs and in the insurance of the risks connected with the sea. Edward Lloyd and his immediate successors catered for the wants of their patrons and issued a news-sheet giving useful information, and many years later (in 1734) Lloyd's List was established, and the authors state "there can be no reasonable doubt that it was the demand of the underwriters for shipping intelligence that led to its establishment." The Coffee-house arranged with the Post Office to be exempt from the then heavy charges for delivery of correspondence. So the connexion grew, and even the Admiralty gave information to the master of Lloyd's Coffee-house and sought and obtained information in return. From about 1760 a 'Register of Shipping' was kept, and this series of registers developed into Lloyd's Registry of Shipping, an institution independent of Lloyd's.

Apart altogether from Lloyd's Coffee-house, the merchants interested in underwriting had taken action when the formation of companies to undertake insurances was under discussion. 'Bubble companies and intrigue' is not an unfair description of company finance of 1720, and the arguments for the formation of insurance companies with a monopoly, and those urged against the proposal by the merchants, seem poor enough to-day. The result did not come from argument, but the two charter companies won their charters and their monopoly by an outrageous piece of bribery of the King himself. The monopoly given to the two companies did not prevent merchants or individuals from underwriting insurance, and probably helped the individuals engaged in underwriting by preventing the formation of a number of companies. Many years later Lloyd's produced arguments to prevent the formation of rivals to the two charter companies, and it was not until the days when free trade was the cry that new marine insurance offices were allowed to be formed.

If a fear for their pockets had encouraged merchants to take joint action with regard to the formation of companies, it was a wish for better attention and greater comfort that led to their action in 1764, when those who formerly frequented Lloyd's Coffee-house set up a new Lloyd's Coffee-house in rivalry, and later on, in 1773, took rooms for the new Lloyd's over the Royal Exchange. The management of the old coffee-house had apparently become slack during the ownership of

an absentee proprietor. The new place was still a coffee-house; refreshments were not confined to a particular class of merchants, and the master of the new house was entitled to profits from the business. As time went on, however, the underwriters gradually took an increasing interest in the affairs of the place: those duties of the master which were secretarial, were taken over in 1804 by John Bennett, jr., who was the first secretary of Lloyd's, and ultimately mastership of the coffee-house ceased. Lloyd's remained at the Royal Exchange, except for a short interval after the fire, until very recently, when the new building in Leadenhall Street became available.

Turning now to the work of Lloyd's, the volume before us is especially interesting in its treatment of the action taken by Lloyd's in connexion with losses by shipping in war time, and the attitude of the merchants and underwriters with regard to dealing with the enemy in the eighteenth century is attractive in its simplicity and thoroughly different from the attitude instilled into everybody between 1914 and 1919. The argument used was that "to carry on trade for the mutual benefit of both nations, is not aiding and assisting the enemy." Heavy premiums were charged for covering the risks, but to the credit of the underwriters the risks were covered, although the underwriters disliked it intensely when Rodney seized St. Eustatius in 1781 with accumulated stores valued at £3,000,000. Over and over again we read of difficult times and of a certain number of failures, but success emerges in the end. Unfortunately, statistical evidence, which one might hope to find with regard to marine insurance in the past, is lacking: in fact, there is little evidence about losses except such as relates to the attempts made to study the shipping losses in the revolutionary war. From a scientific point of view this is regrettable, but investigation of this kind is always difficult, and probably presents insuperable difficulty when risks are covered by individual underwriters.

Throughout the years to which the book relates the rate of loss must have varied between something very small and something which, if it had continued, would have spelt ruin to any underwriter: but anything like a true measure of the risks at any moment is, and apparently must be, lacking. Is it because such a measure is lacking that there are times when marine insurance has a bad spell and cannot make profits? Individual underwriters, possibly by an ingenious study of their own experience, succeed when some of their fellows are less successful. There is evidence in this book that sometimes in the past this actually happened, and it may be happening again at the present time, but whatever difficulties there may have been it is clear that originally minded men like John Angerstein, Brook Watson, Marryat, Cuthbert Heath, or even that strange person Richard Thornton, who would cover a shipment of gold of £250,000, were certain of success, which an average underwriter could neither expect nor deserve. The explanation of the continued success of Lloyd's is probably because there has always been a sufficient number of men of the calibre indicated. One cannot help feeling, however, in reading through the present book, that many of their corporate actions were taken late in the day and were almost forced upon the underwriters.

Many years ago the underwriters produced a form of policy which, as an example of draughtsmanship, would be almost impossible to defend, but it is still in use, and a better defence of its continued use than that given in the book before us is probably that it has been retained because of the innate conservatism of the underwriters on one hand and a belief in the integrity of the underwriters, rather than a trust of a legal document on the other. Again, it was not until 1870 that a compulsory deposit was made giving real security for underwriting contracts, but in one sense at any rate the security was there long before, and the London underwriters were universally trusted. Clearly, if they had not been trusted, it would have been impossible for Lloyd's to have grown from an unconnected group of merchants doing marine underwriting into the position that it holds to-day, with its reputation of being prepared to insure not only marine risks but also fire risks and air risks, and all sorts of miscellaneous risks as well.

It is appropriate that the history of Lloyd's should be written by Mr. Charles Wright, who probably knows more about the history of Lloyd's than anyone living, and by Mr. C. Ernest Fayle, to whom everybody interested in shipping is grateful for his share in the official history of the War, and the book they have produced is well worth reading. The authors have wisely avoided the temptation of giving unstinted praise to their subject, and they have steered a course between the dullness of a business history and the journalism of advertisement. The book is beautifully printed, and, being adorned with many illustrations, for which Mr. Emery Walker is responsible, praise of it on the artistic side is unnecessary and would almost be an impertinence.

## Colloid Chemistry in Great Britain and Abroad.

(1) *Colloid Symposium Monograph: Papers presented at the Fifth National Symposium on Colloid Chemistry, University of Michigan, June 1927.* Edited by Prof. Harry Boyer Weiser. Pp. 394. (New York: The Chemical Catalog Co., Inc., 1928.) 6.50 dollars.

(2) *Laboratory Manual of Colloid Chemistry.* By Prof. Harry N. Holmes. Second edition, rewritten and enlarged. Pp. xviii+228. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1928.) 15*s.* net.

(3) *Lectures on the Biologic Aspects of Colloid and Physiologic Chemistry: a Series of Lectures given at the Mayo Foundation and the Universities of Minnesota, Iowa, Washington (St. Louis), and the Das Moines Academy of Medicine, Iowa, 1925–1926.* Pp. 244. (Philadelphia and London: W. B. Saunders Co., Ltd., 1927.) 12*s.* net.

(4) *The Theory of Emulsions and their Technical Treatment.* By Dr. William Clayton. (Text-Books of Chemical Research and Engineering.) Second edition. Pp. xi+283. (London: J. and A. Churchill, 1928.) 15*s.* net.

(5) *Biologische Kolloidchemie.* Von Dr. Raphael Ed. Liesegang. (Wissenschaftliche Forschungsberichte, Naturwissenschaftliche Reihe, Band 19.) Pp. xii+127. (Dresden und Leipzig: Theodor Steinkopff, 1928.) 8 gold marks.

(6) *Physical Chemistry and Biophysics: for Students of Biology and Medicine.* By Prof. Matthew Steel. Pp. x+372. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1928.) 20*s.* net.

THE list of books at the head of this notice suggests some reflections. Of the six, only one is published in England, while among the four published in the United States there is a volume of nearly 400 pages containing the papers presented at the fifth National Symposium on Colloid Chemistry. The symposium is now an annual institution, while the last general discussion on colloids, arranged jointly by the Faraday Society and the Physical Society of London, took place in 1920. Since then there has been a gradual cessation of all organised activity, and even the publication of the British Association reports on the subject, which met an obvious want, has been discontinued. This is not the place for inquiring into the reasons for this curious neglect of a discipline, the foundations of which were laid by Graham, Linder and Picton, and Hardy, but the opportunity of directing attention to it could not be lost.

(1) This monograph contains 24 papers, the majority of which record original investigations, while the rest review various aspects of the subject. Among the latter is a contribution by Prof. H. R. Kruyt, the 'guest of honour,' in which he sets forth with customary lucidity his well-known views on the substantial unity of all colloidal systems and the manner in which the two stabilising factors, electric charge and solvation, can be differentiated. In a very exhaustive paper, Elmer O. Kraemer discusses the problem of the vertical distribution or sedimentation equilibrium of colloidal particles, and arrives at the conclusion that it is still far from a solution. He does full justice to the important work of Porter and Hedges, who were the first to deduce an equation for the change in concentration with depth which approximately agrees with reality, a deduction treated in a singularly offhand manner by several European authors. It is no doubt annoying that the ideal gas laws do not hold except for the thin layers studied with such success by Perrin, but the facts have to be faced.

The original papers cover a very wide field and all deserve study. A number of them deal—one might say unavoidably—with the 'plasticity' or 'apparent viscosity' of sols. A paper by Bancroft and Nugent on "Synthetic Kidneys" does not quite fulfil the promise of the title, but gives a clear statement of the fascinating problem and a description of a very curious approximate model. Gortner, Hoffman, and Sinclair study the peptising effect of neutral salt solutions on the proteins of wheat flour, and find "a pronounced lyotropic or Hofmeister series of anions"; this paper is one of many symptoms of a healthy reaction from the uncritical acceptance of Loeb's views, which prevailed a few years ago. Space does not permit detailed reference to the remaining papers, but the whole volume, which is excellently printed and illustrated, bears eloquent witness to the activity of American workers.

(2) The present edition of Prof. Holmes's very useful book is about twice the size of the first (1922), and the preface states that "so much theory has been interspersed between the experiments that the manual is now almost a text as well." Whether such a mixture is preferable to the laboratory manual or 'Praktikum' pure and simple is a pedagogic question which may be left open; even if the theory be skipped, the book accomplishes its primary object very fully. It gives concise but adequate directions for 225 experiments which

have been chosen with great judgment, many of them, like those on sedimentation, surface films, and viscosity, having been collected from quite recent literature. The author gives a number of selected courses to meet the requirements of various classes of students : a ' general ' course comprising 102 experiments is stated to require twelve hours per week during one semester. If any large number of students can really devote about 240 hours to laboratory work on colloids, the activity prevailing in the United States in this field is explained.

(3) The subjects of the lectures printed in this volume are : Principles underlying colloid chemistry, by R. A. Millikan ; colloid chemistry in biology and medicine, by Martin H. Fischer ; the physical properties of protoplasm, by R. Chambers ; adsorption and vital phenomena, by R. A. Gortner ; the physics of the ultramicroscope and optical properties of colloid particles, by E. F. Burton; and the biological effects of light, by W. T. Bovie. Prof. Millikan deals with the electric charge on particles, and presents the matter in a highly simplified form ; it is of interest to note that he assumes the outer layer of ions, which balances the charge on the surface of the particle, to be diffuse and to extend a considerable distance into the liquid. Prof. Fischer's paper occupies more than a third of the volume and sets forth his well-known theory of water retention in organisms : that it is controlled much less by osmotic pressure than by the capacity of proteins for holding water, a capacity which varies widely with the hydrogen ion concentration. While the whole volume does not contain anything new to students of the literature of colloids, it fulfils what is presumably its primary object of stimulating the biologist's interest in the subject.

(4) Dr. Clayton's work is still the only one dealing exhaustively with emulsions, which receive rather scant treatment in most of the general text-books, partly, no doubt, for the reason that most emulsions of technical importance are much coarser systems than those falling within the colloidal range. The second edition contains above one hundred pages more than the first, which, by the way, has received the unusual testimonial of translation into German. The additional space is devoted to chapters on the analysis of size distribution, improved methods determining surface and interfacial tension, and other recent developments. The determination of size-distribution curves is becoming recognised as the only method by which emulsions, or the efficacy of different emulsifying agents applied to the same pair of phases, can be rationally compared. The latest attempt at accounting for the ' type ' of emulsion by the arrangement of molecules in the interfacial layer, the ' oriented wedge theory,' is discussed fully ; that it is still inadequate to explain everything is proved by the very curious results obtained by Seifriz with fractions of different density from the same crude oil, which in identical conditions form the opposite types of emulsion. An extremely full bibliography completes the volume, which is indispensable to all students of disperse systems. Prof. Ramsden adds an appendix in which a theory of emulsification by solid particles—a method first used by S. U. Pickering—is developed. It is based on highly novel and debatable views on the nature of interfacial tension, an analysis of which would greatly exceed the whole space available for this review.

(5) This is one of the " Wissenschaftliche Forschungsberichte " published by Steinkopff under the general editorship of Dr. Liesegang, the object of which is to present in concise form the more important results of scientific activity since the year 1914. They supplement the *Abstracts* and *Zentralblätter* of various societies by grouping the material for the benefit of definite classes of readers and by a somewhat more critical treatment. The present volume gives summaries of more than 400 papers from the biochemical, physiological, and medical literature, classified, according to the phenomena principally involved, under the headings : The colloidal medium of organisms, changes of dispersity, permeability, electric charge, adsorption, swelling, interfacial tension, and viscosity.

In each section copious sub-headings give more definite indications of the contents of the papers abstracted, and the volume should materially assist the student in the inevitable—and increasingly arduous—preliminary to any original work, the task of surveying the relevant literature. The enormous range of Dr. Liesegang's own reading often enables him to find parallels and connexions which have escaped the authors : a feature not usually found in ordinary abstracts.

(6) The preface and contents of Prof. Steel's work produce the uncomfortable impression that the American student (provided that he really achieves what authors seem to expect of him) is a being with powers of assimilation which enormously surpass those of average English students. The book is intended to be " suitable for a course continuing through at least a third of an academic year," yet covers not only what is usually found in

elementary treatises on physical chemistry, but also contains a long chapter on "The Nature and Structure of Matter," a chapter of more than 80 pages on colloids, and a number of biological applications. The principal properties of colloids are presented as well as can be done in the space, but the author still follows Loeb in his treatment of the proteins. Not only have Loeb's views never been accepted by the leading European workers, like Pauli and his school, but also much work has been done in the United States (Gortner on proteins, McDougall and Spoehr on agar) to prove the reality of the Hofmeister series, which Loeb denied.

Small slips are probably unavoidable in attempting to deal with the vast range of subjects which the author includes, but there seems to be no excuse for stating that J. C. Stoney calculated "the actual charge (on one electron) by dividing the quantity of electricity required for the electrolysis of 1 c.c. of hydrogen by the number of hydrogen atoms in 1 c.c. as given by Lohschmidt, and found 10-20 amperes (now called absolute electromagnetic units of quantity)," and for failing to correct this singular statement in the proofs. E. H.

## The Spirit World of the Chinese.

*Chinese Ghouls and Goblins.* By G. Willoughby-Meade. Pp. xv+432+16 plates. (London: Constable and Co., Ltd., 1928.) 24*s.* net.

A DISTINGUISHED Chinese scholar has pointed out that there is much akin in the mentality of the Chinese and ourselves; as an example he referred to the sense of humour of the two races. Prof. Giles could quote numerous examples from his own works in support of this dictum. "Strange Stories from a Chinese Studio" can be read as well for a pleasure to be obtained from few extra-European collections of stories and legends, as to gratify an interest in *chinoiseries*, while his "Quips from a Chinese Jest Book" has a subtle cynicism and a certain pawkiness of humour which make a strong appeal to the British temperament. The same appeal, if from a slightly different aspect, is latent in the material of which Mr. Willoughby-Meade's "Chinese Ghouls and Goblins" is composed. The Chinese taste in ghosts, if at times more crude, with a leaning towards the violently horrible, is much the same as our own.

Mr. Willoughby-Meade's book is more than a mere collection of ghost stories. It is an analysis of Chinese spiritual and popular religious belief based upon legends and folklore. These are summarily quoted in considerable number. He also gives a brief exposition of their idea of the soul, of popular Taoism, and the Chinese Buddhism of to-day in order that the Chinese point of view essential for the appreciation of these stories may be comprehensible to those who may have little or no previous acquaintance with the subject.

There has at times been a vogue in certain classes of writing to deprecate a comparison of the Chinese with western peoples to the derogation of the former, on the ground of their long-standing attainment of a high degree of civilisation, differing in kind, it is true, from our own. While it cannot be denied that China at a comparatively early age attained an advanced stage of intellectual, artistic, and material development, it is none the less true that its culture retains among the population at large a relatively high proportion of its more primitive characters. This holds good, of course, of the lower grades of society in any population, but it is particularly applicable to China in estimating her general level of culture. Confucianism and Buddhism, even in the form in which it appears in China, represent a reaching-out after something intellectually and spiritually more satisfying than the primitive animism and the ancestor worship of which Chinese thought and feeling are compact. In both cases, however, their sphere of influence is circumscribed; and further, although it is customary to speak of China as one, it must be remembered that actually it is many.

Mr. Willoughby-Meade is particularly interested in the resemblances between European and Chinese folklore. As already mentioned, the ghost and spirit stories are much like our own; and so with spiritualism; the Chinese, indeed, have a system of spirit writing very similar to planchette. But these stories have to us a flavour of callousness, which is distinctly primitive and might be expected of the Chinese attitude towards the value of human life. There is a subtle horror about the story of the man who was tricked into killing his family and servants, while thinking he was ridding a haunted house of its evil spirits. The Chinese world of spirits is more highly organised than our own, for though Wierus in the sixteenth century could give a complete catalogue of the powers of the air, and the spirit world has a hierarchy for the Rosicrucians and the modern occultists, this is largely intellectual. In popular belief and folklore the orders of spiritual beings have broken down and survive only in fragments; while the belief in a personal devil and his angels has almost vanished. Chinese beliefs represent an earlier phase, more

nearly in touch with the animistic ideas from which they sprang.

Another point in which the author notes resemblance to European folklore is in the beliefs relating to animals. Stories of the transformation of animals, tigers, wolves, foxes, etc., into human form are numerous, especially concerning foxes. Whenever you encounter a Mr. Hu, you may suspect a fox in human form. The name for fox, though written differently, is pronounced in the same way as the surname Hu. This might perhaps be sufficient to account for the prevalence of the fox transformations, if it were not that some of the stories, especially in Prof. Giles' "Strange Stories from a Chinese Studio," almost suggest a tribe or group of a different and perhaps more primitive culture. In comparing the Chinese stories with western stories of werewolves and other forms of animal transformation, however, an important point of difference should be noted. In China the essential form is that of the animal, whereas in the more familiar European type it is the human who assumes the animal form, and when injured or dead resumes the human form. Similarly, in the fairy tale, for example "Beauty and the Beast," the lion is the form induced by magic which disappears when the spell is removed. In China the reverse is the case. It is the human form that is assumed, and the animal form that is resumed when the magic is defeated or death takes place. Here again the Chinese is the more primitive. The author sees in these stories a survival of totemism, but there is little evidence of it, and, like many classes of animal story elsewhere, they appear to point rather to a primitive animism, except in so far as they may be, as suggested above, an emblematic nomenclature of hostile groups and tribes, not necessarily totemic.

The question of inter-tribal or inter-racial relations suggests a reference to Mr. Willoughby-Meade's amusing chapter on "Foreign Devils." Chinese literature is full of references to peoples of grotesque and distorted form. An attempt to identify these, some of whom appear in the accounts of Mandeville and other early European travellers, is a puzzling, if entertaining, exercise in early geography.

The author institutes an interesting comparison in detail with the Kalevala and also with Malay beliefs. As regards the former, the Kalevala is European only in a geographical sense. Its magical ideas, except in so far as they are of a generalised character, are essentially northern Asiatic in character. On the other hand, Malay magic is highly complex. While undoubtedly to some extent indebted to China, it is also in certain elements and in its shamanistic conceptions derivative from northern Asia, the source from which these conceptions have reached China. Of direct connexion between European and Chinese folk beliefs there is probably little; though they may have a common origin. The European beliefs seem to be on an entirely different plane. Possibly archæology may have something to suggest when the relations of prehistoric China and the near and middle east in early times have been more fully studied and the evidence amplified by further discovery.

It has been possible to mention a few only of the interesting topics with which Mr. Willoughby-Meade has dealt. Of dragons and monsters, of divination and magic, ancestor worship, vampires, and the like, all vastly entertaining, we may safely leave it to the reader to discover what there is to say.

## Forests and Sea Power.

*Forests and Sea Power: the Timber Problem of the Royal Navy, 1652–1862.* By Prof. R. G. Albion. (Harvard Economic Studies, Vol. 29.) Awarded the David A. Wells Prize for the Year 1924–25 and published from the Income of the David A. Wells Fund. Pp. xv + 485. (Cambridge, Mass.: Harvard University Press; London: Oxford University Press, 1926.) 21*s*. net.

FROM comparatively early times the woods of England received attention from the Governments of the day. At first the statutes enacted were directed primarily to stem the wasteful destruction of woodlands, as, for example, the Statute of Enclosure of 1482, applicable to the Royal Forests, Chases, etc. In the following century the Statute of Woods (1543) prescribed rules upon which woods should be managed, usually as coppice with standards. This was an outcome of the seizure of Church lands by Henry VIII.; but nevertheless, up to the Restoration in the succeeding century, very large clearances of woodlands took place. During these centuries of our history, the English woods were chiefly called upon to supply the requirements of the population for various classes of material in local demand. During the two centuries ensuing from Cromwell's day, 1652 to 1862, the Government's chief interest in the woods of the country lay in the latter's dependence upon them to furnish the chief supplies in large timber required by the Navy.

In "Forests and Sea Power" Prof. R. G. Albion deals with this problem in a very lucid and in-

formative manner. It is at first sight curious that such a peculiarly English subject should have been left to be dealt with by an American. But not the least interesting part of the book are the pages which show the political aspects of the forest policy which resulted in the development of the first colonies both in the United States (before the War of Independence) and in Canada. For the Admiralty supplemented their Baltic supplies of masts and other naval stores with the produce from the forests across the Atlantic.

For a considerable part of the two centuries the big timber, in the form of oak, was obtained from England, and the author traces the methods by which it was obtained. He depicts the hand-to-mouth policy of successive regimes and the 'muddle through' measures which appear to have persisted in the Supply Department of the Admiralty throughout the period, and might well have spelt disaster on three distinct occasions—the Dutch Wars, the American Revolution, and the Napoleonic Wars. A criticism is permissible on the subject of the action of the Admiralty in supplementing the failing English oak supplies by teak timber. This receives but a cursory mention from the author. In his list of references no allusion is made to the Records of the Honourable the East India Company, which appear not to have been consulted. From the end of the eighteenth century and throughout the first four decades of the nineteenth, the Admiralty pressed upon the Court of Directors the necessity of procuring increasing supplies of teak timber from India and Burma. A voluminous correspondence took place, and as is shown in Stebbing's "Forests of India," vol. 1, Pt. 2 (1922), enormous areas of teak forests were cut out to supply these demands.

To all interested in a study of the development of the British Empire, as based on the growth of our naval power, this book may be commended as of absorbing interest. Moreover, it is not without some bearing upon afforestation problems within the British Empire at the present day.

## Our Bookshelf.

*Photochimie.* Par Prof. A. Berthoud. (Collection de physique et chimie.) Pp. viii + 323. (Paris: Gaston Doin et Cie, 1928.) 40 francs.

THE rapid development of molecular physics during the last twenty years has stimulated interest in photochemical processes, which are now being studied with renewed vigour. No little advance is to be recorded in this domain in interpreting the mechanism of photochemical action in terms of the Stark-Einstein law of quantum excitation, the conception of both molecules and atoms in excited states and of collisions of the second kind. Whilst from many points of view the physical processes occurring in gases or liquids when subjected to radiation of wave-lengths lying within a band of their absorption spectrum are obscure and the mathematical formulation still in a state of flux, yet in many directions we may trace the influence of these investigations in rendering the subject of photochemistry more precise and quantitative.

During the last two years a number of monographs and textbooks on photochemistry have been published, but many of them are disappointing, in that whilst giving exhaustive résumés of the products obtained on irridation of complex organic compounds with ultra-violet light, but little attention is devoted to the correlation of recent information derived from physical sources with the chemical changes involved in the simpler photochemical reactions. Prof. Berthoud's book is in many ways one of the most satisfactory volumes published on the subject, for a not unsuccessful attempt has been made to weld the two aspects, physical and chemical, into a homogeneous whole.

The volume is conveniently divided into two sections, the physical and the chemical. In the first section the laws of radiation and the theories of light absorption and emission, the photoelectric effect, as well as phosphorescence and fluorescence, are described, whilst the second is devoted to a detailed consideration of the varieties of photochemical change. Especially interesting are the chapters on optical sensitisation and on chlorophyll. Prof. Berthoud appears to incline to the belief that in all cases of halogenation the primary reaction of light absorption is the dissociation of the molecule of the halogen into atoms. Whilst it is true that many reactions are readily explicable on this hypothesis, in other cases such as the chlorination of hydrogen or the bromination of hexahydrobenzene, this assumption leads to somewhat arbitrary assumptions. The printing of the book, judged by English standards, is rather poor, and the absence of a subject and name index is to be regretted. ERIC K. RIDEAL.

*Railway Signalling, Theory and Practice: a Practical Manual for Engineers, Transportation Officers, and Students.* By S. T. Dutton. (Lockwood's Manuals.) Pp. viii + 148. (London: Crosby Lockwood and Son, 1928.) 7*s.* 6*d.* net.

WHILE the travelling public is well acquainted with the locomotives and trains which transport them from place to place, much less is generally known of the no less important means by which the safe operation of railway traffic is assured. Such a manual as this is therefore welcome, as it clearly sets forth the theoretical requirements of signalling and the practical means of carrying them out.

The work is concerned entirely with the fixed signals themselves, their connexion with the operating levers in the signal box, and the interlocking apparatus which harmonises the movements

of points and signals and prevents conflicting signals from being given. The different kinds of signal are described and the reasons for their use explained. The arrangements required for single-line working are then described and the methods of operation discussed, English and Indian practice being compared. Double-line working and its rules are similarly dealt with. The arrangement and construction of signal cabins are described, and the connexion of the signals with the levers. The following chapters deal with point rod connexions, point locking and detection, and the methods of compensating the rods for temperature changes. An important chapter treats lucidly with the preparation of locking charts and tables. Consideration is then given to the problem of the interlocking of points and signals at junctions, special attention being paid to the interlocking of facing points. A useful appendix gives specifications for signalling materials.

The book is illustrated with numerous diagrams and will be found useful by the student of safe railway working as well as by the practical signal engineer. E. A. FORWARD.

*Insect and Fungus Pests of the Farm.* By J. C. F. Fryer and F. T. Brooks. (*The Farmer and Stock-Breeder* Manuals.) Pp. 198. (London: Ernest Benn, Ltd., 1928.) 8*s*. 6*d*. net.

THIS volume represents an attempt on the part of expert plant pathologists to put before the farming community, in simple, non-technical language, an outline of our present knowledge with regard to insect and fungus pests of farm crops. It is recognised that no clear-cut rules can be given for dealing with each pest, as methods of treatment must inevitably vary with the local conditions associated with individual attacks. The aim is, therefore, to put forward the main principles of control in the hope that agriculturists of all types may be encouraged to attempt to apply them, and, by working in a spirit of co-operation, aid in the application of scientific principles to commercial conditions.

To this end, unnecessary technical details of life history have been omitted, and attention concentrated upon the phases directly responsible for damage to crops. The general symptoms accompanying attack afford a good indication of the insect or disease concerned, and weather has a much closer connexion with the severity or lightness of attack than is generally realised. At the present time direct offensive by chemical means is too expensive for general use, and control must chiefly be exercised by methods of prevention.

The diseases and pests dealt with are grouped according to the crops chiefly attacked, but a certain range of universal soil pests, including wireworms, leather jackets, slugs, etc., are omnivorous and may affect crops of very varied types. The authors also touch lightly on the same problem as it concerns horticultural crops, and the book concludes with a short bibliography and an indication of the whereabouts of the advisory entomologists and mycologists of the Ministry of Agriculture, from whom advice may be sought.

*History of the Mongols from the 9th to the 19th Century.* By the late Sir Henry H. Howorth. Part 4: Supplement and Indices. Pp. iv + 378. (London: Longmans, Green and Co., Ltd., 1927.) 42*s*. net.

THE late Sir Henry Howorth was an indefatigable worker in many fields, and in certain circles his studies in the early history of the Church will always be highly appreciated. His name, however, will perhaps be best remembered as the author of a monumental history of the Mongols. A defect of that great work was the absence of an index, which the author had always deplored. Now, after his death, his sons have undertaken the publication of separate indices to Part 1 and Part 2, Divisions 1 and 2, and Part 3, which are issued together in the present volume. The author had also planned a new edition which should take into account the vast mass of material which had accrued in the fifty years since the original edition. Certain introductory chapters to Part 1 had already been written when the War and growing physical infirmities interrupted the work. These introductory chapters, however, are now issued as a supplement, substantially as they were left by the author, and with the indices form Volume 4 of the whole work. These chapters deal with the ethnography and zoology of Central Asia, the life of the Mongols, and their religion. The last-named chapter, in view of the increase of our knowledge of Lamaism in recent years and the comprehensive nature of the survey, will be found particularly helpful to the student.

*The Diseases of Sugar Beet.* Dr. Otto Appel. English edition edited by R. N. Dowling. The Work translated by C. Leslie Wood. Pp. v + 22 + 22 plates. (London: Ernest Benn, Ltd., 1927.) 6*s*. net.

THE increasing attention that is being given to the growing of sugar beet in Great Britain renders it advisable that growers should be forewarned as to the nature of the insect and fungus pests which are liable to attack the crop, and which might cause serious epidemics. With this object in view a translation has been made of Dr. Otto Appel's book, in which about a score of the worst pests are simply and shortly described, with hints as to prevention and cure. The letterpress is accompanied by excellent coloured illustrations (by A. Dressel), which convey a very clear idea of the morphological phenomena associated with each pest and which should render the task of identification less difficult to the grower.

*Air Ministry. Flying for Air Survey Photography.* By F. Tymms and Flight-Lieut. C. Porri. Pp. 46 + 4 plates. (London: H.M. Stationery Office, 1927.) 2*s*. net.

THIS small book on the methods of air survey is based on reports received from operators in different parts of the country to whom a lengthy questionnaire was sent. It thus records the practical experience of those engaged in aerial survey, but it makes no claim to be a manual of the subject or to deal exhaustively with instrument and methods. The book should prove useful to all aerial surveyors.

## Letters to the Editor.

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

### The Compton Effect and Polarisation.

WHEN a beam of X-rays passes through a medium, three kinds of phenomena may be observed: the photoelectric effect, the Compton effect, and the so-called classical scattering. The conversion of the number of recoil and photoelectrons made by means of the Wilson expansion chamber by A. H. Compton and D. Skobeltzin showed that the probability of the Compton effect greatly increases as the wave-length decreases. On the other hand, the intensity of the scattered radiation does not depend upon the wave-length of the incident X-rays. It may be expected

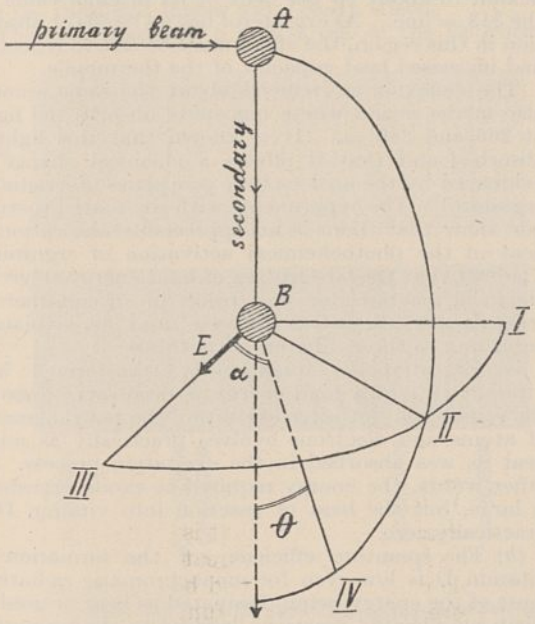


FIG. 1.

from this that where hard X-rays are used, the modified rays will be predominant, whereas in the case of soft X-rays (Barkla's experiments) the scattered radiation will consist almost entirely of the unmodified rays (classical scattering).

Hard X-rays were obtained by means of an apparatus giving a voltage up to 200,000 volts and provided with a rectifier. The continuous radiation emitted by a tungsten target was made comparatively homogeneous by allowing the beam to pass simultaneously through uranium, lead, and copper filters. The homogeneity of these rays was checked by measuring their absorption in different substances, and the effective wave-length of the separated narrow region of the spectrum could be thus determined. All the measurements were made by means of an ionisation chamber of small capacity which was connected to a string electrometer. The effective wave-length of secondary rays, which were scattered from paraffin at right angles to the incident rays, was also determined by the absorption method.

These measurements showed that an increase in the wave-length, equal to 0·022 A., took place in the process of scattering. According to the theory of the Compton effect this increase should be equal to 0·0243 A. This agreement between the observed and calculated values shows that in this case the scattered radiation consisted almost entirely of the modified rays. Some discrepancy between these figures may be explained by the fact that we did not use a monochromatic line but a small region of the spectrum, and a fraction of the radiation of greater wave-lengths could be present there.

In the same way the further softening of the X-rays after the second scattering (tertiary rays) was confirmed. Thus we have a means of obtaining a beam of X-rays consisting of modified rays and naturally the question arises whether these rays, are polarised or not. In order to get information regarding the polarisation of the scattered radiation, it is necessary to allow the rays scattered from the first radiator to strike the second radiator, and to measure the intensity of the tertiary rays thus obtained. Both radiators were made of paraffin (Fig. 1). The second radiator $B$ was placed along the line $AB$ at right angles to the primary beam. The measurements of the intensity of tertiary rays were made in a plane perpendicular to the secondary rays in three directions, I, II, and III. The following data were obtained in one of numerous experiments:

| Directions of the tertiary rays | I. | II. | III. |
|---|---|---|---|
| Current in the ionisation chamber | 8·18 | 4·04 | 0·20 |

These figures show that the polarisation of modified rays is quite similar to that of rays scattered according to the classical theory. In fact, in the case of classical scattering, the electric vector $E$ of secondary rays will have the direction indicated in Fig. 1 by an arrow; the intensity of tertiary rays will have a maximum in the direction I, perpendicular to this vector, a minimum equal to zero in the direction III, and a value equal to half of the maximum intensity in the direction II, making an angle of 45° with the electric vector. The figures given above are in good agreement with what could be expected from the classical theory: the intensity of the tertiary rays in the direction II is almost exactly a half of that in the direction I, and the intensity in the direction III makes up only 2·5 per cent of the maximum intensity. The fact that the intensity in this direction was not zero may be explained by the multiple scattering of the X-rays in the scattering blocks, and also by the finite dimensions of the aperture in the ionisation chamber.

As the direction of the recoil electrons lies always in the plane containing both incident and scattered quanta, the polarisation of the scattered radiation will not be without effect upon the spacial distribution of the recoil electrons when they are produced by polarised radiation. For example, it is evident that the greatest number of recoil electrons, corresponding to the quanta scattered in the plane I $B$ III, will be in the plane $AB$ I, because the intensity of the scattered radiation in this plane is a maximum. On the other hand, there will be no recoil electrons in plane $AB$ III, corresponding to the rays scattered in the direction III, because the intensity of these rays is zero. Thus the directions of recoil electrons will lie principally in the plane passing through the magnetic vector of the incident beam.

For some direction IV of the scattered quantum, making an angle $\theta$ with the direction of the incident ray $AB$, we shall have a change of wave-length equal to $\Delta\lambda = 0{\cdot}0486 \sin^2\theta/2$. The scattered rays will be plane-polarised, so that their electric vector will lie

in the plane III *B* IV, passing through the direction IV and the direction of the electric vector of incident rays. The intensity of scattered rays will be, for a given angle $\theta$, proportional to $\sin^2\alpha$, where $\alpha$ is the angle between the directions IV and III, and, moreover, will depend upon the probability of the incident quantum being deflected at the angle $\theta$. This dependence of the intensity of scattered rays on the angle $\alpha$ shows that also for those rays which are scattered not at right angles to the incident beam, the recoil electrons will lie chiefly in the plane containing the magnetic vector of the incident rays, that is, in the plane *AB* I.

From observations of spacial distribution of the tracks of recoil electrons produced by polarised X-rays in a Wilson expansion chamber, it is possible to determine the polarisations of these rays. Such experiments were performed by Kirchner, who, using rather hard X-rays, investigated the azimuthal distribution of recoil electrons, and found that they were ejected principally in the plane containing the magnetic vector of the incident rays. But it must be borne in mind that the length of tracks was very small and did not exceed some millimetres. Such short-ranged recoil electrons give very crooked tracks, from which it is very difficult to judge with certainty the direction in which the electrons have been ejected, and therefore this method cannot give such quantitative results as the investigation of the intensity of scattered X-rays.

In the case of polarised $\gamma$-rays, the expansion-chamber method could be used with advantage, because the recoil electrons ejected by $\gamma$-rays give very long and almost straight tracks. Polarised $\gamma$-rays may be easily obtained by the method described above, that is, by allowing them to scatter from light substances at right angles to the incident beam.

The results of experiments described above may be summarised as follow:

In the case of hard X-rays ($\lambda = 0{\cdot}07$ A. to $0{\cdot}1$ A.) the secondary radiation scattered from light substances consists almost entirely of rays with increased wave-length (in consequence of the Compton effect).

The scattered (modified) rays are polarised in the same manner as they should be in the case of classical scattering. The same may be said of the spacial distribution of the intensity of scattered rays.

P. LUKIRSKY.

Leningrad,
July 6.

### The Photochemistry of Ergosterol.

IN order to study the changes undergone by ergosterol under the influence of ultra-violet irradiation, the following arrangement has been devised: The flat platinum surface of a sensitive platinum-tellurium thermopile (constructed by Dr. W. Vanselow in this laboratory) was coated with a layer of solid ergosterol cemented with ether and was then exposed to monochromatic radiation from an intense quartz-mercury arc using a Hilger quartz monochromator. Variations in the intensity of the light source were checked by the use of a second thermopile.

The following galvanometer deflexions, in millimetres, were obtained:

| Line. | Thermopile Empty. | Thermopile with Layer of Ergosterol. | Ratio. |
|---|---|---|---|
| 265 $\mu\mu$ | 8 | 6 | 0·75 |
| 280 $\mu\mu$ | 4 | 2·3 | 0·62 |
| 313 $\mu\mu$ | 34 | 22 | 0·65 |

A deflexion of 1 mm. corresponds to a radiation intensity of 0·65 erg per square mm. per second. The illuminated surface of the thermopile had an area of 6·6 sq. mm. The layer of ergosterol was about 2 mm. thick. The deflexion of the galvanometer could be noticed almost immediately after the exposure of the coated thermopile to the monochromatic radiation.

That all the light was absorbed by the layer of ergosterol and none passed directly through to the thermopile was demonstrated by depositing a similar layer on the outer quartz window of the double thermopile in front of the first empty unit. The galvanometer under these conditions showed no deflexion. The sample of ergosterol used had been prepared from yeast by saponification with alcoholic potash, extraction with ether, repeated recrystallisation from 95 per cent alcohol, acetylation of the crude ergosterol, recrystallisation of the acetate from glacial acetic acid and alcohol, saponification, and finally three recrystallisations from absolute alcohol. It was beautifully crystalline, snow-white, and had a melting-point of 163° uncorrected.

The layer of ergosterol cut the galvanometer deflexion to about 65 per cent of its original value for the 313 $\mu\mu$ line. As ergosterol has no bands of absorption in this region, the effect must be due to reflection and increased heat capacity of the thermopile.

The deflexion is reduced about the same amount also in the region where ergosterol absorbs the light, at 265 and 280 $\mu\mu$. It is known that this light is absorbed and that it effects a chemical change as evidenced by the anti-rachitic properties of irradiated ergosterol. The experiments with the coated thermopile show that there is no appreciable absorption of heat in the photochemical activation of ergosterol. The fact that this absorption of light energy to give a chemical reaction does not result in an endothermic reaction for the whole process may be explained according to three different hypotheses:

(*a*) Ergosterol is quantitively transformed into vitamin D, and a high energy is necessary to excite the ergosterol, but after excitation the rearrangement of atoms and electrons evolves practically as much heat as was absorbed in the excitation process. In other words, the energy required to excite ergosterol is large, but the heat of reaction into vitamin D is practically zero.

(*b*) The quantum efficiency of the formation of vitamin D is low even for monochromatic radiation, most of the energy being dissipated as heat or used to elicit complicated reactions leading to the formation of new products other than vitamin D.

(*c*) Not ergosterol itself, but an impurity, is the mother substance of vitamin D, and most of the energy absorbed by ergosterol is dissipated as heat.

Rosenheim and Webster[1] have found that the changes undergone by ergosterol under the influence of polychromatic light are of a complex nature. On the other hand, quantitative measurements, which will be reported elsewhere in detail, have shown that the quantum efficiency of the photochemical activation of ergosterol by monochromatic light is constant over a wide range of radiations, 750-1000 ergs being necessary with the 256, 265, 280, and 293 $\mu\mu$ lines to form an amount of vitamin D sufficient to cause a demonstrable deposition of calcium in the bones of a rachitic rat.

These findings would seem to make the second hypothesis likely. The third one is extremely doubtful in the light of a recent paper by Windaus, Borgeaud, and Brunken.[2]

The facts show at least that the production of vitamin D, even by monochromatic ultra-violet light,

[1] Rosenheim and Webster, *Lancet*, Sept. 17, 622; 1927.
[2] Windaus, Borgeaud and Brunken, *Nachr. Gesell. Wissensch. Göttingen Math.-Physik. Klasse*, 313; 1927.

may be quite complicated, and that it is perhaps premature to assume that the new band of absorption appearing at 247 $\mu\mu$ in irradiated ergosterol is a characteristic band of vitamin D.

The arrangement described here may prove to be useful in the study of other photochemical processes.

My best thanks are due to Prof. Farrington Daniels for the hospitality of his laboratory.

STANISLAW KAZIMIERZ KON.
Laboratory of Physical Chemistry,
University of Wisconsin,
Madison, Wisconsin, July 13.

### The Stark Effect at Very High Field.

FOR the spectroscopic study of atomic and molecular structure, the production of high magnetic and electric fields is of prime importance. I have lately been engaged in this problem, and although I do not believe the limit has been reached, still, so far, I have obtained a field of 650 k.v. per cm. (being roughly extrapolated from the previous date for $H_\alpha$, neglecting the third and higher order Stark effect).

The tube used was a quartz one of the Lo Surdo

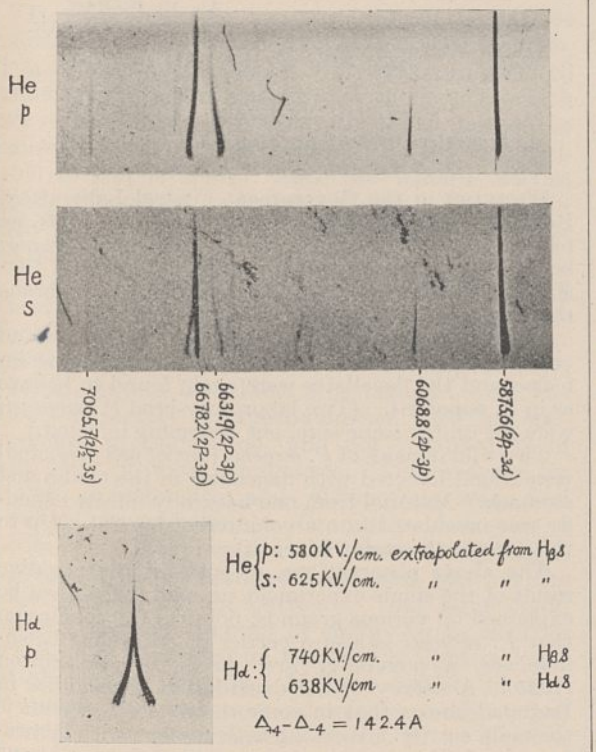


FIG. 1.

type, the inner diameter being 0·8 to 2 mm. For the excitation, a powerful transformer with a synchronous motor rectifier was used. Particular care was taken to choose the most suitable phase setting of the vanes of the rectifier. In most cases the current remained below 0·5 milliamp. The exact value of the terminal voltage has so far not been measured; but, roughly speaking, the largest field would have been only of the order of 150 k.v., if the ordinary positions of the vanes had been used.

With the help of this very strong field, I have observed various lines of the helium and lithium spectra which were hitherto not found to be affected by the electric field; for example, both the helium line λ7066 A. and the lithium line λ6702 A. were found to be shifted to the violet. In the case of the neon spectrum a large number of lines were found to show quite complicated patterns of the Stark effect, allowing a more extensive study than was carried out by Nyquist (*Phys. Rev.*, **10**, 226-243; 1917). With hydrogen an interesting feature observed was that the relative intensities of the $p$-component of $H_\alpha$-line were found to be in the ratio 22 : 65 : 45, instead of Stark's former data of 1 : 1·1 : 1·2, and this new result seems to be in better agreement with Schrödinger's recent calculations. The accompanying photograph (Fig. 1) shows a part of the $p$- and $s$-components of the helium spectrum and the $p$-component of $H_\alpha$. The discrepancy between the field values extrapolated from $H_\alpha$ and $H_\beta$ must be largely due to the third and higher order Stark effect of $H_\beta$. The detailed report will be published in the scientific papers of the Institute.

In conclusion, I may state that it seems to be quite promising to apply this method for the Stark effect study of other elements.

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### Contractions for Titles of Periodicals.

THE advantage of a standard list of contractions for periodical titles for general use in scientific journals would so outweigh initial inconveniences of changing present systems that it seems ungracious, with a comprehensive list of abbreviations now available in the "World List of Scientific Periodicals" (1901–1920), to question its suitability for general adoption. I am, however, doubtful whether the "World List" meets the particular requirements of journals circulating widely abroad. For these the title contractions must be free from ambiguities, indicative of the language of the originals, and full enough for a reader of any nationality to reconstruct the title sufficiently to enable him to find the title-entry easily in an alphabetically arranged catalogue of periodicals.

To secure freedom from ambiguity the use of the same contraction for words of different meaning should be avoided. The "World List" does not always do this. For example, *Indian Engineering* is contracted to *Ind. Engng.*, and *Journal of Industrial Hygiene* to *J. Ind. Hyg.* A reader recognising the *Ind.* in *J. Ind. Hyg.* as standing for *Industrial*, might well assume that *Ind. Engng.* stood for *Industrial Engineering*, only to discover on obtaining the latter journal from a library or bookseller that it was not the one required.

As indicative of the language of the original the retention of an article, preposition, or conjunction in contractions of foreign titles is helpful. The "World List" normally omits these. The *Annali di Clinica medica*, Palermo, becomes simply *Ann. Clin. med.*, being determined as Italian because of the higher order of familiarity of the Italian language over Portuguese, and because its form of contraction precludes English, French, or German. But the knowledge of languages implied here will not always save a reader from doubt. The French publication *L'Argus : Journal International des Assurances*, Paris, becomes simply *Argus*, which gives no clue to the language of the original, and a reader cannot be presumed to know that France alone has a scientific periodical of this name. The retention of the article, or of the imprint 'Paris' here seems necessary.

The third requirement, that the contraction be full enough to facilitate the reader's search for the journal-title in any library list, seems to me the most

important, and the one in which the "World List" fails most conspicuously. An instance may be given. The *Bulletin trimestriel de la Société d'horticulture de Sedan* appears in the "World List" as *Bull. Soc. Hort. Sedan*: the *Bulletin de la Société centrale d'horticulture du département de la Seine-Inférieure*, Rouen, as *Bull. Soc. Hort. Seine-Inf.* In any alphabetical catalogue one would expect to find the entry for the first journal near to and preceding the second. In fact, in the "World List" the two are some 590 entries apart, the effect of the essential words *centrale* and *trimestriel* being to separate them widely and to reverse their positions. Contractions should not ignore essential words that so appreciably affect the alphabetical position of titles. These contractions would more usefully have been *Bull. Soc. cent. d'Hort. Seine-Inf.* and *Bull. trim. Soc. d'Hort. Sedan.* Occasionally a contraction in the "World List" rearranges the form of title, thus the *Journal of the Royal Army Medical Corps* becomes *R.A.M.C. Jl.*, a baffling form for most foreigners. The language of the original is even departed from on occasion, thus *Věstník Klubu Přirodovědeckého v Prostějově* becomes *Jahrb. naturw. Kl. Prossnitz.*

The very great value of the "World List" is not gainsaid. It would, however, be interesting to know the opinion of others as to the suitability for universal adoption of its system of abbreviations for the titles of periodicals.

R. L. SHEPPARD.

Bureau of Hygiene and Tropical Diseases,
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Aug. 4.

### Molecular Spectra in the Extreme Infra-Red.

THE appearance in the spectrum of monochromatic light diffused by fluids, of new lines of modified frequency (*Ind. Jour. Phys.*, vol. 2, pp. 387 and 399; 1928), gives us a powerful, accurate, and convenient method of exploring molecular spectra, especially in the near and extreme infra-red regions. We have only to photograph the spectrum of the

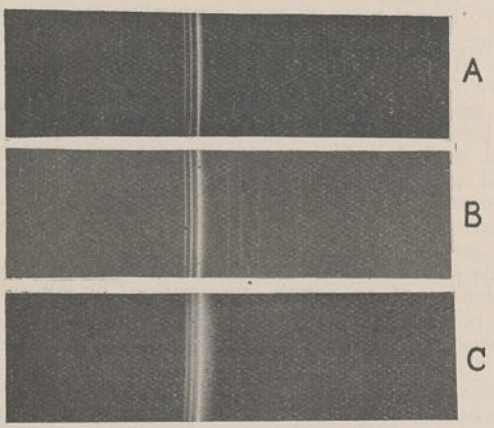


FIG. 1.

scattered light, and the frequency-differences between the incident light and the new radiations excited by it give us the molecular frequencies. As an illustration of what the method is capable of, we may mention the case of carbon tetrachloride, the spectrum of the mercury arc scattered by which is reproduced as Fig. 1 B, 1 A being the incident spectrum. The 4358 A. line, which is the principal exciter, is accompanied by three sharp lines close to it on the right, from which we deduce 45·4 $\mu$, 31·8 $\mu$, and 21·7 $\mu$ as wave-lengths of three hitherto unknown infra-red lines in the spectrum of the carbon tetrachloride molecule. In addition, we have a doublet 13·0 $\mu$ and 12·6 $\mu$, the position of which as an unresolved line was approximately known from the work of Coblentz.

Fig. 1 C shows the nebulosity or continuous spectrum accompanying the 4358 line when it is scattered by benzene. The existence of a continuous radiation accompanying the lines and bands in the scattered spectrum from liquids has been pointed out by us earlier and is indeed visible in our published photographs. Its natural explanation would appear to be that it arises from a combination of the rotational frequencies of the molecule with the frequencies of the incident or scattered radiations, the impedance to the free rotation of the molecules in a dense fluid being the reason why such combination results in a continuous spectrum instead of discrete lines. The unmodified lines being the strongest, the nebulosity accompanying them appears very conspicuous. Incidentally, with reference to a recent interesting paper by Cabannes and Daure (*Comptes rendus*, June 4, 1928), we may direct attention to the distinctly imperfect symmetry of the nebulosity on the two sides of the 4358 line appearing in Fig. 1 C.

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### Infection of *Phlebotomus sergenti* with *Leishmania tropica*.

WORKING in the Government Central Laboratory, Baghdad, as guests of the director, Dr. A. E. Mills, we found that cultures of a strain of *Leishmania tropica* behaved in *P. sergenti* exactly as in *P. papatasii*, that is, in sandflies infected by feeding through a membrane the flagellates tended to an anterior position.

Laboratory-bred *P. sergenti* (17 ♀ ♀) were fed on an oriental sore in Mosul. Of these eleven became infected and the flagellates were again found to behave as in *P. papatasii*. (Two laboratory-bred *P. papatasii* were fed on the same sore, one becoming infected.)

Two wild females of *P. sergenti* (out of 683 dissected) were found infected with flagellates in the cardia and stomach. Material from one naturally infected sandfly was inoculated into a volunteer (May 28). Up to the present the result is negative.

The above observations, in spite of the negative result of the single experiment on man, which can be explained on various grounds, point to the conclusion that *P. sergenti* is also a carrier of cutaneous Leishmaniasis, a possibility first considered by Sinton (1925). A survey of the distribution of sandflies in Baghdad shows that in some districts *P. sergenti* is the main carrier. Working in Jerusalem with laboratory-bred *P. sergenti* we found that in specimens infected by feeding on man *L. tropica* (long forms of the flagellates only) reaches more than half way down the proboscis after six days at 27° C.

The Kala-Azar Commission of the Royal Society (W. S. Patton and E. Hindle, *Proc. Roy. Soc.* B. vol. 101; 1927) found that out of 430 specimens of *P. sergenti* artificially infected with *L. donovani* only twenty-three showed flagellates in the cardia and none in the œsophagus and pharynx. The tendency of *L. tropica* to an anterior position in *P. sergenti* is therefore in marked contrast to the behaviour of *L. donovani* in the same sandfly.

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# The Waves of an Electron.[1]

By Prof. GEORGE P. THOMSON, University of Aberdeen.

THE history of the newer physics, as it may be called, is largely the history of the very successful attempts which have been made to explain the facts of the physical universe in terms of electricity. In particular, the natural units of electricity, the electron first isolated as the carrier of the negative charge in the cathode rays, and the more massive proton with its equal positive charge, have been the bricks out of which physicists have tried to build model atoms. But until recently the only properties which could be attributed with certainty to the electron were its mass, $9 \times 10^{-28}$ gm., and its charge, $-4{\cdot}77 \times 10^{-10}$ electrostatic units. It is indeed possible to calculate a 'size' on the assumption that it follows the same laws as a charged metal sphere in a laboratory, but the value found, $3{\cdot}7 \times 10^{-13}$, is neither confirmed nor contradicted by any experimental evidence.

To show why we are now obliged to ascribe much more complicated properties to the electron, I must make a digression into optics. It is well known that there is a number of phenomena which are examples of wave-motion in what used to be called the ether, though it seems now more fashionable to call it space. Such are wireless waves, light, ultra-violet radiation, X-rays. They differ only in wave-length, and it is convenient to refer to them all as light.

Now at the beginning of the century, the wave theory of light was one of the most firmly established parts of physics. It is true that for many purposes light was treated as consisting of rays, that is, effects travelling in a straight line, but this was merely an approximation used for convenience in calculation, and not regarded as of any great physical significance. The evidence for waves (interference and diffraction) was, and remains, overwhelming. Gradually, however, a series of experimental and theoretical results accumulated which showed that this was not the whole story, and in particular that light could communicate an amount of energy to an electron which only depended on the *kind* of light and not at all on the *intensity*. If light consists of continuous waves this seems almost impossible; but it is just what we should expect if, as Newton firmly held, light is due to a stream of corpuscles. In such a case, if one of these hit an electron, it would give to it an energy which would be quite independent of the number of other corpuscles present in the stream, that is, of the intensity of the light.

Louis de Broglie has hit on a brilliant synthesis of the two views. Put very briefly, it comes to saying that light is indeed corpuscular, but that the corpuscles are accompanied and guided by waves. Now the bearing of this on our subject is as follows: de Broglie's theory is quite a general one, and should apply to *any* sort of corpuscular motion; in particular electrons should be accompanied by waves which determine their motion. It would seem at first sight that this would involve a contradiction with what is already known about the motion of electrons. For example, waves spread after passing through a small aperture, while electrons can be concentrated into a fine beam by a tube or series of slits. But it is all a question of wave-length. Ordinary visible light only spreads very slightly round obstacles because its wave-length is small compared with the size of ordinary objects. Wireless waves bend much because their wave-length is large.

There is, in fact, a relation pointed out more than a century ago by Hamilton between optics and dynamics. The laws of dynamics in their most general expression, the principle of action, are mathematically identical with Fermat's principle, which is the most general statement of optics on the ray theory. Now in optics, rays are an approximation to the wave theory, more and more nearly true the smaller the wave-length; perhaps

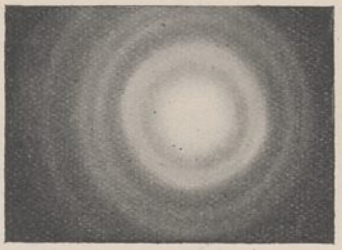

FIG. 1.—Rings produced by a gold film.

the accepted mechanics of Newton and Hamilton is also only an approximation, true in practice because the wave-lengths concerned are very small? If so, we must develop a new mechanics to deal with cases when the wave-length is not of negligible size.

De Broglie's results are as follows: For any moving particle the wave-length $\lambda = h/$ (momentum) where $h$ is Planck's constant $= 6{\cdot}58 \times 10^{-27}$. This in fact comes out negligibly small for any ordinary body. Even for an electron moving with the moderate energy of 150 volts it is $10^{-8}$ cm., or about that of a soft X-ray, while for cathode rays of, say, 15,000 volts, it is $10^{-9}$ cm.

Still, Sir William Bragg and his son have shown us how to measure the wave-lengths of X-rays, small though they are, and the electron waves may yield to a similar treatment.

We must first consider some general properties of these waves. According to de Broglie the speed of the waves, $V$, is $c^2/v$, where $v$ is the speed of the particle, and $c$ the velocity of light. They are thus faster than light. This result would be contrary to relativity if the waves carried energy, and so could transmit a signal, but as the energy is supposed associated only with the *particle*, this objection does not come in; indeed, on the classical

[1] From a discourse delivered at the Royal Institution of Great Britain on Friday, June 8.

optical theory, cases are known of metals, such as sodium, having a refractive index less than unity, which implies a wave velocity greater than $c$. From the above two equations, taking account of the variation of mass with speed, $V^2 = c^2 + \frac{m_0^2\lambda^2}{h^2c^4}$, and so depends on $\lambda$. Thus there is *dispersion*, in the optical sense, for these electron waves even in free space.

The late Lord Rayleigh showed that in such a case, besides the velocity of the independent waves, there is what he called a *group velocity*, which is the speed with which the pattern formed by the superposition of several waves of slightly different wave-length moves along. Now an application of his formula shows that in this case the group velocity is precisely $v$, the speed of the electron, so that the electron carries its *group* with it—or the group carries the electron—though the individual waves composing the group are perpetually shooting through from behind.

Again, since an electron is charged, its motion is affected by an electric or a magnetic field. On the older view of an electron this was simply a consequence of the laws of electricity. On the new view the electron goes where its wave takes it. Somehow, the only possible paths are those along which the wave is propagated. On this view the change in motion of the electron is analogous to the change in direction of a ray of light when it enters a refracting medium. In fact, by choosing the field in an appropriate manner, we can imitate the effect on light of a corresponding piece of glass. For example, we can make a field equivalent to an ordinary convergent lens and bring electrons to a focus.

Of course, this is only a translation between one view and the other. To test the new theory we must use something which has a regular structure comparable in size with the supposed wave-length. Here the wide experience obtained with X-rays comes to our aid, and the natural regularities of a crystal give what is needed. The regularly spaced atoms of a crystal each scatter the waves, since they scatter the electrons. Such a system of regularly arranged scattering points produces, as is well known, a peculiar effect on a simple wave, which is deflected into a few definite directions. It forms, in fact, the three-dimensional analogue of the ordinary optical ruled diffraction grating.

The idea of using a crystal in this way has been carried out by Davisson and Germer in America, and by Reid and myself in Great Britain. If a beam of X-rays is passed through a single crystal and allowed to fall on a photographic plate, the developed picture is a series of spots the position of which depends on the structure of the crystal. If it passes through a powder formed of a large number of very small crystals arranged at random, the spots due to each tiny crystal join together to form a series of concentric rings, the relative sizes of which depend on the crystal structure, the absolute size of the whole pattern being proportional to the wave-length of the X-rays. Both these methods, or their equivalent, have of course been extensively used in the investigation of crystal structure by X-rays.

The apparatus used by Reid and myself is a direct application of this method to the study of electrons. A narrow beam of cathode rays passes normally through a very thin film of metal by which it is scattered or diffracted. The scattered rays diverge till they reach a photographic plate parallel to the thin film and about 30 cm. away, where their impact is recorded. It is necessary to use very thin films because electrons have vastly less penetrating power than X-rays, and they must not only penetrate the film, but also be so little affected by it that the scattering is what is technically called 'single.' In practice this means that only a small minority should be appreciably scattered at all. The films we used were only a few millionths of a centimetre thick; in fact, it is no use trying a metal film unless it is thin enough to be transparent. Some of the metals give uniform rings (Fig. 1), others spots arranged round rings. Both can be paralleled in analogous results with X-rays.

In comparing theory with experiments we have three separate checks. First, the relative sizes of the rings must conform to the known crystal structure. For the metals I used they go as the square roots of certain integers. In fact, the first few rings should be in the ratio $\sqrt{3} : \sqrt{4} : \sqrt{8} : \sqrt{11} : \sqrt{12} : \sqrt{16} : \sqrt{19} : \sqrt{20}$. The above table shows the extent of the agreement.

RELATIVE DIAMETER OF RINGS.

| Metal | $\sqrt{3}$ | $\sqrt{4}$ | $\sqrt{8}$ | $\sqrt{11}$, $\sqrt{12}$ | $\sqrt{16}$ | $\sqrt{19}$, $\sqrt{20}$ | $\sqrt{24}$ | $\sqrt{27}$ | $\sqrt{35}$, $\sqrt{36}$ |
|---|---|---|---|---|---|---|---|---|---|
| Gold | $\sqrt{2{\cdot}93}$ | $\sqrt{4{\cdot}02}$ | $\sqrt{8{\cdot}00}$ | $\sqrt{11{\cdot}2}$ | | $\sqrt{19{\cdot}8}$ | | | |
| | $\sqrt{3{\cdot}05}$ | $\sqrt{4{\cdot}05}$ | $\sqrt{8{\cdot}00}$ | $\sqrt{11{\cdot}4}$ | | $\sqrt{19{\cdot}1}$ | | | |
| | $\sqrt{2{\cdot}96}$ | $\sqrt{4{\cdot}08}$ | $\sqrt{8{\cdot}00}$ | $\sqrt{11{\cdot}2}$ | | $\sqrt{19{\cdot}5}$ | $\sqrt{22{\cdot}7}$ | $\sqrt{26{\cdot}6}$ | $\sqrt{35{\cdot}4}$ |
| Aluminium | | $\sqrt{4{\cdot}00}$ | $\sqrt{8{\cdot}00}$ | $\sqrt{10{\cdot}9}$ | $\sqrt{16{\cdot}5}$ | $\sqrt{20{\cdot}4}$ | | $\sqrt{27{\cdot}0}$ | |
| | | $\sqrt{3{\cdot}98}$ | $\sqrt{8{\cdot}00}$ | $\sqrt{11{\cdot}0}$ | $\sqrt{15{\cdot}7}$ | $\sqrt{21{\cdot}2}$ | | $\sqrt{27{\cdot}8}$ | |
| | | $\sqrt{4{\cdot}02}$ | $\sqrt{8{\cdot}00}$ | $\sqrt{10{\cdot}9}$ | $\sqrt{15{\cdot}9}$ | $\sqrt{19{\cdot}4}$ | | $\sqrt{26{\cdot}8}$ | $\sqrt{35{\cdot}0}$ |
| Platinum | $\sqrt{3{\cdot}00}$ | $\sqrt{4{\cdot}00}$ | $\sqrt{8{\cdot}00}$ | $\sqrt{10{\cdot}9}$ | $\sqrt{15{\cdot}3}$ | $\sqrt{18{\cdot}4}$ | $\sqrt{24{\cdot}0}$ | $\sqrt{26{\cdot}5}$ | |
| | $\sqrt{3{\cdot}07}$ | $\sqrt{4{\cdot}01}$ | $\sqrt{8{\cdot}00}$ | $\sqrt{11{\cdot}3}$ | | | | | |
| | $\sqrt{3{\cdot}04}$ | $\sqrt{4{\cdot}03}$ | $\sqrt{8{\cdot}00}$ | $\sqrt{11{\cdot}2}$ | $\sqrt{16{\cdot}4}$ | $\sqrt{19{\cdot}0}$ | $\sqrt{23{\cdot}4}$ | $\sqrt{27{\cdot}1}$ | $\sqrt{35{\cdot}0}$ |

The rings corresponding to $\sqrt{11}$ and $\sqrt{12}$, $\sqrt{19}$ and $\sqrt{20}$, and $\sqrt{35}$ and $\sqrt{36}$ were generally too close together to be separated.

Secondly, if de Broglie's theory is true, the wave-length is inversely as the momentum, that is, apart from a small relativity correction, the product of the diameter of any one ring into the square root of the measured energy of the rays should be constant.

| Aluminium. | | Gold. | | Platinum. | |
|---|---|---|---|---|---|
| Voltage. | $D\sqrt{P}$. | Voltage. | $D\sqrt{P}$. | Voltage. | $D\sqrt{P}$. |
| 21,800 | (359) | 21,000 | (344) | 18,200 | (378) |
| 34,500 | 385 | 33,700 | 377 | 25,500 | 395 |
| 45,000 | 385 | 44,000 | 377 | 34,500 | 420 |
| 57,600 | 395 | 55,000 | 379 | 40,000 | 401 |
| 64,000 | 385 | 58,000 | 376 | 45,000 | 413 |
| Means | 387 | | 377 | | 407 |

| Celluloid. | | | |
|---|---|---|---|
| Voltage. | $D\sqrt{P}$. | Voltage. | $D\sqrt{P}$. |
| 9,800 | 185 | 23,200 | 193 |
| 11,500 | 175 | 30,500 | 186 |
| 16,100 | 189 | 36,000 | 193 |
| 16,800 | 191 | 42,500 | 189 |
| 21,000 | 190 | 50,000 | 195 |

Apart from the numbers in brackets, which corresponded to very faint rings, the agreement is satisfactory.

Thirdly, the actual size of the rings is calculable from the assumed wave-length, and the known spacing of atoms in the crystal. The best way of showing the agreement is to work back, calculating the crystal spacing from the experiments and theory, and comparing with that found by X-rays.

SIZE OF CRYSTAL UNIT.

| | Aluminium. | Gold. | Platinum. |
|---|---|---|---|
| X-ray measurements . . | $4{\cdot}046 \times 10^{-8}$ | $4{\cdot}06 \times 10^{-8}$ | $3{\cdot}91 \times 10^{-8}$ |
| Cathode ray measurements | $4{\cdot}06 \times 10^{-8}$ / $4{\cdot}00 \times 10^{-8}$ | $4{\cdot}18 \times 10^{-8}$ | $3{\cdot}88 \times 10^{-8}$ / $3{\cdot}89 \times 10^{-8}$ |

The bracketed measurements were made with different apparatuses.

Finally, in a few cases the individual spots can be used. This is when the small area struck by the rays happens to consist wholly or mainly of a single crystal. In such a case we can find the orientation of the crystal from some of the spots and see if the others check, as in fact they are found to do.

I think that this agreement may be regarded as establishing the essential truth of the theory.

There remain great difficulties of interpretation. What are these waves? Are they another name for the electron itself? How many waves in series does an electron have? What is the relation between the electron waves and those of light and X-rays? Some of these questions I should like very briefly to discuss, but we now leave the sure foothold of experiment for the dangerous but fascinating paths traced by the mathematicians among the quicksands of metaphysics. First, as to the length of the train of waves. Here we have a little direct evidence. The sharpness of the rings depends, among other things, on this length. A short train of waves results in blurred rings. If we suppose the whole width of the rings due to this, I calculate from the fact that it is sometimes possible to separate the $\sqrt{11}$ and $\sqrt{12}$ rings that there must be at least 48 ordered waves in the series. Probably there are many more, as several other causes tend to widen the rings. But this may only apply to my particular experimental arrangement.

Theoretically, it seems probable that an exact knowledge of the speed of an electron implies that it has an infinite wave-train associated with it, just as ideally monochromatic light implies an infinite train of light waves. Since there cannot actually be an infinite wave-train, this means that an electron's speed can never be exactly known, which in one sense is not surprising, for all measurement is approximate, and it can be shown that the conditions under which the velocity of an electron could be found with great accuracy are precisely those in which a long train of waves could accompany it. But suppose we have a short train of waves. The velocity is uncertain. Is this because there are really many electrons concerned and they have different velocities? In most of the experiments one could devise there would be, but I do not think this covers all cases.

Imagine a small speck of radio-active material which emits electrons as fast $\beta$-rays. If we make it small enough the particles may follow each other at intervals of minutes, or days, or years. It seems impossible to suppose that these electrons have any connexion with each other. They come from different atoms at widely different times. One is forced to the conclusion that each must have its own separate wave system. But this wave train must be finite, probably in fact it is rather short, and one reaches the surprising conclusion that the electron *has* no definite velocity, even though it may be moving in force-free space. This raises obvious difficulties about energy which I do not pretend to be able to solve, but the work of Ellis and Worster on radium *E* seems to show that there is an uncertainty of this kind, which is in fact of about the right amount.

As regards the relation between electron waves and light waves: they are certainly not the same, even when their wave-lengths are equal. They go at different speeds: one is refracted by electric and magnetic fields, while the other is not; their penetrating powers in ordinary matter are widely different. If they are the actual motion of an ether, it must differ in some way in the two cases.

My father, Sir J. J. Thomson, has shown that the relation between wave-length and velocity of

the electron waves is precisely that which holds for light waves in a medium containing free electric charges. The properties of such a medium have recently become of great importance, for the possibility of long-distance wireless has been shown to be due to the existence of a region with these properties in the upper atmosphere. It is tempting to regard this agreement as something more than a mere coincidence, and to consider the waves of the electron as waves in an ether modified by the presence of the tubes of force, which since the days of Faraday many physicists have regarded as having a real existence round an electric charge. Thus the electron would provide, not indeed its own ether, but the necessary modification of that ether.

I should like also to suggest another possibility. Personally, I see no necessity for there to be any vibration of a material or quasi-material object. The essence of a wave is the transference of a *state* according to certain laws. The state may, or may not, be one of motion. On this view the function of the waves is to produce conditions at the electron which oblige the latter to move along the instantaneous position of the wave-normal (in the absence of a magnetic field), and along another, but determinate, direction in a magnetic field. But though it seems possible to regard the motion of the electron as determined by the wave in its immediate neighbourhood, it must never be forgotten that the direction of each part of a wave-front depends on the history of the whole wave-front. Any circumstance that influences one part of a wave influences the whole, and this is of the essence of wave motion. The electron is influenced by conditions at a distance, but indirectly through its waves. Thus in our experiments the electron is influenced not merely by the nearest atoms of the crystal, but also by the whole of the crystal which is exposed to the beam. The *width* of the wave-front must be taken as the cross-section of the tube which limits the beam of electrons.

Although the whole wave-front, in theory, affects the electron, all parts do not affect it equally. Thus, suppose the width of the beam were diminished by gradually reducing the size of the tube, apart from the obvious diminution in intensity, the only effect would be a diminution in resolving power due to the reduction in the number of grating elements. When the resolving power is large a considerable change, such as is produced by halving the number of atoms affected, produces comparatively little change in the pattern of the diffracted rays, that is, the distribution of scattered electrons.

The main features of the pattern are determined by the first few elements, just as, on the older view, the direction of the scattered electron would be mostly determined by the forces exerted on it by the atoms near which it goes and comparatively little by the more distant ones.

The easiest way of looking at the whole thing seems to be to regard the waves as an expression of the laws of motion. The uniform motion of Newton's first law is replaced by a simple plane wave, and so on. On this view, the electron remains the reality, and this seems right, for after all it is the electron as a particle which is actually detected in any practicable experiment, and the waves come to bear the same sort of relation to it that Newton's or Einstein's law of gravitation bears to the planets which obey it.

It is remarkable how near this view comes to that proposed by Newton in the case of light, which as we have seen is analogous, and I can scarcely give a better statement of the position, allowing for slight changes in terminology, than by quoting what he says :

"Those that are averse from assenting to any new discoveries but such as they can explain by an hypothesis, may for the present suppose, that as stones by falling upon water put the water into an undulatory motion, and all bodies by percussion excite vibrations in the Air ; so the Rays of Light, excite vibrations in the refracting Medium or Substance . . . that the vibrations thus excited are propagated in the refracting or reflecting Medium or Substance, much after the manner that vibrations are propagated in the Air for causing Sound, and move faster than the rays so as to overtake them . . . and that every Ray is successively disposed to be easily reflected or easily transmitted, by every vibration which overtakes it. But whether this Hypothesis be true or false I do not here consider."

In what follows Newton contents himself by describing the experimental facts. But his hypothesis, the guess of genius, after a century of discredit, is reasserting its superiority over the more logical, but less inspired, ideas of the early nineteenth century.

## The Initiation of Respiration at Birth.

By Prof. YANDELL HENDERSON, Yale University, New Haven, Connecticut.

IN a classic paper forty years ago, Miescher-Rusch reviewed the evidence then available in regard to the control and regulation of respiration in the adult, and also in regard to the initiation of respiration at birth. He pointed out that afferent nervous stimulation is a merely accessory influence, and that the blood gases are the dominating control with carbon dioxide in the major rôle. He did no experiments, however, to prove this thesis.

About twenty years ago the experimental demonstration and proof were developed by Haldane with Priestley and Douglas that in man, and by inference in all mammals after the independent life of the individual is established, respiration is chiefly controlled by carbon dioxide. But the conditions causing the initiation of breathing at birth have remained until now undemonstrated, and their relations undefined. The belief that it is the chill of exposure to the air that starts the new-born to breathing has come down from a remote past, and is still held unquestioned by

clinicians generally. Accordingly if, after the cord is tied and the placental circulation stopped, the child does not spontaneously expand its lungs, make the first cry and breathe, it is spanked, swung, shaken, plunged in cold water and otherwise stimulated through irritation of its skin.

Recently evidence has developed indicating that this ancient treatment, or maltreatment, has little influence on the outcome, and demonstrating that the essential stimulus, or stimulant, of the first, as of all subsequent, inspirations is carbon dioxide. The evidence indicates, however, that, when respiration does not begin spontaneously, the reason is not lack of a normal amount of carbon dioxide; for a supernormal amount may have accumulated. The cause is rather the depression of the sensitivity of the respiratory centre induced by prolonged asphyxia; for during difficult labour the flow of the blood through the umbilical vessels may be impeded, or the brain may be compressed. Consequently the 'threshold' of the respiratory centre for the stimulus of carbon dioxide becomes abnormally high, an effect which seems to occur also in the victims of drowning. The child therefore makes no inspiratory effort; the lungs remain in their original compressed condition; no oxygen reaches the blood through them; the respiratory centre becomes more deeply asphyxiated; and its threshold for carbon dioxide rises still higher.

The engineering of resuscitation requires, therefore, not irritation of the skin, nor merely a normal amount of carbon dioxide; but it must provide (1) dilatation of the lungs, so that gases may diffuse into the blood, (2) oxygen to restore the sensitivity of the nerve centres and thus to lower the threshold of the respiratory centre, and (3) carbon dioxide at more than normal partial pressure, so as to rise above the still abnormally elevated threshold. Even when oxygen in ample amount is supplied to the lungs and blood, a centre depressed by an intracranial hæmorrhage may require more than the normal partial pressure of carbon dioxide to induce activity. This has been demonstrated by White for adult patients. With infants which have not breathed spontaneously or after starting have ceased again because of intracranial hæmorrhage, it is sometimes necessary to inflate the lungs repeatedly with 10 or 15 per cent of carbon dioxide in oxygen, and then to give a prolonged inhalation with gradually decreasing concentrations of carbon dioxide, in order to start and maintain active respiration.[1]

The demonstration of these causal physiological relations has developed along two parallel lines, one confirming the other. American anæsthetists have now very generally adopted the procedure, which I developed from Haldane's conception of respiration and from my own early experiments, in which the inhalation of carbon dioxide mixed with oxygen is used to stimulate breathing to a considerably increased volume at the initiation and termination of anæsthesia. Advantageous, and in part unexpected, results are developing, such as the elimination of post-anæsthetic pulmonary complications. Once this procedure is established in any hospital it almost invariably follows that, when a cyanotic and non-breathing child arrives in the maternity ward, the obstetrician, instead of risking failure with spanking and cold water, sends for the anæsthetist with his cylinders of carbon dioxide and oxygen. Thus lives may be saved to the extent, so far as can now be estimated, of 1 or 2 per cent of all births.

Another feature of this matter appears from the fact that morphine and the anæsthetics not only raise the threshold of nerve centres for afferent stimuli, and thus exclude pain; they also raise the threshold of the respiratory centre for carbon dioxide, and thus depress respiration. Morphine has thus brought relief to the patient who is to undergo operation, but anxiety to the anæsthetist; for owing to the decreased volume of breathing, both the initiation and termination of anæsthesia are made more difficult and dangerous. By the use of carbon dioxide this disadvantage of morphine is counteracted, and the patient may have a considerable dose of morphine without risk that his breathing will fail fatally.

Similarly in child-birth, the administration of morphine to the mother within an hour before delivery has been liable to result in a child that never breathed; for the drug passes from the maternal circulation to that of the placenta, and thus to the respiratory centre of the child. The threshold of the centre for carbon dioxide is thus raised above the strength of this chemical stimulus that the new-born can spontaneously supply. In fact, heretofore, nearly every measure applied to the mother to decrease her pains has increased the likelihood that the child will not breathe. With the inhalation of carbon dioxide and oxygen for the child, much more may now be safely done to ease the pains of the mother.

A second and confirmatory line of demonstration has developed from the use of a mixture of oxygen and carbon dioxide for the treatment of carbon monoxide asphyxia. In many American cities the fire brigades are now equipped with the inhalators which Haggard and I have introduced. Doctors who have happened to see a case of carbon monoxide poisoning resuscitated by this means, and who thereafter deliver an infant which does not breathe, have successfully invoked the aid of the fire brigade with their inhalator. From this experience it is becoming evident that, while 5 per cent of carbon dioxide is often sufficient, a concentration up to 7 or 8 per cent would be entirely safe and more effective for all forms of asphyxia.

These facts, gathered largely in fields where practical application is the primary object, repay in part the debt which such applications owe to purely theoretical experiments. In particular they reinforce the conception of the relation of the threshold of the respiratory centre to the requisite stimulus. Any hypothesis as to the physico-chemical conditions which excite the centre to activity must take these clinical phenomena into account as well as the purely experimental data.

[1] For technical details see Henderson, *Jour. Amer. Med. Assn.*, Feb. 25, 1928, vol. 90, p. 583.

## News and Views.

ON Aug. 28 occurs the bicentenary of the birth of Johann Heinrich Lambert, one of the most industrious and interesting mathematicians and natural philosophers of the eighteenth century. Born at Mühlhausen, Alsace, of French extraction, Lambert was in turn tailor's apprentice, clerk, bookkeeper, secretary, and tutor, and while engaged as the latter travelled and made the acquaintance of many learned men. From 1764 until his death on Sept. 25, 1772, he was a protégé of Frederick the Great and was one of that group of learned men who were attracted to Berlin and given a pension as a member of the Berlin Academy of Sciences. Lambert's industry was almost incredible. He made inquiries into and wrote upon many branches of physics, mathematics, and astronomy, and was much given to speculation. Of his "Cosmologische Breife" Miss Clerke said: "The conceptions of this remarkable man were grandiose, his intuitions bold, his views on some points a singular anticipation of subsequent discoveries. The sidereal world presented itself to him as a hierachy of systems, starting from the planetary scheme, rising to throngs of suns within the circuit of the Milky Way—the 'ecliptic of the stars' as he phrased it—expanding to include groups of many Milky Ways; these again combining to form the unit of a higher order of assemblage, and so onwards and upwards until the mind reels and sinks before the immensity of the contemplated creations."

THE commemoration of the one hundred and fiftieth anniversary of the discovery of the Hawaiian or Sandwich Islands by Cook—whose own bicentenary is being celebrated in Yorkshire next month—was held on Aug. 16 and succeeding days in the Hawaiian Islands. The events included the unveiling of a monument to Cook on the small island of Waimea, off the island of Kauai, to mark the spot where Cook first landed on Jan. 7, 1778; a memorial service in Kealakakua Bay, in the Island of Hawaii, on the shore of which stands a monument marking the spot where Cook met his death on Feb. 14, 1779; and memorial exercises at Honolulu, the capital of the islands, which itself stands on the beautiful island of Oahu. During the celebrations the United States has been represented by the battleship *Pennsylvania*, and Great Britain, Australia, and New Zealand have been represented by the cruisers *Cornwall*, *Brisbane*, and *Dunedin*. Mr. Dwight F. Davis, the U.S. Secretary for War, was present, and addresses on Cook's career and service were delivered by Mr. Hofgaard, the president of the local historical society, and Mr. Houston, member of Congress for Hawaii, who referred to Cook as "one of those men of whom Great Britain is so prolific, carrying her flag through the world's waste places in advance of science and human welfare."

ON Sept. 1 and 2 last year the first ascent of Mont Blanc direct from the Brenva Glacier on the Italian side of the mountain was made by Mr. F. S. Smyth and Prof. T. Graham Brown. The name of Smyth is not new in Alpine annals, and in particular as regards Mont Blanc, for in August 1855 the Rev. Christopher Smyth and the Rev. J. Grenville Smyth, with Messrs. Kennedy, Hudson, and Ainslie, but without guides, made the first ascent of Mont Blanc by the Dôme du Goûter route from St. Gervais; while a fortnight previously the two Smyths, with Messrs. Hudson, Birkbeck, and Stevenson and four guides, had made the first ascent of the highest peak of Monte Rosa, the Dufourspitze. Last year's feat, the attainment of Mont Blanc by the direct route from the glacier de Brenva—which appears wellnigh impossible to all who have stood on the Col du Géant and regarded that apparently upright wall of ice and rock, scored by couloirs scoured by avalanches of ice, snow, and stones for the greater part of the day and night—was well worthy of his great namesakes, and the account by Mr. Smyth in the May 1928 number of the *Alpine Journal* is one of the most fascinating in the brilliant and tragic annals of the great white mountain. Not content with last season's performance, however, Mr. Smyth and Prof. Graham Brown have now (Aug. 6–8) added to their achievement by ascending from their sleeping-place of last year—a reddish rock buttress which they had named "The Red Sentinel," where they again passed a night in sleeping-bags—to the summit of Mont Blanc de Courmayeur, the somewhat lower peak, 15,595 feet (Mont Blanc being 15,782 feet high above the sea), which one sees just below, to the south-east, as one stands on the summit of Europe.

THIS year's climb, however, is of still greater difficulty than that of last season, and involves at the start from the Red Sentinel the passage of a great couloir 200 feet wide at its narrowest point and flanked by perpendicular walls of black ice (the climber's technical term for clear ice, which of course is bluish green in colour), which are constantly sending down cataracts of ice fragments as soon as the sun is up. Then came firm but very steep granite rocks, and two ice ridges, one like a blue blade in its upper reaches, where the sun shone through its transparent interior. The step-cutting up these ridges was rendered most unpleasant by a bitterly cold north wind, which blew the stinging ice spicules like so many needles into the climbers' faces and every exposed part, and froze their clothes to their bodies. Then came another stiff rock climb, a steep ice slope of clear black ice, requiring handholds as well as steps to be cut; then an ice chimney, and afterwards a careful traversing of ice-sheeted rocks. These led suddenly to an immense wall of ice 700 feet high, castellated with gendarmes and sentinels ever ready to fall, but fortunately showing a gap only 30 feet high through which the climbers were able to cut their way, and finally arrive by easier slopes of snow, of which so little had been met with this year of black ice, at the familiar snow summit of Mont Blanc de Courmayeur. It was then 7.45 P.M. on Aug. 7, and after watching the shadow of Mont Blanc creep

over the plains of Italy, the two intrepid mountaineers walked up to the summit of Mont Blanc itself, and then hastened down to the Vallot Refuge at the 14,312 feet level, on the Rocher des Bosses on the Chamonix side.

A WIRELESS message received in Ottawa from the Canadian Government police post at Chesterfield Inlet, sets at rest the two years old mystery of the fate of Mr. John Hornby, who had spent many years in the exploration of the wilds of northern Canada. His body and those of his companions, his cousin, Mr. Edgar Christian, and Mr. Harold Adlard, were found in a lonely cabin at the junction of the Hanbury and Thelon Rivers, 300 miles west of Chesterfield Inlet, where they had starved to death. Hornby, who was fifty-one years of age and was educated at Harrow, was a well-known explorer, prospector, and trapper. During his twenty years in the Canadian wilds he had collected animals and skins for the Canadian Government; he was an authority on the habits of the caribou, and had a scheme for herding them as the Lapps herd their domestic reindeer; and he was familiar with the habits of the Eskimo, with whom he had frequently lived. On his last journey he had planned a two-years exploration of the land beyond the Great Slave Lake with the intention eventually of reaching the coast. The latest news of the wanderings of the party is conveyed in a letter from Mr. Adlard to his parents, in which he stated that he and Christian, leaving Edmonton in May 1926, had paddled their canoe most of the 600 miles to Fort Resolution, where they had joined Hornby, They proposed to travel during the summer months, and in winter to build a hut and live by trapping, hunting, and fishing. No news was expected of the party after it had passed Fort Smith, but for more than a year a look out for it had been kept by the Canadian Mounted Police.

CONSIDERABLE anxiety has been caused in Kashmir and the Punjab by the ice-dam which has formed across the valley of the Shyok, an upper tributary of the Indus, which drains from the Remo glacier. In an article in the *Times* it is explained that this dam is caused by the Little Khumdan glacier, which in 1926 began to push its snout across the Shyok valley. The dam is said to be about four hundred feet high, and to have caused a lake above it twelve miles long and 200 feet deep. If the glacier snout gives way suddenly, serious floods must result, entailing the destruction of the numerous alluvial flats along the valley, and possibly the bridge which carries the road to the town of Gilgit. There is a possibility of further danger when the flood waters flowing along the Indus valley burst out into the plains of the Punjab in the neighbourhood of Attock. The bursting of the dam was expected to occur about Aug. 21, but eight days earlier a false alarm was given that the flood was on its way. Elaborate precautions have been taken by the Government of India to warn the inhabitants of the valley. It is possible that the leakage may be gradual, and disaster be thus escaped; in any case the sooner the dam bursts the better, for the Indus is now low, but will probably soon rise to its normal level. A flood due to the same cause occurred in 1841, but in that year the lake formed by the ice-dam was 40 miles long and 1000 feet deep.

IN a recent address delivered at the fifty-eighth annual breakfast of the National Temperance League with the British Medical Association at Cardiff, Dr. J. D. Rolleston maintained that much more could be done by the medical profession in the campaign against alcohol than at present. He claimed that increased importance might be attached to the subject in the teaching on public health. Whereas Edmund Alexander Parkes, the founder of the science of modern hygiene, had devoted many pages to alcohol in his "Manual of Hygiene" published sixty years ago, in most modern text-books it receives scant attention. While acknowledging the work done by churches of all denominations in the campaign against alcohol, Dr. Rolleston declared that the odour of sanctity connected with the idea of temperance has a repellent effect. He suggested that those engaged in the various branches of the public health service, such as medical officers of health, medical superintendents of fever hospitals and doctors to welfare centres, might take an active part in the campaign against alcoholism. The medical superintendents of fever hospitals who have to give instruction in acute infectious diseases to students have an excellent opportunity of informing their hearers of the low therapeutic value of alcohol and the likelihood of its giving rise to the drink habit by its ill-advised administration, as well as by giving them glimpses of the ramifications of alcoholism into the various departments of medicine and its sociological importance. The July number of the *Bulletin of Hygiene* contains a review by Dr. Rolleston of recent literature on alcoholism, in which historical aspects, prevalence, etiology, experimental work, diagnosis, prophylaxis, treatment, and legislation are considered.

IT is reported that the Australian Government will accept the offer recently made by the Empire Marketing Board for entomological research in Australia. Dr. R. J. Tillyard, the chief Commonwealth entomologist, is now on his way to Canberra, where the Central Research Station is to be built. The investigations undertaken will be mainly along the lines of biological control, and some of the first problems to receive attention will be the control of Sheep Blow-Fly, Buffalo Fly, Codlin Moth, and St. John's Wort; the last named, which is a familiar weed in England, has spread at an amazing rate in Australia and rendered useless many thousands of acres of valuable pasture land. Close co-operation will be maintained with the Parasite Laboratory of the Imperial Bureau of Entomology at Farnham Royal, where work has already commenced on the Blow-Fly, Codlin Moth, and St. John's Wort problems.

AN interesting demonstration of the Kodacolor Process for amateur kinematography in colours was recently given in London by Messrs. Kodak Ltd., of Kingsway; the process will not, however, be available commercially for some months. The two films shown

gave a good indication of the scope of this process. Flower studies, goldfish swimming in a pool, seaside scenes, and a group of children at play in a garden were shown, quite good range and rendering of the colours being observed. The film is coated on the back with a panchromatic emulsion, whilst its front surface consists of a series of very small lens elements formed by stamping the film with a suitable die, the lens of the ciné camera being fitted with a filter with red, green, and blue segments. On exposure, a large number of small images of the triple colour diaphragm are formed on the film. The film is developed and reversed to give a positive, which, on being passed through a projector fitted with a similar tricolour filter to that used in the camera, renders the original scene in its natural colours on the screen.

AN important report of an inquiry by Dr. Allan C. Parsons into the after-histories of persons attacked by encephalitis lethargica ('sleepy sickness') has been issued by the Ministry of Health (*Reps. on Pub. Health and Med. Subjects*, No. 49. Price 4*s.* 6*d.*). The report is based on an analysis of the data concerning some 3500 patients—about one-fifth of the total number of cases notified from January 1919 to December 1926. The analysis shows that if 100 cases are investigated three years after the primary illness, the *average* findings will be that 35 patients have died, 25 patients have survived without serious consequences, and 40 patients have become more or less disabled in mind or body, or both. Changes in conduct and disposition are among the most striking and troublesome of the sequels of the disease, particularly in children and young adolescents. These moral changes occur in some 25 per cent of the patients, the most common being lying, thieving, bullying, outbursts of temper and violence, and sexual offences.

"THE Campaign against Rats" is the title of an article by Dr. Louis Bahr in *The World's Health* for July (vol. 9, p. 226). He surveys the part played by rats in the dissemination of disease and the economic damage caused by them, which in Great Britain is estimated to amount to fifteen million pounds annually. For extermination Dr. Bahr recommends the method adopted in Denmark, which consists in the use of a bacterial culture or virus, known as 'ratin,' followed 3-4 weeks later by a squill-containing poison, 'ratinin.' Dr. Bahr claims that if this method be systematically used seasonally, only a very small number of rats manage to survive.

WE much regret to announce the death on Aug. 19, at the age of seventy-two years, of Viscount Haldane of Cloan, K.T., O.M., F.R.S., Chancellor of the Universities of Bristol and St. Andrews, the distinguished statesman and philosopher who has twice been Lord Chancellor of Great Britain.

SINCE the death of Prof. C. Diener the chairs of palæontology and palæobiology in the University of Vienna have been united, and the combined professorship is now held by Prof. Othenio Abel. He has three assistants.

THE following elections have been made by the Vienna Academy of Sciences: *Honorary Foreign Members*: Sir Ernest Rutherford (Cambridge) and Prof. R. von Hertwig (Munich); *Corresponding Foreign Members*: Prof. Erwin Schrödinger (Berlin), Sir Jagadis C. Bose (Calcutta), Prof. Victor Goldschmit (Göttingen), Prof. T. H. Morgan (New York), and Prof. I. A. Hammar (Upsala).

BARKHAM MANOR, Piltdown, where the skull of *Eoanthropus dawsoni* was found in 1912, has been sold to a new owner, Mr. David Kerr, who is now digging the Piltdown gravel for use on the roads of the estate. It is at present well exposed over a large area, and the numerous curiously weathered flints are especially interesting. By the courtesy of Mr. Kerr, Sir Arthur Smith Woodward is watching the excavations, but he has not hitherto found any fossils. Several burnt flints and, for the first time, some fragments of charcoal have been noticed.

MESSRS. Adam Hilger, Ltd., 24 Rochester Place, Camden Road, London, N.W.1, inform us that statements are being made that they have expressed opinions concerning the therapeutic value of materials sent for spectroscopic test. All that Messrs. Hilger undertake to do in such cases is to make spectroscopic observations concerning the materials, and any statements to the effect that they have given opinions concerning their value in radiation therapy are incorrect.

THE council of the Royal Agricultural Society has just announced the renewal of its long-standing offer of a silver medal, together with books to the value of £10, for a "monograph or essay giving evidence of original research on any agricultural subject, or on any of the cognate agricultural sciences, or on agricultural economics." The offer is not materially alluring, but it is only fair to this distinguished Society to admit that the 'medal' has an honourable record behind it. The distinction which it conveys has stimulated some excellent work in the past, and although the winners have not contributed much in the way of scientific research strictly so called, their labours have reached a high level of industry and originality.

Two catalogues of second-hand books, of interest to the naturalist, whether he be of the professional or of the sporting stamp, have been issued by R. S. Frampton, 37 Fonthill Road, Finsbury Park, London, N.4. The more unusual comprises a collection of books on angling, made during the last forty years by a practical angler and collector of sporting books, and a few of the latter unassociated with angling are added. The angling books number 625, and range from the subject proper to Huxley's "Crayfish," but they include many items not mentioned in Westwood and Satchell's "Bibliotheca Piscatoria" and its Supplement of 1901. The second catalogue contains the names of 1709 works bearing on general natural history and the associated sciences. The titles are classified in groups ranging from agriculture, anthropology, and astronomy, to ichthyology, microscope, and ornithology. The majority of its

items belong to the second half of the nineteenth century. In both the angling and the natural history catalogues, the prices are generally lower than the usual quotations.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned :—A pharmacist for the Royal Naval Hospitals—The Medical Director-General of the Navy, Queen Anne's Chambers, Tothill Street, S.W.1 (Aug. 30). Three assistant surveyors in the department of the Civil Engineer-in-Chief, Admiralty, and H.M. Naval Establishments at Home and Abroad—The Civil Engineer-in-Chief, Admiralty, S.W.1 (Aug. 31). A lecturer in the mechanical and civil engineering department of the Sunderland Technical College—The Chief Education Officer, Education Offices, 15 John Street, Sunderland (Sept. 3). An assistant lecturer and demonstrator in mechanical engineering in the Faculty of Engineering, the University of Bristol—The Registrar, Merchant Venturers' Technical College, Bristol (Sept. 5). An assistant lecturer and demonstrator in the British School of Malting and Brewing and department of the biochemistry of fermentation of the University of Birmingham—The Secretary, The University, Birmingham (Sept. 7). A half-time assistant in the department of mathematics of the University College of Swansea—The Registrar, University College, Singleton Park, Swansea (Sept. 8). A temporary assistant lecturer in mathematics in the University of Manchester—The Registrar, The University, Manchester (Sept. 10). An assistant lecturer in zoology in the University of Manchester—The Registrar, The University, Manchester (Sept. 10). A warden of the Moulton Farm Institute and assistant county agricultural organiser—The Secretary for Education, County Education Offices, Northampton (Sept. 14). A professor of forensic medicine in the Faculty of Medicine, Egyptian University, Cairo, and a professor of clinical surgery in the Faculty of Medicine, Egyptian University, and surgeon to Kasr-el-Ainy Hospital and Director of the Surgical Unit—The Dean of the Faculty of Medicine, Kasr-el-Ainy, Cairo, Egypt (Sept. 26). A reader in physics in the University of Dacca, East Bengal—The Registrar, University of Dacca, East Bengal, India (Sept. 30). A professor of physics at Agra College, Agra—The Officiating Principal, Agra College, Agra, U.P., India (Oct. 14). A vice-principal and a resident secretary of the Chadacre Agricultural Institute—Earl of Iveagh, 11 St. James's Square, S.W.1. An inspector of surveys under the Sudan Government, Survey Department—Advisory Engineer, Sudan Government, London Office, Wellington House, Buckingham Gate, S.W.1. A secretary of the City of London College—The Secretary, City of London College, White Street, E.C.2. A director of the Endemic Diseases Section, Public Health Department, Egyptian Government—The Under Secretary of State, Public Health Department, Cairo.

## Our Astronomical Column.

AUGUST METEORS OF 1928.—Mr. W. F. Denning writes : "The August meteors returned this year with tolerable activity, but in point of numbers they were not very abundant so far as the data enabled a fair judgment to be formed. On the night (Aug. 11), when the maximum is usually attained, the sky was cloudy in the hours following midnight and observation could not be made, so that the time and strength of the shower at its best were not ascertainable. However, the display did not fail in bringing some bright and beautiful objects, with the same swiftness of motion and phosphorescent trails as we have been accustomed to witness. The radiant, too, exhibited the usual displacement to eastwards night to night.

"At Bristol before $23^h$ G.M.T., Aug. 11, 28 meteors were noticed. On Aug. 12, 165 meteors were counted in $5\frac{1}{2}$ hours by two observers between $21^h$ G.M.T. and $3^h$ G.M.T. Aug. 13. In the early morning of Aug. 14, between $2^h$ and $4^h$ G.M.T., meteors were falling at the rate of about 27 per hour for one observer. The most conspicuous object observed was a fireball on Aug. 14, 2.17 A.M. It passed down the sky in the south-east region of Aquila near the west-south-west horizon, and at the end of its flight gave a great outburst of light which lit up the sky like a lightning flash. It must have passed from north-east to south-west over Cornwall during its combustion, but duplicate observations have not yet been received to enable the exact place to be fixed."

BETELGEUSE AND ANTARES.—These two stars are the brightest stars of type *M*, and have attracted much attention in recent years from their enormous diameters as revealed by the Mt. Wilson interferometer. It had previously been ascertained that both stars had variable radial velocities, and that Betelgeuse showed variation in light, but for a long time no correlation was detected between the two variations, and no period assigned to the light-variation.

Dr. Spencer Jones discusses the problem in *Mon. Not. Roy. Astr. Soc.* for June, using some spectroscopic observations made at Lick Observatory and the Cape during the last thirty years. He treats it in the manner usually adopted for spectroscopic binaries. He obtains for Betelgeuse : period 5·78 years, eccentricity 0·21, amplitude of velocity variation 2·1 km./sec. The corresponding quantities for Antares are 7·35 years, 0·49, 2·1 km./sec. In each star there is evidence of smaller irregular disturbances with periods of a few months. The period 5·78 years probably coincides with that of the light-variation of Betelgeuse ; the maximum velocity of recession comes about half a year after light minimum, that of approach one year after light maximum. This is analogous to the conditions in the Cepheid variables, and it is concluded that the variable radial velocity arises from pulsation of the star's surface, not from duplicity ; the latter would probably be detected with the interferometer if it existed. The amount of pulsation in the case of Betelgeuse would be well over one-third of the radius of the star, a larger amount than that noted in the Cepheids. Dr. Jones suggests that this may arise from the very low density of the outer layers of the star. The interferometer indicated that the star's radius was variable ; on the whole, the variations accord with the above theory, though those in the year 1923 were discordant.

Observations of the diameter with the new 50-foot interferometer over a number of years should afford a trustworthy test of the pulsation hypothesis ; it is also suggested that observers should note whether the colour of the stars changes ; theory demands that they should be redder at maximum expansion, and whiter at maximum contraction.

## Research Items

CAPSIANS AND BADARIANS.—In *Ancient Egypt* (pt. 1, 1928), Prof. V. Gordon Childe criticises some of the arguments adduced by Dr. Scharff, the German orientalist, as proof of the western origin for Early Predynastic culture in Egypt. Dr. Scharff notes the appearance in Mauretania of tanged and concave-based arrow heads, but while these in Egypt go back to Badarian times, the native Capsian form of the Mediterranean coast-lands was the chisel-ended variety, tipped with flint trapezes or lunates. These are foreign to the Badarian and Fayum cultures; they seem to have been used by the Libyan element in Egypt, but only after the development of the barbed and tanged varieties. The first tanged arrow-head cited from Mauretania by Scharff comes from 'dolmenic' tombs, the general affinities of which are with the Nubian *C*-group. Its arrival in Africa Minor is actually a good deal older. It is found in early neolithic deposits at Abd el-Adhim and at Redeye in Tunisia as an intruder in a Final Capsian microlithic context, while in the oasis of Négrine, south of Tebessa, in a late Tardenoisian context, only the lunate and trapeze are found—types also predominant at Abd el-Adhim. None of these tanged forms is so old as Badarian, and in Spain they belong to the relatively late Los Millares. Hence the neolithic begins on the Nile with a form secondary farther west, and the true North African begins at a later date with the white cross-lined pottery. This suggests that in addition to the current from the west affecting Egypt in the First Predynastic age was a counter current reaching Mauretania after Egypt. Other western parallels may be similarly explained, the conclusion being that there are elements in Badarian that are not African in the same sense as Early Predynastic is where these elements are blended with others that are truly western; but even so a western crossed an eastern drift.

YAKṢAS.—Dr. Ananda K. Coomaraswamy has made a study of the origin and status of the Yakṣa (*Smithsonian Miscell. Collect.*, vol. 80, No. 6), which is a valuable contribution to the study of survivals in modern Hinduism and carries a step further the analysis of the diverse elements which have contributed to the composition of Hindu culture. In the centuries preceding the Christian era the religion of India passed through its greatest crises, and though Vedic ritual has in part survived to the present day, the outlook of medieval and modern India is profoundly different from that of the Vedic period. The philosophy of the Upanishads and Buddhism was for the individual who had left behind him the social order; but there grew up in Indian religion a tolerance for beliefs in which life was not abnegation but the fulfilment of function. Of this tolerance belief in the Yakṣas is one manifestation. In popular folklore the Yakṣas are classed with the demoniac Raksaṣas, but they were once tutelary deities, indigenous and non-Aryan and usually beneficent powers of wealth and fertility. This is shown by the iconography, especially in the association of a female voluptuous figure with a tree. The foot sometimes touches the trunk suggesting fertilisation, in accordance with the Hindu conceit that the touch of a beautiful woman's foot is needed for the blossoming of the asoka tree. Yakṣa worship was a Bakti cult with images, altars, temples, and offerings. Thus it came about that the Yakṣas were practically Devas, and that all the greater deities could be regarded as Yakṣas, thus effecting a syncretism of the dieties of the Aryan conquerors and the personifications of the animistic beliefs of the non-Aryan peoples they conquered.

AMERICAN BATS.—Two genera of American bats which afford striking contrasts in many particulars, *Myotis* and *Pizonyx*, have been monographed by Gerrit S. Miller and Glover M. Allen (*Smiths. Inst., U.S. Nat. Mus., Bull.* 144; 1928). The former genus is represented in America by forty-six recognisable races, so similar in habit that the authors are "forced to regard the process of specific differentiation in the group as a whole as primarily dependent on some other factor than any influence which might be exercised directly by the environment." Yet they find that climatic conditions have a marked influence on colour: the coastal area from Alaska to California has darkened local forms, in the semi-arid regions to the east the colour is less intense, while in the desert conditions of the south-west and parts of the interior the same species become extremely pale. The distribution of the species suggests that the American *Myotis* stock was derived originally from the northern part of the Old World. In contrast to the wide range of *Myotis*, *Pizonyx*, with a single species, is confined to the coast and islands of the Gulf of California, Mexico, and its many peculiarities suggest that it has evolved in response to some peculiar habit. The enlarged foot and claws, relative freedom of the leg from the wing membrane, and lengthened tooth cusps, perhaps indicate a diet consisting partly of fish, but so far no food has been found in the stomachs of specimens examined.

PHYSIOLOGICAL PROBLEMS AT HIGH ALTITUDES.—During the Mount Everest expeditions of 1922 and 1924 it was proved that man can live, for some days at least, at altitudes above 23,000 ft. (oxygen pressure = 9·5 per cent atmosphere), and can climb, though with difficulty, at 28,000 ft. It has yet to be proved whether man can climb at 29,000 ft., where the oxygen pressure is only 7½ per cent of an atmosphere. Dr. Argyll Campbell has proved that some mammals—rabbit, rat, mouse—after gradual acclimatisation, will live for a week at this low oxygen pressure and afterwards recover, but they were at rest in a moderate temperature, and not active and exposed to climatic rigours as climbers would be. A monkey, however, under similar conditions, became collapsed and recovered with difficulty. In animals which die from the effect of these low atmospheric pressures, fatty degeneration of the heart and liver is found. It is prolonged periods of exposure that are harmful, and the longer climbers are exposed to very low oxygen pressures the smaller will be their chance of reaching the summit, however expert they may be. Dr. Campbell suggests that possibly the daily inhalation of oxygen at normal pressure for a few hours when above 15,000 ft. may inhibit to some extent these evil effects (*Lancet*, July 14, p. 84).

THE MARINE ENVIRONMENT.—H. H. Poole and W. R. G. Atkins contribute further work on light-penetration into sea-water to the *M.B.A. Journal* (N.S. **15**, 2). They describe refinements of their photo-electric measuring apparatus and give additional determinations of the vertical absorption coefficient with comparisons of readings of Secchi's disc. J. R. Bruce in the same number studies the physical conditions of the Sandy Beach at Port Erin and the carbon dioxide and sulphide relations, especially in connexion with the well-known 'black layer.'

DANISH HYDROMEDUSÆ.—Dr. P. L. Kramp gives a detailed account of the biology and distribution of all

the Danish Hydromedusæ in his memoir, "The Hydromedusæ of the Danish Waters" (*Mémoires de l'Académie des Sciences et des Lettres de Danemark*, Copenhagen, Section de Sciences, 8me série, t. 12, No. I.). The work covers much ground and is interesting, both from the point of view of the systematist and of the plankton worker, being divided into two parts, the first dealing with the regional and seasonal occurrence of each species, the second with the results as applied to the general principles of plankton research. All the Danish species are studied in detail with their life-histories, special attention being given to the appearance of the hydroids at different seasons. Much that is new results from the winter researches, as previous work was almost exclusively undertaken in spring and summer. Thus, the fully developed colonies of *Coryne Sarsii*, the hydroid of *Sarsia tubulosa*, are apparently only found in the winter and early spring, when they liberate the medusæ and die down, which accounts for their rarity in summer. Three forms of the medusa are distinguished, a 'Blue Sarsia,' a 'Brown Sarsia,' and a 'Red Sarsia,' all attributed to the same species *S. tubulosa*, but with different distribution. Details of its many other forms have been described in the author's previous work on the Anthomedusæ of the Danish *Ingolf* Expedition (1926). The hydroid of the little gemmiferous *Rathkea octopunctata* is still unknown, although the medusa is so common. Gemmation apparently depends very much on the temperature of the water, and the medusæ keep to the lower water layers. Dr. Kramp throughout his work emphasises the fact that medusæ are of practical importance as an aid to hydrography in their capacity of indicators of currents, and are perhaps the most valuable of all pelagic organisms for this purpose.

TREE HABIT IN ANGIOSPERMS.—In a recent paper Dr. Agnes Arber discusses the arguments that have been adduced in favour of the arboreal ancestry of the Angiosperms, and concludes that they are inadequate to substantiate the theory (*New Phytologist*, vol. 27, No. 2). It is considered that the probabilities are in favour of an herbaceous habit in the primeval Angiospermic stock, which is held to have originated long ages before the earliest appearance of the group in the fossil record; the flowering plants, as they first come into our ken in the Mesozoic, would thus be already an old group. The fact that the floral characters of many woody plants are more primitive than those of their herbaceous relations is attributed, not to their being "more ancient" than the herbs in question, but to the *evolutionary lag* which has occurred in trees on account of the lengthening of the generations which is the result of the arboreal habit. Herbs with their shorter generations must have been able to evolve more rapidly, and thus tend to show more advanced floral specialisation. The frequency of the tree habit in the Angiosperms is held to point to the extreme antiquity of the flowering plant stock, which has allowed time for many lineages to reach a phase of senility; for trees show two characters which are indicative of old age in animal races—growth to a relatively large size, and the accumulation of non-living material in the body. The tree habit is probably the outcome of a certain fundamental tendency—the liability to the accumulation of waste products. It is hazarded that the earliest historical symptom of this tendency was the deposition of a wall round the plant cell, which has perhaps been the most important single factor in hampering the evolution of the plant as compared with that of the animal. The same tendency is regarded as having reached an ultimate expression in the massive framework of the forest tree.

PYRAMIDELLIDÆ FROM THE GULF OF CALIFORNIA.—Dr. F. Baker, Dr. G. D. Hanna, and A. M. Strong describe 53 forms of Pyramidellidæ from the Gulf of California (*Proc. Calif. Acad. Sci.*, Ser. IV, vol. 17). The greater part of the specimens were obtained by Dr. Baker in the spring and summer of 1921 when on an expedition sent out by the California Academy of Sciences. Twenty-two new species and one new subspecies are included in the number, and illustrated from photographs taken, we are told, by special optical equipment necessitated by the small size of the objects. For identification purposes, however, it would have been better had the photographs been retouched before being reproduced.

THE SILVER IODIDE PHOTO-CELL.—In No. 139 of volume 8 of *Scientific Papers* of the Institute of Physical and Chemical Research of Japan, Messrs. S. Iúmori and T. Takebe summarise their researches on the properties of the above cell. The electrodes of thin sheet silver are immersed in a solution of potassium iodide in a glass trough coated with tinfoil to exclude light except from an area of one of the electrodes. Either the potential difference between the illuminated and non-illuminated plate may be measured by a potentiometer, or the current the cell produces may be measured. For illuminations between 100 and 1000 foot candles the potential difference produced $= a$ (illumination) $- b$ where $a$ and $b$ are constants depending on the temperature, and concentration of the solution, the area of electrode illuminated, and the wave-length of the light used. The authors give a theory of the cell and show how the cell may be applied in photometry. They state that it shows neither inertia nor fatigue in use, but that it is difficult to construct two cells which have the same constants.

DUST IN MINES.—The *Journal of the South African Institution of Engineers*, volume 36, No. 7, 1928, contains an interesting article by James Boyd on the estimation of dust in mine air on the Witwatersrand. The author gives a complete history of the problem, showing how and when siliceous dust was recognised as the principal cause of the disease known as miners' phthisis. He describes the various methods used for determining the proportion of such dust in the mine air both by gravimetric and volumetric methods, and naturally pays especial attention to the use of the 'konimeter.' He describes briefly the methods employed in other countries, and compares them with the methods used in the Transvaal, discussing in detail the errors to which each method is liable. Finally, he shows the results obtained in the Transvaal by systematic dust sampling, on the basis of which the preventative measures now in use were adopted. From 1916 to the present day there has been a great and steady improvement, the general average of dust in the air being less to-day than one-third of what it was at the former date. A complete bibliography, which will be found specially valuable to students of the subject, is attached to the paper.

THE THERMAL AGITATION OF ELECTRICITY.—The possibility that thermal motion of electricity in a conductor might produce a detectable fluctuation of the potential difference between its terminals, which was recognised by W. Schottky in 1918, and again considered by Dr. J. B. Johnson last year (see NATURE, Jan. 8, p. 50, 1927), is dealt with in some detail by the latter author and Dr. H. Nyquist in the July issue of the *Physical Review*. The average square of the difference of potential through a conductor due to this cause should be proportional to its resistance and to its absolute temperature, but should be otherwise quite independent of its shape or material, since such

quantities as charge, mass, and number of the carriers of electricity do not appear explicitly in the theoretical expression for the electromotive force. An experimental test, made by amplification through six stages of audion tubes on to a vacuum thermocouple, has now verified all the essential points of the theory. The resistances used varied between a few thousand ohms and a few megohms, and were made of such widely differing materials as carbon, in the form of filaments, metals, in wire or films, and salts and acids in aqueous and alcoholic solution. The temperature range was between that of liquid air and that of boiling water. A mean value of Boltzmann's constant, obtained from twenty-three such measurements, was 7 per cent less than the accepted number, a result within the probable error of the determination. The phenomenon is of importance technically, and attention was in fact directed to it by the dependence of amplifier 'noise' upon the input resistance. Dr. Johnson points out that the effect may be minimised by working with as low an input resistance as is feasible and controlling its temperature, and by making the frequency range of the system no greater than is essential for the proper transmission of the applied voltage, but that for voice frequencies an alternating potential of about a microvolt is the smallest that can be satisfactorily amplified with usual circuits.

CELLULOSE ACETATE.—Parts 2-6 of vol. 3 of the *Report of the Aeronautical Research Institute*, Tokyo Imperial University, are concerned with researches on cellulose acetate and its solution, carried out by K. Atsuki, R. Shinoda, and Y. Tanaka. The quality of aeroplane dope prepared from cellulose acetate depends to a large extent upon the solvent used. It was found that a mixed solvent, consisting of acetone, ethyl alcohol, benzene, benzyl alcohol, and triphenyl phosphate, and possessing the greatest solvent power and lowest viscosity, produced a film of maximum tensile strength. Cellulose acetate frequently contains a residue of sulphuric acid, which may cause spontaneous decomposition and cannot readily be removed without impairing the quality of the dope. The addition of 1-2 per cent of calcium naphthenate appears to be an efficient method of stabilisation, the sulphuric acid being converted into calcium sulphate. The acetylation of cellulose and the relation of temperature and time of ripening to the viscosity of cellulose acetate have also been investigated.

EXPERIMENTS ON INTENSIVE DRYING.—Some interesting results obtained by R. H. Purcell on the effect of drying on the reduction of copper, bismuth, mercury, and silver oxides by carbon monoxide, and of copper oxide by hydrogen, are described in the *Journal of the Chemical Society* for May. In the case of pure copper and bismuth oxides, prolonged drying of both the oxide and the carbon monoxide decreased the rate of reaction. The temperature required for reduction depended on the time of drying, but rose to a maximum of about 425°. At this temperature it is possible that the reduction was effected by carbon formed by decomposition of the carbon monoxide. In the case of hydrogen and copper oxide, however, no difference was observed even when the materials had been dried for two years. Similarly, drying had no effect on the reaction between mercuric and silver oxides and carbon monoxide, or on the union of mercury and oxygen. Other experiments indicated that organic vapours may catalyse the reduction of copper oxide by carbon monoxide, though not so efficiently as water.

ELECTRICAL HEATING OF SOILS.—The heating of the soil in greenhouses and hotbeds by means of hot-water pipes or manure has been universal until quite recently. In 1923 G. Jacobson, the electrical engineer at Aker (near Oslo) in Norway, noticed that the grass over a buried electric cable near the power station was far more luxuriant and vigorous in appearance than the grass elsewhere. This led him to make experiments in his own garden. He heated the soil electrically by means of buried lead-covered cables enclosing high resistance wire circuits. The success attained has made the system a commercial one. In Norway alone there are about 200 nurseries which make use of this method. In Great Britain there are two installations, one at the Cheshunt Horticultural Research Station and the other on the farm of Mr. Borlase Matthews at East Grinstead. Mr. Matthews has communicated a paper on the method to the *Electrical Review* for Aug. 10. He gives data from which the cost of the method can be readily computed. It is not necessary to maintain a constant supply of energy as at 75° F., the standard temperature, the soil retains its heat for a long period. Arrangements can therefore be made with the electric supply authorities, who can supply energy cheaply at certain hours of the day. This can be done by automatic switches which turn on the supply during the periods when the station is lightly loaded. Much less labour is required when the soil is heated electrically, and the plants are as healthy and strong as when the best manure hotbed is employed. In Sweden the method has been tested on a large scale. The standard electric beds are 92 feet long and the cables are enclosed in earthenware ducts to prevent them being damaged by the gardener's spade. Strawberries have been raised to maturity in two months by this means. Potatoes planted in April were ready for digging at the end of June, two months before the ordinary crop. The commercial results obtained have proved satisfactory.

LIGHTHOUSE ILLUMINATION.—In an article in *Engineering* of July 6, Dr. Du Riche Preller gives an account of some recent developments in the systems of lighting used in lighthouses in France. In 1922 high-power incandescent lamps began to replace the electric arc for use in lighthouse illumination. The four important channel lighthouses of Dunkirk, Calais, La Canche (south of Boulogne), and Cape de la Hève (Havre) have all adopted the incandescent lamp system. The lighthouse of Les Baleines, in the Bay of Biscay, is also being converted to incandescent lighting. In British lighthouses four-kilowatt lamps are used, but in France, Philips lamps up to ten kilowatts are in use. The lights at St. Catherine's Point and the Isle of Man on the British coast, and those of Grisnez and Ushant on the French side, give a striking illustration of the difference between French and British practice. The long-duration flashes of five seconds and the slow rotation of the St. Catharine's apparatus give one extreme and the lightning flashes of one-tenth of a second and the rapid rotation of the Grisnez apparatus give the other extreme. The difference between the two practices is probably due to the prevailing greater density of the atmosphere on the British coasts. For this reason a longer time is required before the light becomes perceptible. For this reason also the British atmosphere necessitates intensive illumination of the nearer sea within a moderate range rather than overhead long-distance flashes to the horizon. The prevalence of violet rays is found to militate against the penetration of the luminous beam into a dense atmosphere. The French system, modified so that the flashes are not less than two-tenths of a second, has been adopted in a number of British lighthouses.

# The Glasgow Meeting of the British Association.

## PROGRAMMES OF SECTIONS.

### SECTION A (MATHEMATICS AND PHYSICS).

AN interesting and versatile programme has been arranged in Section A (Mathematics and Physics) for the Glasgow meeting. The Section meets under the presidency of Prof. A. W. Porter, whose address will deal with "The Volta Effect: Old and New Evidence," a subject which has interested physicists for many years.

The programme includes three main discussions; the first, on Thursday, Sept. 6, is on the mechanism of thunderstorms, a controversial subject on which Dr. G. C. Simpson, Prof. C. T. R. Wilson, Prof. E. V. Appleton, and others will contribute their views; the second, on Friday, Sept. 7, deals with the photographic measurement of radiation. Dr. R. A. Sampson, the opener, will be followed by Dr. Toy, Dr. Spencer Jones, Dr. Astbury, and other workers in a field which has wide applications in many branches of physics. On Tuesday, Sept. 11, Dr. C. J. Davisson (U.S.A.) and Prof. G. P. Thomson will give an account of their work on the scattering of electrons by crystals, in which they have demonstrated the wave-like properties of a stream of electrons. This subject should promote a valuable discussion.

Among the individual papers which are of wide and varied interest, special reference may perhaps be made to a contribution from Prof. de Haas (Holland) on "New Experiments on Supraconductors," and a lecture with demonstrations by Prof. Taylor Jones on spark ignition. Members will also welcome Prof. Zeeman as a foreign guest. Lastly, in the sub-section, the rapidly advancing subject of meteorology will be strongly represented.

### SECTION B (CHEMISTRY).

THE organising committee of Section B (Chemistry), having considered that the annual meeting of the British Association, so far as chemistry is concerned, provides a suitable opportunity for the discussion of the results of modern investigations, has planned the programme on lines somewhat different from those of previous years. Prof. E. C. C. Baly is the president of the Section, and his address on "Fluorescence, Phosphorescence, and Chemical Reaction" will be followed by a discussion. Dr. J. Vargas Eyre will introduce a discussion on fermentation, and will deal more particularly with the chemical and physico-chemical aspects of fermentative processes. This discussion, in which Mr. J. L. Baker, Dr. A. C. Thaysen, and others will take part, is particularly opportune in view of the recent impetus which has been given to research on fermentation processes in Great Britain. Another important discussion, which will be opened by Sir William Pope, is on recent advances in stereochemistry, and in this Prof. James Kenner, Dr. H. J. Backer (Holland), Dr. N. V. Sidgwick, and others will participate. Dr. E. K. Rideal has arranged a series of demonstrations on "Light Experiments" as a basis of a discussion of the mechanism of the transfer of energy between molecules.

The programme also contains two items of more than usual interest. Exhibitions of kinematograph films of chemical interest will be given on three days, unfortunately but unavoidably, while some of the discussions are proceeding. Messrs. Imperial Chemical Industries, Ltd., have invited one hundred members of Section B to be their guests at the Ardeer Factory of Nobel's Explosives Co., Ltd., on Saturday, Sept. 8. This invitation has been cordially accepted, as well as those of other representative chemical firms who will entertain the members during the course of the meeting.

### SECTION C (GEOLOGY).

IT is fitting that at the Glasgow meeting of the Association the president of Section C should be one of the Scottish school, Mr. E. B. Bailey, of H.M. Geological Survey, who has chosen for his address "The Palæozoic Mountain Systems of Europe and America."

The meeting will open with an account of the geology of the district by Prof. J. W. Gregory, Dr. G. W. Tyrrell, and Dr. J. Weir, each of whom will deal with one phase of the subject. This will be followed by papers on Northern Ireland, the Hebrides, and the Shetlands. Friday will be largely given to papers on glacial geology; one of the most interesting of these should be that by Drs. W. F. P. McLintock and J. Phemister, which illustrates the application of gravitational survey methods to buried channels.

Two discussions have been arranged, on problems of Highland geology and the tectonics of Asia. The latter, with contributions from workers in China, Siberia, India, and Persia, should prove very interesting. Questions of economic importance will be considered by Mr. E. H. Davison on "The China Clay Deposits of the West of England," and Mr. G. Vibart Douglas on "The Pyritic and Cupreous Ore-bodies of Huelva, Spain." The programme is perhaps deficient in palæontological subjects—the only one being by Dr. W. K. Spencer on "Palæozoic Star-fish."

### SECTION E (GEOGRAPHY).

THE Report for 1927 of the British Association Committee on the Teaching of Geography directed attention to the extremely unsatisfactory position of this subject in Scottish education. The programme of Section E for the Glasgow meeting has been framed in part to meet this peculiar situation. The presidential address by Prof. J. L. Myres, on "Ancient Geography in Modern Education," will be preceded by two studies on Denmark and New York City, illustrative of the methods and import of geographical study. These will be followed by an important discussion on the teaching of geography in Scotland.

The tendency for increasing attention to local geographical research is shown not only by four papers on the Glasgow district, but also by two others on the lower valleys of the Rivers Tweed and Tees. In the field of cartography, papers will be read on colonial surveys, revision of survey maps, air surveys and standardisation in layer colouring.

Recent exploration will be dealt with by Mr. F. Rennell Rodd in his "Land of the Tuaregs," whilst Prof. Douglas Johnson, one of the foreign guests, will speak on physiographic features of the Atlantic Coast of North America in relation to problems of recent coastal subsidence.

### SECTION G (ENGINEERING).

THE papers to be given in this section are of wide interest, although of course all are closely connected with engineering. Some deal with important and recent developments, while others are distinctly of an academic character.

The president will take for his address "The Influence of Engineering on Civilisation," and will sketch in broad outline the developments that have taken place in the various branches of engineering during

the last century, and refer to the amenities and changes that these have brought about in many aspects of human life. The first paper to be given to the Section, "Engineering of the Zuyderzee," by Mr. J. W. Thierry, describes important engineering works that are being carried out in Holland to reclaim large tracts of land, which in a few years will make important additions to the productive area of that country. The methods of constructing the work, and particularly the tidal problems that will have to be met during the construction, are dealt with in an interesting way. Following this paper there is a discussion on the preliminary education for the engineering profession. The speakers are to be Sir William Ellis, Prof. A. L. Mellanby, and Sir James Henderson.

Two very important developments that have been taking place during recent years, (*a*) in connexion with high pressure boilers, as, for example, the boilers of the steamer *King George V.*, which work at 500 lb. pressure, and (*b*) heavy oil engines for aircraft and railways, will be dealt with by Mr. H. Yarrow and Mr. A. E. L. Chorlton respectively. Recent work in connexion with evaporative cooling for aeroplanes will also be discussed.

A number of papers will be given on subjects related to electrical engineering, and it is expected that an interesting discussion will take place on the report of the Committee on Electrical Terms and Definitions, which was set up by the British Association two years ago to consider the electrical terms and definitions published by the British Engineering Standards Association.

The subject of internal combustion engines, particularly from the point of view of cycles used in them, and the changes that take place in the specific heat during compression and combustion, will be discussed by Profs. Goudie and Witchell. A paper is also to be given on the adiabatic flow of mercury through nozzles. The subject of materials is to receive attention, particularly in connexion with the effect of velocity of test on the notch brittleness of mild steel, and a brief report will be received from the Earth Pressures Committee.

### Section H (Anthropology)

Section H offers a full and attractive programme—too long indeed for complete enumeration here—in which, not unnaturally, Scottish subjects figure largely. Prof. T. H. Bryce will open a discussion on human distributions in early Scotland, and in two further communications will consider the natural or artificial origin of certain so-called cultivation terraces in Peeblesshire and describe excavations at a monastic settlement on the island of Eileach an Naoimh. Dr. James Ritchie will submit further evidence relating to the occurrence of palæolithic implements in Sutherland, and Mr. Graham Callender will deal with the relative levels of land and sea in Scotland from an archæological point of view. Canon MacCulloch will discuss the origin of the Picts, and communications dealing with survivals and other aspects of folklore in Scotland will be presented by the Rev. J. MacPherson and the Rev. A. J. MacLean. Archæology outside Scotland is well represented. Mr. A. L. Armstrong will describe further excavations in the Cresswell Caves of Derbyshire. Dr. R. E. M. Wheeler and Mr. S. N. Miller will report on recent excavations in Roman Britain. The account by the latter of his work at York will be particularly interesting in view of the character of recent finds.

Going further afield, it is scarcely necessary to emphasise the interest of Miss Garrod's discovery of fragments of another Neanderthal skull in a Palestinian cave, of Prof. Petrie's survey of the results achieved by the British School of Archæology in Egypt in its work in Southern Palestine, and of Mr. Field's report on excavations by the Oxford expedition at Kish and on the Field Museum's expeditions to the Syrian desert in 1927–28. The archæology of eastern Europe will be discussed in communications by Prof. Gordon Childe on the origin of certain Hallstadt types, by Mr. W. A. Heurtley on excavations of the British School in Athens on Macedonian sites, by Mr. O. Davies on tin in prehistoric Greece, and by Mr. Stanley Casson on his excavations in Constantinople.

In ethnography, Capt. Wilson's account of traces of an old terrace system of agriculture in Tanganyika is also of interest to archæologists, and raises some questions relating to the history of the cultivation of wheat. Mr. Robert Kerr will describe the valuable Gordon Munro collection of Japanese antiquities in the Royal Scottish Museum. Not only have these never been described as a whole, but they are also of considerable interest to archæologists in relation to the question of distributions in the prehistoric world. Mr. M'Ilwraith will describe certain secret societies in North-west America and Mr. G. W. B. Huntingford the hunting tribes of Kenya. Africa also figures in the archæological section of the programme in Mr. Miles Burkitt's review of our present knowledge of the Stone Age in South Africa. Sir Richard Paget on the nature and origin of human speech and Miss Blackman in suggesting the use of the colour-top as a means of recording skin colour should both arouse considerable discussion.

### Section I (Physiology).

Of considerable topical interest and importance is a paper in Section I (Physiology) on the measurement of ultra-violet radiation. Many forms of lamp are now available, and are coming into extensive use in the clinic and in the home, but the measurement of the radiation emitted has hitherto involved apparatus available only in physical laboratories. Prof. F. G. Baily has designed a standard arc lamp, constant in its emission, with which comparisons can be made by exposing sensitised paper and observing the darkening produced in the two cases. A qualitative investigation of the rays emitted can also be made by using screens permeable down to different wave-lengths.

In a joint discussion with Section M (Agriculture) the question of milk production and its relation to diet is being discussed, especially with regard to the content of milk in growth-promoting and other accessory factors, while a sectional discussion on cell structures may, it is hoped, lead to some measure of agreement on a topic concerning which there has recently been keen controversy.

Mr. W. D. Paterson is describing a method whereby graphic records of the pulse-rate, and the systolic and diastolic blood-pressures, can be quickly and accurately taken in man even during quite severe exercise.

### Section J (Psychology).

Section J (Psychology) meets this year under the presidency of Prof. T. H. Pear, who will take as the subject of his address "The Nature of Skill": this is to be followed by a joint discussion with Section F (Economics) on the present position of skill in industry, in which the points of view of psychology, economics, and industry will be presented by Prof. Pear, Prof. H. Clay, and Mr. C. G. Renold.

The programme includes papers on all branches of psychology, theoretical and practical, industrial, medical, and educational. Dr. C. S. Myers will open the meeting with a paper on "Educability," a subject which he has made his own. Dr. W. Brown will speak on "Personality and Methods of Mental Analysis," and Prof. C. W. Valentine on "Some Applications of Experiments in Child Psychology."

An item of general interest is a demonstration of tests used in vocational guidance, which is to be given by members of the staff of the National Institute of Industrial Psychology; the demonstration will be preceded by short papers on the theoretical and practical aspects of the tests. In addition to these there will be several papers on the analysis of mental tests and the capacities they examine.

A visit to the engineering works of Messrs. Mavor and Coulson has been arranged to run concurrently with the reading of papers at one of the afternoon sessions.

### SECTION K (BOTANY).

IT may be taken as a sign of the growth of active interest in British forestry that the council of the British Association has granted the formation of a division of Section K to deal with matters of afforestation, and the programme which has been prepared for the Glasgow meeting is worthy of the occasion. Such matters as Empire timber development, a retrospect of the forests of Europe before and after the industrial period, the care of forest nurseries, the planting of deer forests, and the preservation of timber, will bulk largely in the programme, while the economic balance between agriculture and forestry will be considered at a joint meeting with Section M.

Under the presidency of Dame Helen Gwynne Vaughan, a varied programme will be discussed in the Section. The presidential address will deal with the relation of nutrition to sex in the Fungi, and will be followed by a series of mycological papers bearing chiefly on economic problems and on the physiology, reproduction, and systematics of Fungi.

Ecology will be represented by papers on the forests of northern Rhodesia, and the peat bogs and sand hill areas of Canada, and cytology and genetics will be represented, as will also be palæontology and systematic anatomy. A wide range of problems in plant physiology, growth, nutrition, and response to stimulation will be discussed in sequence, and special sessions will be devoted to the discussion of the size factor in plant morphology, the investigation of the biological problems of British fresh waters, and the interpretation of growth curves. A semi-popular lecture on forestry in Scotland, past, present, and future, will be delivered by Sir John Stirling Maxwell.

Among the excursions which have been arranged are visits to Benmore Estate—concurrent with the arrangements for the memorial to the late Sir Isaac Bayley Balfour—to Ben Lui and Loch Katrine.

### SECTION L (EDUCATIONAL SCIENCE).

A FULL and varied programme has been arranged for Section L. Dr. Cyril Norwood, in his presidential address, will deal with "The Next Steps in Education." Interesting papers on "Wireless in the Service of Education" and "An Experiment in Educational Broadcasting" are expected from Sir John Reith (Director-General B.B.C.) and Mr. Salter Davies, director of education for Kent, respectively; and it is anticipated that Sir William Bragg and Sir Oliver Lodge will take part in the discussion. Demonstrations of wireless reception suitable for school purposes will also be given and a model studio will be open for inspection. One session will be devoted to a joint discussion with Section G on school, university, and practical training in the education of the engineer, Col. Ivor Curtis (Air Ministry) providing a paper for Section L. The work of post-primary education in Scotland is to be considered in five separate papers, from the national, the training college, the secondary school, the technical school, and the university aspects. A lively discussion will probably follow. Among the other subjects to be considered are: the methods and results of educational research (three papers), educational clinics and psychological tests (papers by Dr. Boyd, Dr. R. H. Crowley, and Miss Margaret Drummond), and the marking and standardisation of composition (Dr. G. Perrie Williams and Mr. D. B. Mair). A demonstration on music in the school is included in the programme again—Mr. Hugh Hunter is organising the musical display, and Mr. Hugh Roberton, leader of the Orpheus Choir, is to give an address on "School Music." The Section will also take part in the Stow Commemoration meetings. The report of the committee on science in school certificate examination will be presented by Sir Richard Gregory, and Dr. Kimmins is expected to make an interim report on behalf of the committee on recent views on formal training.

### SECTION M (AGRICULTURE).

SECTION M proposes to devote a whole morning to the reading and discussion of Dr. Gordon's presidential address on the live-stock industry and its development. This is the first occasion on which the live-stock branch of the agricultural industry—by far the most important—has formed the subject of a presidential address. In the discussion which is to follow, Sir Robert Gregg, chairman of the Scottish Board of Agriculture, Prof. J. A. S. Watson, of Oxford, and Prof. R. G. White, of Bangor, are to take part. Dr. Gordon has been a pioneer in the development of the live-stock industry, and has a lifelong experience of the subject, particularly from the point of view of State assistance and control. It is expected that he will deal, amongst other things, with the operation of the Live Stock Breeding Act in Northern Ireland, for which he was mainly responsible. The subject is at present being keenly debated not only in official circles in England and Scotland, but also amongst farmers' organisations.

Monday morning, Sept. 10, will be devoted to milk problems, a subject of considerable importance in the west of Scotland. A paper on the milk selling agency, which has recently been successfully launched in the Glasgow district, is being contributed by Mr. A. E. Magee, and Prof. Berry and Mr. Macneilage are to deal with the difficult problem of the "Utilisation of Surplus Milk and Milk Residues."

Three joint discussions have been arranged—with Section I on lactation and nutritional factors allied thereto, and with Section F on the incidence of taxation in agriculture. Mr. Venn, who is opening the latter discussion, holds the view that agriculture is a sheltered industry, and is not at present bearing its proper share of taxation. The subject is of particular interest in view of the proposed rating relief to agriculture, and is one which is likely to be very keenly debated. The economic balance of agriculture and forestry forms the subject of the third joint discussion, in this instance with the Forestry Sub-Section, on the initiative of which the discussion has been arranged.

### CONFERENCE OF CORRESPONDING SOCIETIES.

THE Conference of Corresponding Societies will be devoted to the science of scenery. Dr. Vaughan Cornish, in his presidential address on "The Preservation of Scenic Beauty in Town and Country," will emphasise the importance of providing a secure foundation for an æsthetic of scenery, in order that reliable advice may be given for its preservation. The greatest of all detriments to the scenery of London is smoke, in spite of occasional fine effects of coloured haze, because it militates against the *al fresco* life on which the social scenery of cities depends for its variety and charm. Decorative and pleasing

as are the agricultural districts of Britain, they have this in common with the scenery of cities, that human effort and contrivance are everywhere visible, and although the human aspect of scenery interests everyone, it does not by itself provide sufficient stimulus for the imagination. A nation needs wide prospects of spontaneous Nature accessible to all. Fortunately, the sea cliffs of our island home present an elemental outlook unsurpassed in grandeur even by Alpine scenery, an image of infinity and eternity of inestimable influence upon the loftier imaginings of the people. Access to the cliffs must be secured, wild lands reserved, and the charm of old-world villages protected. A resolution that His Majesty's Government be urged to stimulate local authorities in the protection of scenic amenity in town and country will be proposed by Dr. C. R. Gibson, Royal Philosophical Society of Glasgow, seconded by Mr. T. Sheppard, Museums Association, and supported by the Earl of Crawford.

The second and concluding session will be devoted to the scenery of the English Lake District and its preservation. Dr. H. R. Mill will deal with the geography of the region, a paper will follow upon Wordsworth's interpretation of Nature, and Mr. Ewart James will give an account of a scheme of regional planning for the preservation of scenic amenity in the district.

## International Radiology.

THE second International Congress of Radiology, held in Stockholm on July 23–27, proved a pronounced success and one which will long live in the recollections of those who attended it. The Congress was treated by Sweden as of national significance, and the various meetings were held in the Houses of Parliament, which were lent by the Government for the purpose. The municipality of Stockholm offered many facilities and generous hospitality, and had beflagged the main streets and buildings. About 1000 members from 40 different countries were enrolled, the total number with ladies and others interested in the Congress amounting to about 1500. H.R.H. the Crown Prince of Sweden opened the Congress in a wholly admirable speech in English, and stayed to listen to a number of the opening papers. The president, Prof. Gösta Forssell of Stockholm, was presented with a badge and chain of office by the members of the British Institute of Radiology. The chancellor of the Swedish Universities, and Dr. Thurstan Holland, president of the first International Congress, held in London in 1925, also spoke.

The King and Queen of Sweden entertained the members of the Congress at the Royal Palace in the afternoon, the various official delegates being presented to the Crown Prince. The following evening the municipality of Stockholm gave a banquet and ball in the Gilded Room of the world-famous City Hall. Some 750 guests attended the dinner, at which Dr. G. W. C. Kaye offered the thanks of the English-speaking members. Later in the evening nearly 2000 attended the dance, which was held in the magnificent Blue Hall, the scene being one of almost oriental splendour.

The organisation of the Congress was masterly in the extreme and reflects the greatest credit on those responsible. No detail appeared to have been omitted which would contribute to the convenience of the members or facilitate the smooth working of the meetings and social gatherings. The numerous Congress publications were all printed in English, German, and French. Abstracts of the various papers read, some 250 in number, were supplied, together with a 'catalogue' of portraits and particulars of all the members. An exhibition of X-ray and radium apparatus of unusual excellence and dimensions included a joint exhibit of British manufacturers which attracted much attention.

The four main congressional sections, which ran simultaneously, were devoted respectively to diagnostics, therapy, heliotherapy, and radiophysics. Among the medical papers from England may be mentioned one on the rationale of radiation therapy, by Dr. R. Knox, and one by Dr. S. Melville, who contributed to a discussion on instruction and training in medical radiology. Prof. Forssell's demonstration, which drew a large audience, of the after-results of X-ray and radium therapy, illustrated in an outstanding way the degree of success of this type of treatment in malignant disease. Dr. R. G. Canti's striking kinematograph film showing the effect of radium radiation on the living cell attracted so large an audience that it had to be repeated. Dr. S. G. Scott gave a paper on the remarkably beneficial effects of X-ray treatment on asthma. Prof. Friedrich described the new Institute of Radiology of the University of Berlin. Prof. Siegbahn and his school of workers took an active part in the physics section, to which papers were also contributed by Dessauer, Duane, Glasser, Behnken, Solomon, and others.

The two lasting achievements of the Congress were, first, the unanimous international adoption of the proposals of the British X-ray and Radium Protection Committee. This sets the seal of international approval on the British pioneer efforts to set up standards of protection and so avoid the well-known dangers of over-exposure for the X-ray worker. The result should be to unify protective measures and devices and improve the working conditions of X-ray and radium operators in all countries. The question of seeking legal authorisation for such recommendations was left to each country to deal with as appears to it best. A standing International Protection Committee was set up with Dr. G. W. C. Kaye and Dr. S. Melville as honorary secretaries.

The second noteworthy accomplishment was the adoption of an international unit of X-ray intensity. This unit is that originally proposed by Villard and afterwards and more definitely by Friedrich, and is now defined as "the quantity of X-radiation which, when the secondary electrons are fully utilised and the wall effect of the chamber is avoided, produces, in one cubic centimetre of atmospheric air at 0° C. and 76 cms. mercury pressure, such a degree of conductivity that one electrostatic unit of charge is measured at saturation current." It was agreed to call the unit 'the Röntgen' and to designate it by the letter small '*r*.' It still remains, of course, that a specification of dosage for therapeutic or other purposes will require also a specification of quality of the radiation used, and for practical purposes this is sufficiently defined at present either by the half-value layer in some specified material or by the effective wave-length method of Duane. The International X-ray Unit Committee, set up in London at the first Congress, at the instance of the British Committee, was invited to continue its work to evaluate, if possible, the erythema dose of the therapeutist in *r* units. Prof. Siegbahn was elected chairman, and Prof. E. A. Owen and Prof. H. Holthusen hon. secretaries.

The third International Congress will be held in September 1931 in Paris under the presidency of Dr. A. Béclère. For the interim, an executive committee of seven from as many different countries was set up, the British representative being Dr. Thurstan Holland.

## Education and Industry.

### TWO NEW INQUIRIES.

IT will be recalled that, following the report of the Emmott Committee of Inquiry into Technical Education (see NATURE, Jan. 14, 1928), Lord Eustace Percy outlined to that committee as much of his future policy with regard to education for commerce and industry as was possible pending the publication of the report of the Malcolm committee which was dealing with related problems. That policy aimed "to use the machinery we have already got and to secure wider publicity for the inquiries we are already conducting." Many inquiries had been and were being made; but, "while we have had many inquiries, we have hardly had a programme."

Subsequent events go to show that the programme has been commenced. Two special inquiries mentioned in the reply to the Emmott Report are to be set up. "I hope to begin the new series of reports on education for commerce and industry by the publication of an introductory survey in October," said Lord Eustace Percy in the House of Commons on Aug. 2. "I have not yet finally completed the constitution of the Advisory Committees in connexion with the two special inquiries on training for salesmanship," but "Mr. F. W. Goodenough, Chairman of the British Commercial Gas Association, has consented to be chairman of the former, and Sir Dugald Clerk of the latter." The committees will consist of representatives of trade and industry associated with teachers and professors in technical colleges and universities, and will, so far as possible, be representative of the various branches of industry with which they will be dealing. Representatives of local education authorities will advise on the administrative aspects of technical education. The actual investigations will be carried out by inspectors of the Board, and the committees will be mainly concerned to advise on the scope and methods of investigations and to review, and comment on, the findings.

It must not be forgotten, however, that, valuable as will be these separate inquiries, they need to be supplemented by a more permanent national machinery. The Malcolm committee, which has now presented its report (see NATURE, July 28, 1928; pp. 121-123), has recommended such machinery. When it is put into operation there need no longer be any doubt that separate inquiries will be conducted on the sound basis of a national programme.

## University and Educational Intelligence.

APPLICATIONS are invited by the Manchester Municipal College of Technology for a scholarship, value £40 per annum for two years, tenable in the full-time course in applied optics at the college. The scholarship, which is endowed by the British Optical Association, will be awarded upon the results obtained at the entrance examination to be held on Sept. 24, 25, and 26, particulars of which are to be had from the Registrar.

THE Research Information Service of the National Research Council of the United States has published a list of doctorates conferred in the sciences by universities in that country in 1926–27, giving the titles of the doctors' theses classified by subjects and by universities. The number of doctorates, 792, is the highest yet reached in any year. Of the subjects, chemistry heads the list with 268. Physics comes next with 91, followed by psychology (74), zoology (70), botany (53), mathematics (46), geology (42), physiology (34), bacteriology (20), agriculture (19), pathology (16, including plant pathology, 13), geography (14), anatomy (13), engineering (10), astronomy (9), metallurgy (4), public health (4), anthropology (3), mineralogy (2). Of the fifty universities by which the doctorates were conferred, Chicago, as usual, comes first, having conferred 86; next come Columbia (62), Cornell (62), Wisconsin (55), Johns Hopkins (44), California (42), Harvard (42). Similar lists are published independently by the Library of Congress.

THE place of museums in education is discussed in an article by the Director of the American Association of Museums in the March issue of *School Life*, the official organ of the United States Bureau of Education. Attention is directed to the fact that only a small proportion, estimated at less than two per cent, of the school children of the United States come under the direct influence of museum collections. To extend this influence, two national associations, representing respectively the schools and the museums, have recently addressed themselves to the task of promoting co-operation along two lines: instruction of classes at the museum, and lending of illustrative material, selected by the teacher, for use as aids in the regular work of the class room. The associations have adopted a joint statement of principles, and a commission is to be appointed, consisting of representatives of universities, colleges, and schools, and of art, science, and history museums, to gather information as to where material for visual education can be obtained, and also to furnish material to schools in places in which there are no museums. The associations' joint manifesto insists upon the duty of the schools to bring children into touch with "the greatest of all museums, the out-of-doors," and to use museum objects and pictorial illustrations by way of supplement to such study in the open. It enumerates the most useful kinds of visual material. By such means, coupled with the further growth, already rapid, in the number of small museums, an improvement will, it is hoped, be effected in the teaching of natural science in the elementary schools, in which there is at present little real incentive for attention to the study of Nature.

AN adult education movement, already important, is rapidly growing in the United States of America, where some 350 universities and colleges are stimulating it by offering university extension services of various kinds, described in some detail in "College and University Extension Helps in Adult Education," published as *Bulletin No. 3* (1928) by the United States Bureau of Education. What is to be done with the ample leisure now enjoyed in that country is, says the *Bulletin*, the most important question in the United States to-day, and among the foremost agencies that give promise of helping to save civilisation from the decline with which it is threatened through the misuse of leisure is university extension. The bulletin is a guide-book and advertisement intended to help institutions offering valuable opportunities in this field to compete successfully not only with those who only profess to be purveyors of amusement, but also with those who, like the quack lecturers in applied psychology, exploit in their own interests and to the detriment of their dupes adult demands for instruction. The two kinds of extension work most in demand are work by correspondence and work in classes held outside the institutions, but there is, in addition, a wide variety of extension activities, including public lectures, parent-teacher association or other club service, etc. The list of topics elucidates the definition given by Dr. Abraham Flexner in his recent Rhodes Trust lecture at Oxford of the American university as comprised of three parts—a college for boys and girls, a service station or agency for the general public, and a graduate school for advanced students.

## Calendar of Customs and Festivals.

August 26.

ST. ANNE DE LA PALUDE.—St. Anne in Brittany is the great healer, the waters of whose fountain were regarded by the peasants as effective in any disease or injury. The people believe her to be a Breton, confusing her with Anne of Brittany, wife of Louis XI. Driven out by her husband, it is said, she was carried out to sea in a ship under the conduct of an angel and conveyed to the coast of Judea where the Virgin was born. When old, she returned to Brittany and became the patroness of fishermen at Plounévez-Porzay, where one of the most important of the *pardons* of Brittany is held in her honour on the last Sunday in August. On the preceding day innumerable beggars, crippled and diseased, assemble. Part of the original foundation, and once known as Kings of the Palude, they demand alms as 'the right of the poor.' They disperse at night before the actual festival.

The specially maritime character of the *pardon* is shown by the models of anchors trimmed with pine branches and of ships hung in the church. On the walls are garlands of ivy and holly. In the procession, which is an essential part of the ceremony, all wear elaborate costumes preserved for the occasion, but the widows wear a grey hood, and the 'saved' the garments which they wore when St. Anne intervened to save them in shipwreck. Local legends make it clear that the festival perpetuates a festival of a sea goddess. The tradition is that Ahes or Dahut, daughter of King Gralon of Ker-Is, once frequented the wood of Ploumarech, where she, with her maidens, washed her royal linen. She was drowned by her father and became a siren who, with her beauty, wooed sailors to their destruction in the sea.

As Mary Morgan, a beautiful woman with golden hair, but below a fish-like monster, she lures young men with her passionate songs until they cast off their clothes and plunge naked into the sea. She is mentioned by Giraldus Cambrensis as a Celtic goddess, and in Arthurian legend is "Morgan le Fay."

THE *PARDON* IN BRITTANY.—The *Pardon*, that is, the assembly of pilgrims for the performance of religious exercises at the shrine of a saint, is as important an element in the life of the Breton peasant as the analogous *patron* or *pattern* once was in the life of the Irish peasant. The innumerable little shrines scattered throughout the country are visited by individuals, sometimes by proxy, at any time in performance of vows; but the greater ceremonies on the official saints' days are attended sometimes by as many as sixteen to seventeen thousand people, recalling the vast assemblies of many thousands which in medieval times were accused of being witches' sabbats. The pilgrimages are usually made on foot; but it was at one time the custom that the Pardon of the Midsummer Fire, at the festival of St. John in the vale of Traoun-Meriadec, should be reached by boat. The flotilla from each village was headed by a newly painted vessel, decorated with garlands and flowers, in which were conveyed the village priest and his assistants. The Pardon of the Midsummer Fire, at which a huge bonfire was lit on a once sacred hill, was dedicated to St. John; but his cult superseded that of an earlier, purely Breton saint, Meriadec, in the fifteenth century. The cult of Meriadec had undoubtedly incorporated features from an earlier worship of the sun-god Hoel, of which many traces still survive in the modern Pardon. The bonfire on the hill is connected with the tower of the church by a rope, along which the figure of an archangel travels to light the fire. When the fire used to be lit at night, a fiery dragon swooped on to the pile to give the appearance of fire from heaven.

Several pardons of almost equal importance to that of the midsummer fires are held in the course of the year—the Pardon of St. Yves on May 19 at Minihy was especially devoted to the poor and the beggar. The Pardon at Rumengol was associated with the legend and tomb of Gralon, King of Ker-Is, whose daughter is identified with the sea-goddess Mary Morgan. Rumengol itself is stated in the legend to be the last refuge of the Druids, and even now it is thought that the poor of that place form a caste by themselves who have extraordinary and magical powers. The Pardon of St. Ronan involved a long and arduous procession over the mountains on the second Sunday in July. It included a visit to St. Ronan's 'stone mare,' a huge rock of eccentric form, which had conveyed him by sea from Ireland and followed him wherever he went. The privilege of bearing the banner in the procession is determined by a contest, the winning village holding the honour for seven years.

Of the lesser pardons, one which retained some remarkable primitive features was held in the mountains of Aré in honour of St. Servais 'The Little.' The people of Vannes and Cornouailles assembled in two distinct bands, carrying staves instead of the usual candles. Inside the church each party invoked the saint to avert the frost from themselves and send it to the other, granting oats and wheat to themselves. Finally, when the priest had passed in procession between the two parties, at the cry "Scatter the frost!" they fell upon one another and fought with their staves for the banner and the small figure of the saint which stood on a trestle. The figuré of the saint was invariably torn to pieces in the struggle and many of the combatants injured; but whichever side won enjoyed a bountiful harvest. (See A. Le Braz, "The Land of Pardons," Transl. F. Gosling, London, 1912.)

August 29.

In Egypt the old variable solar calendar was abandoned in the year 30 B.C., and the fixed Alexandrian calendar was adopted. From that time forward festivals ceased to be movable in accordance with the procession of the seasons owing to the discrepancy between the actual date and the solar calendar. Accordingly the Egyptian New Year's Day fell on the date corresponding to Aug. 29.

AUGUST IN MACEDONIA.—The harvest operations having been completed in July, August is devoted to periods of alternate feasting and fasting. The month opens with the Feast of the Progress of the Precious and Vivifying Cross, when bonfires are lit and boys jump over them shouting "Dig up! Bury!" A fortnight's fast is followed by the Feast of the Repose of the Virgin; then comes the Return of the Virgin on Aug. 23, celebrated by solemn dances and songs, and on Aug. 29, the Cutting off of the Precious Head of St. John the Baptist, is a further abstinence. The first twelve days of the month are carefully watched as a prognostication of the weather, each day forecasting a month of the coming year.

The first three days of August are sacred to the Drymiais. No tree is cut for fear it should wither, and no one bathes in the sea for fear their bodies would swell, and no clothes are washed lest they decay. Bathers in August carry a rusty nail to protect them. A similar period is observed in March. The belief prevails elsewhere on the coast of Greece and in the Ægean islands. A similar belief has been noted in Ireland (see "Aynia," Aug. 3).

## Societies and Academies.

### PARIS.

**Academy of Sciences**, July 9.—**A. Cotton**: The large electromagnet of the Academy of Sciences. A full description with five illustrations of the giant electromagnet constructed at Bellevue, at the Office national des Recherches scientifiques et industrielles et des Inventions. The magnet has a total weight of 120 metric tons, of which 105 tons are iron and 6 tons copper. Preliminary measurements give 46,400 gauss as the strength of the magnetic field obtained. The cost of the instrument was defrayed by a grant of a million francs from the Pasteur Day fund.—**P. Helbronner**: The measurement of the arc of meridian in the French Alps.—**G. Nicoladzé**: The configurations of ordinary space.—**H. Jonas**: The transformation of the integral surfaces of the partial differential equation $s^2 - rt = (pq)^{\frac{1}{2}}$.—**de Possel**: The prolongation of Riemann surfaces.—**Henrik L. Selber**: The theorem of Picard.—**R. Tambs Lyche**: Limit functions.—**Pierre Dive**: The generalisation of Stokes's theorem on figures of equilibrium.—**S. Szczeniewski**: The reflection of the electrons. The results of the experiments described agree with those calculated from the formula of L. de Broglie.—**G. Landsberg** and **L. Mandelstam**: Some new facts relating to the diffusion of light in crystals.—**G. Simon**: The production of gratings by photography.—**Gaston Rapin**: The direct electrolytic preparation of potassium permanganate. The use of a silicon-manganese alloy as anode with solution of caustic alkali as electrolyte gives a good yield of permanganate.—**P. Bonèt-Maury**: The vaporisation of polonium in a vacuum. The polonium is condensed on copper plates cooled by liquid air: from 80 per cent to 88 per cent of the polonium volatilised is condensed on the copper.—**A. Boutaric** and **F. Banès**: The phenomena of dyeing colloidal granules. When certain sols (arsenic sulphide, ferric oxide, gold) are frozen, the particles separate in the form of small crystals without fixing the colouring matter mixed with the sol, but when after flocculation with an electrolyte the colouring matter has been fixed by the granules, a subsequent freezing does not cause a separation of the dye. The absorption of neutral red, Bismarck brown, and Congo red by colloids has been studied by means of the freezing method.—**Nathaniel Thon**: The influence of electrolytes on the velocity of cataphoresis and the relations between the electrokinetic potential and the electromotor potential of gold.—**Ch. Quillard**: Contribution to the study of the reactivity of combustibles. Method of measuring the velocity of propagation of the combustion. There appears to be no relation between the temperature of inflammation and the velocity of propagation of combustion.—**M. Brutzkus**: The synthesis of organic bodies and of ammonia starting with water gas, without the use of catalysts. A note on the changes produced by simple compression of a mixture of water gas and air.—**Mlle. Cécile Noir** and **Tchéng-Datchang**: The preparation of cyanogen in the wet way. The gas obtained by the interaction of solutions of copper sulphate and potassium cyanide consists of 78 per cent cyanogen, 1-2 per cent hydrogen cyanide, and 20 per cent carbon dioxide. Jacquemin's method for preparing cyanogen by oxidising cuprous cyanide with ferric chloride gives purer gas in quantitative yields.—**Mlle. Marthe Montagne**: New researches relative to the action of organo-magnesium derivatives on some fatty dialkylamides.—**Marius Séon**: Contribution to the study of the action of gaseous hydrobromic acid on the ether salts of organic acids at the ordinary pressure. On the basis of some experiments described the author gives $R.CO.OR' + HBr = R.CO.OH + R'Br$ as a general reaction, R being any monovalent radical, and R' an alkyl group.—**J. Tomitch**: A series of lavas from southern Serbia.—**Y. Milon** and **L. Dangeard**: The importance of the phenomena of solifluction in Brittany during the Quaternary period. The phenomena of solifluction was observed by J. G. Andersson at Bear Island, and applied by him to explain the rivers of stones in the Falkland Isles.—Formations of similar origin are found in Brittany and Normandy: several examples are cited.—**Clémencet**: Researches on the development of the perithecium in the genus *Elaphomyces*.—**P. Milovidov**: The chemical constitution of the chondriosomes and the plasts in plants.—**Raymond-Hamet**: The identity of yohimbine and quebrachine. Fourneau and Page stated that yohimbine extracted by Spiegel from the bark of *Pausinystalia Johimbe* and quebrachine isolated by Hesse from the bark of *Aspidosperma Quebracho blanco* were identical. This conclusion has been criticised on several grounds. The author has prepared pure specimens from both sources and proves that yohimbine and quebrachine are both chemically and physiologically identical.—**Henri Marcelet**: The presence of a fatty acid, not hitherto observed, in a fish oil. This acid has been isolated from the saturated fatty acids of the oil of *Dorosoma rasus*, and has the composition $C_{17}H_{34}O_2$.—**Mme. L. Randoin** and **Mlle. A. Michaux**: The comparative variations in the amounts of water, fatty acids, and cholesterol in the liver and spleen of the normal guinea-pig, and in the guinea-pig submitted to a diet deprived of the anti-scorbutic vitamin.—**A. Paillot**: The relative importance of the various factors contributing to limit the spreading of the *Pyralis* of maize in the east of France.—**Y. Manouélian** and **J. Viala**: Virulent neuroses and excretory canals of the salivary glands.—**S. I. Zlatogoroff**: The etiology of scarlet fever.

### CAPE TOWN.

**Royal Society of South Africa**, June 20.—**V. A. Wager**: The breeding habits and life history of some Transvaal amphibia. The hitherto unrecorded life history and breeding habits of *Hemisus marmoratum* are described. The frogs were found at Gravelotte, in north-eastern Transvaal, the most southern record at present known. The eggs are laid in small cavities under the surface of the bank of a pool and are looked after by the female until they are hatched. The female then digs a tunnel from the nest to the water, down which the young tadpoles wriggle in a mass. The young tadpoles have a peculiar method of respiration by means of blood vessels in close proximity to the skin on the under side of the body—no external gills being present. They are able to remain alive out of the water for as much as 18 days. The later brief stages of the tadpoles are described in detail. Also brief notes are given on *Phrynomerus bifasciatus* and on *Hyperolius marmoratus*.—**J. H. Power** and **W. Rose**: Notes on the habits and life histories of some Cape Peninsula Anura. The breeding habits and life histories of *Hyperolius horstockii* and *Arthroleptella lightfootii* are described. Nothing has been previously known of the life histories of either the genus *Hyperolius* or *Arthroleptella*. The metamorphosis of the small mountain toad, *Bufo rosei*, is also given.—**D. G. Steyn** and **M. Rindl**: The toxicity of the fruit of *Melia Azedarach* (Syringa berries). *Melia Azedarach*, a tree native to the Himalayan region, is widely planted as an ornamental tree. It is known in South Africa as Bessiboom, Sering or Syringa, and the drupes, known as Syringa berries, are commonly

believed to be toxic. The recorded information with regard to their toxicity, obtained from American, Australian, and South African sources, is conflicting. In view of the inconclusive nature of the recorded evidence it seemed desirable to reinvestigate the problem, both from the toxicological and chemical point of view. The results show that hogs, sheep, goats, rabbits, and guinea-pigs are susceptible to the syringa toxin, pigs being the most susceptible animals, and goats less so than sheep. Muscovy-ducks were not killed even by relatively high doses of the plant material. The symptoms produced in the fatal cases are paralysis and narcosis. Death usually occurs through suffocation. Cold alcohol completely removes the toxin from the ground fruit, but the product is contaminated with considerable quantities of innocuous resin. Continuous extraction with ether fails to remove the toxin completely. The toxins are not of the nature of alkaloids, toxalbumins, or glucosides easily hydrolysed by acids. They most probably belong to that indefinite group known as "bitter principles."—**Dr. Jan Dommisse**: Mean sea-level and other tidal phenomena in Table Bay. The paper is a brief summary of work on (1) mean sea-level at Cape Town, (2) correlation between mean sea-level and barometric pressure, (3) nineteen yearly tides, (4) special tidal phenomenon in February 1907, and (5) tide constants.—**Dr. F. G. Cawston**: The resistance of *Limnædiæ* to varying degrees of desiccation. The periodical drying of pools results in the death of those examples of the *Limnæidæ* which are stranded on the surface, as they are unprotected by an operculated shell; those that settle down into the mud are not affected by dry winds or the strong sun's rays, though they are still subject to the attacks of some of their natural enemies. *Physopsis* and *Bulinus* are better able than *Limnæa* to hibernate in mud, because of the protection afforded by their stouter shell and smaller aperture. With appropriate food *Planorbis pfeifferi* (Krauss), *Bulinus tropica* (Krauss), and *Melanoides tuberculatus* (Müller) have survived burying in garden soil for twelve days at a time, though all the *Limnæa* were dead. The extensive growth of *Eichcornia crassipes* (Ponteder) rapidly dries up a pool infested with *Limnæidæ*, and *Tephrosia* might be used to destroy fluke-infested species.—**D. Slome and L. Hogben**: Preliminary communication on the chromatic function in *Xenopus lævis*. The power of chromatic response is well developed in *Xenopus lævis*. Between 15° and 30° C. photic stimuli are the main agencies contributing to pigmentary effector activity. A statistical method of describing the extent of expansion or contraction of the dermal melanophores by assigning arbitrary numerical symbols was applied to the comparison of series of animals kept at different intensities of illumination with the field of vision defined by surfaces of different absorptive power. The results show: (*a*) that there is a slight degree of primary reactivity independent of the eyes, tending to greater expansion with greater illumination, (*b*) that there is a secondary and independent response for which the eyes are the receptor organs, (*c*) that the secondary response by contraction in a light-scattering and expansion to a light-absorbing surface is of much greater extent and requires a lower intensity of illumination than the primary response, (*d*) that the melanophores of eyeless toads or of normal toads kept for some time in darkness are intermediate in condition.

LENINGRAD.

Academy of Sciences (*Comptes rendus*, No. 9).—**F. Levinson-Lessing**: Some controversial problems in the classification and nomenclature of rocks. Keratophyric rocks in the broad sense of the term must be regarded as leucocratic palæotypic (diagnetised) soda rocks (in some cases also potash rocks). They are subdivided into keratophyres proper, oxykeratophytes, and quartz keratophyres, as well as keratophyrites, oxykeratophyrites, and quartz keratophyrites.—**A. Tolmachev**: Lower Yenisei as a phyto-geographical boundary. The Yenisei valley is considered by many biogeographers as a boundary between the two great divisions of the Palæarctic region, one corresponding to the ancient Angara continent, and the other comprising the West Siberian lowlands. The distribution of plants in the northern parts of Siberia indicates, however, that the actual boundary between the two floras does not coincide with the geological boundary, but passes distinctly westwards from the lower Yenisei. This is explained by recent expansion of the Angara flora westwards, and a general principle is advanced, that biogeographical boundaries do not necessarily coincide with the geological ones, being dependent on recent migrations of organisms.—**A. Grosse**: Isolation of protactinium. Protactinium can be obtained in sufficient quantities by repeating many times the following processes: (1) protactinium, together with phosphates of zirconium and hafnium, is precipitated from the concentrated solution in hydrochloric acid; (2) phosphoric acid is separated from the phosphates of zirconium, hafnium, and protactinium by melting with potassium carbonate; (3) protactinium is isolated (though only partly) from zirconium and hafnium by the partial crystallisation of oxychlorides from the concentrated hydrochloric acid. In this way protactinium can be obtained as the oxide, $Pa_2O_5$.—**M. D. Zverev**: Bionomics of *Erythropus vespertinus* L. and *Hypotriorchis subbuteo* L. A pair of *E. vespertinus* has been observed on a nest with some young birds, which were fed by the old ones, but the young proved later to be those of *H. subbuteo*, and old birds of the latter species took care of them, while the pair of *E. vespertinus* disappeared.—**N. A. Kulik**: The sands of the Petchora region. These sands have definite characters showing their marine origin, and they have not been disturbed since their deposition; their age is that of the last regression of the northern ocean.

*Comptes rendus*, No. 10.—**P. P. Lazarev**: Some statistical problems concerning the movements of animals. While it is impossible to predict movements of individual infusoria, movements of a large number of them are subject to the same laws as movements of small inorganic particles.—**P. P. Lazarev, L. M. Couper, and A. Dubinskaja-Voskresenskaja**: The influence of age on the adaptation of peripheral vision. Visional adaptation has been studied in subjects of widely different age, from six to eighty-one years, and it was found that up to fifty years the power of adaptation is practically constant, but later it decreases rapidly.—**P. P. Lazarev**: A method for determination of the age limit in man. The age limit of man has been determined by a complete hardening of certain bones at about 130-150 years. The author suggests that age limit may be determined also by studying sensibility of centres of peripheral vision and of other nervous centres.—**P. P. Lazarev and A. Dubinskaja-Voskresenskaja**: Influence of alcohol on visual adaptation. Adaptability of vision is modified, but not essentially affected, by alcohol.—**Z. Sergeeva**: Respiratory organs of Isopoda. Preliminary report on the structure of the gills of *Porcellio lævis*, *Armadillium pallasi*, *Spæroma serratum*. Oxidising ferments in

the blood of the species studied have been proved microchemically.—V. Gromov: The age of palæolithic remains in Siberia. A classification of all known palæolithic remains in Siberia and an attempt to correlate them with the geological history of the country.

*Comptes rendus*, No. 11.—F. Loewinson-Lessing and A. Turcev: The magnetic properties of some stony meteorites. A number of meteorites were examined with regard to their magnetic condition, and it was found that, with the exception of two, all were feebly magnetised. A study of the artificial magnetisation of meteorites at different temperatures was also undertaken, with the result that between 400° and 500° C. a sharp increase in magnetism was observed.—D. Stcherbakov and A. F. Sosedko: Investigations of the 1927 expedition to South Ferghana for the study of antimony and mercury deposits.—P. Kobeko and I. V. Kurtchaov: Formation of oxygen at the anode during the electrolysis of glass. The production of oxygen in the process of dissociation of glass by a current at different temperatures proves that Faraday's law is wholly applicable to the electrolysis of glass; nevertheless, the use of the law is not justified in the case of an ionising current.—S. Kostychev and V. Faërmann: The fermentation of zymase is due to living cells. The fermentation of various samples of zymase proved to be a purely biological process due to the presence of yeast, while the presence of the hypothetical zymase could not be proved experimentally.—S. Kostychev and A. Chomitch: The absence of extracellular fermentation in the maceration juice of yeast. A series of careful experiments proved that the fermentation of the juice of macerated yeast is not due to the presence of zymase, but to a biological process, though the actual agent of the fermentation has not been yet found.

## ROME.

**Royal National Academy of the Lincei, Mar. 18.**—E. Bianchi: Atmospheric extinction at Rome. The fact that Andrissi has recently obtained the value 1·90 for the atmospheric extinction ($\rho$) at Rome, whereas the author found 1·02, is readily explainable, since the measurements were made in spring, summer, and autumn in the former case, and in the winter in the latter; moreover, the zenithal distances were different in the two instances.—G. Abetti: Activity and altitude of the solar chromosphere in 1927. Combination of the results of measurements made at Madrid and at Arcetri in 1926 and 1927 gives, for the course of the altitude of the solar chromosphere, curves which are very similar for the two years, and confirms the general lowering in the latter year and the probable slight lowering at the poles; a minimum at latitude 60° and a maximum at 30° are also well defined. Comparison of these curves with those indicating the areas of the protuberances deduced from measurements made at Arcetri shows that the maximum and minimum altitudes of the atmosphere, for both 1926 and 1927, correspond with the maximum and principal minimum of these areas observed at about the same latitudes. The general activity of the chromosphere, deduced from the total area of the protuberances based on the observations at Arcetri, is diminished by 250 units in passing from 1926 to 1927.—F. Zambonini and Silvia Restaino: Double sulphates of rare earth and alkali metals (11). Sulphates of cerium (cerous) and rubidium. Investigation of the isotherm for the system $Ce_2(SO_4)_3 - Rb_2SO_4 - H_2O$ at 25° reveals the existence only of the compound $Ce_2(SO_4)_3$, $Rb_2SO_4$, $2H_2O$, which persists over a wide region of concentration. The 1 : 1 : 8 – compound, which is a usual type in this series, is formed under other conditions and has the specific gravity 2·954 and the crystallographic constants,

$$a : b : c = 0{\cdot}3479 : 1 : 0{\cdot}9181, \beta = 96° 7'.$$

The anhydrous compound, $Ce_2(SO_4)_3$, $Rb_2SO_4$, is also described.—S. Franchi: The most suitable denomination and the cartography of the crystalline mass on which the city of Savona is partly founded.—A. Masotti: The conception of constant tensors in any variety. Considerations similar to those advanced by the author in a recent note on the equivalence of tensors, lead, when applied to Cisotti's views on the idea of constant tensors in Euclidean varieties, to the conclusion that a tensor should be regarded as constant in a field if its components may be made stationary in any point of the field by choosing Cartesian coordinates in that point.—S. Cherubino: Pseudo-normalising substitutions and normalisation in the general theory of real Abelian varieties.—P. Tortorici: A class of continuous functionals.—Maria Pastori: The geometrical significance of intrinsic derivation.—A. Colucci: The generalised second differential parameter.—A. de Mira Fernandes: Geodesic displacement, Riemannian curvature, and Bianchi's associated curvature.—C. Ferrari: The plane plate and the Kutta-Joukowski law. Cisotti has recently calculated the action of a plane irrotational current of density $\rho$ and of asymptotic velocity $c$ in the presence of a circumference C on a plane plate inclined at the angle $\beta$ to the asymptotic direction of the velocity, by determining the pressures on the two opposite faces of the plate by means of Bernouilli's formula. The resulting force, which has the value $\rho c C \cos\beta$, is necessarily perpendicular to the plate and not to the velocity at infinity, as it would be in accordance with the Kutta-Joukowski theorem. Such exception is, however, only apparent and is a direct consequence of the method of calculation used, which does not take account of the pressure at the edges. At the extremities of the plate there is, indeed, infinite velocity and hence negative pressure, which is exerted on an infinitely small area, but has an infinite magnitude of the same order. There results a finite force which acts in the plane of the plate, and which, when combined with the normal force found by Cisotti, gives a resultant normal to the direction of the velocity of the current, as the Kutta-Joukowski theory requires. The proof of this has been given by Kutta for a circular wing and is now given for a plane wing.—V. Ronchi: Interference of corpuscular propagations. Interference phenomena, which have, up to the present time, furnished unshaken support to the classic theory of the propagation of light, are regarded as characteristic for undulatory propagations and as incompatible with any corpuscular theory. Propagation by means of corpuscles regularly distributed may exhibit phenomena comparable with those of stationary waves, and interference phenomena are not characteristic of undulatory propagation alone.—G. Malquori: The systems, $Pb(NO_3)_2 - LiNO_3 - H_2O$ and $Pb(NO_3)_2 - CsNO_3 - H_2O$ at 25°. Comparison of the results of investigation of these systems with those obtained by Gladstone and Saunders for the corresponding systems containing $KNO_3$ and $NaNO_3$ at different temperatures shows clearly that hydration of the alkali cations exerts distinct influence on the variations observed in the solubility of lead nitrate, the increase in this solubility increasing with the ionic radius of the cation. The fact that the increases in solubility are greater at the lower temperatures indicates the formation of complex compounds.—L. Fernandes:

Sulpho-salts (6). Molybdovanadothioaquates. Various compounds of the three types,

$$\left[\begin{matrix}H_2 & (MoS_4)_4 \\ & (VS_3)_2\end{matrix}\right](NH_4)_5 \qquad \left[\begin{matrix}H_2 & (MoS_4)_3 \\ & (VS_3)_3\end{matrix}\right](NH_4)_5$$

$$\left[\begin{matrix}H_2 & (MoS_4)_2 \\ & (VS_3)_4\end{matrix}\right](NH_4)_5$$

are described.—**G. R. Levi** and **C. G. Fontana**: Precipitated zinc sulphide. The individual crystals of zinc sulphide precipitated in various ways are found to have similar dimensions, namely, about 20 A., which may be the dimensions of the pores of the filter-paper. The crystalline form of all the precipitates is that of zinc blende.—**G. Scagliarini** and **E. Brasi**: Additive compounds of halides of divalent metals and organic bases (6). Interaction of cadmium halides and hexamethylenetetramine in aqueous or acetone solution yields the compounds: $2CdCl_2$, $C_6H_{12}N_4$; $CdBr_2$, $2C_6H_{12}N_4$; $CdI_2$, $8H_2O$, $C_6H_{12}N_4$; $CdCl_2$, $C_6H_{12}N_4$; and $2CdI_2$, $C_6H_{12}N_4$.—**D. Cattaneo**: Ultramicroscopy of the crystalline lens (4). Modifications of the ultramicroscopic structure in the process of cataract. Cataract appears to consist in a passage from a homogeneous system to a heterogeneous system by precipitation, in the form of granules or droplets, of the proteins constituting the fundamental protoplasm.—**U. D'Ancona**: The possibility of arranging systematically the larval species of the Murenoids.—**A. de Lollis**: Modifications of the blood, hæmolymphatic apparatus, and kidneys in rabbits treated with transfusion of homogeneous blood.—**A. Galamini**: Investigations on the physiological action of alcohol. Action on the nitrogen exchange of albino rats fed with an insufficient subprotein, sublipinic, hypercarbohydrate diet (5). Alcohol exerts a favourable action on the resistance of albino rats on a diet of maize and varying proportions of beer yeast. This action does not consist in the conservation of protein substances, which are consumed in larger quantities when alcohol is administered.

## Diary of Societies.

### CONGRESSES.

AUGUST 30–SEPTEMBER 2.

SOCIÉTÉ HELVÉTIQUE DES SCIENCES NATURELLES (at Lausanne).

SEPTEMBER 3–10.

INTERNATIONAL CONGRESS OF MATHEMATICS (at Bologna).—In following sections:—Arithmetic, Algebra, Analysis; Geometry; Mechanics, Astronomy, Geodesy, Geophysics, Physical-mathematics, Theoretical Physics; Statistics, Mathematical Economics, Calculation of the Probabilities, Science of the Actuary; Engineering and Industrial Applications; Elementary Mathematics, Didactical Questions, Mathematical Logic; Philosophy, History of Mathematics.

SEPTEMBER 5–12.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE (at Glasgow).

*Wednesday, Sept.* 5.

At 8.30 P.M.—

Inaugural General Meeting (in St. Andrew's Hall, Charing Cross).—Sir William Bragg: Modern Developments of the Physical Sciences and their Relation to National Problems (Presidential Address).

*Thursday, Sept.* 6.

At 10 A.M.—

Prof. E. C. C. Baly: Fluoresence, Phosphorescence, and Chemical Reaction (Presidential Address to Section B).

Prof. W. Garstang: Larval Forms: Their Origin and Evolutional History (Presidential Address to Section D).

Joint Discussion on Human Distributions in Scotland.

Prof. Dame Helen Gwynne-Vaughan: Sex and Nutrition in the Fungi (Presidential Address to Section K).

Dr. J. S. Gordon: The Livestock Industry and its Development (Presidential Address to Section M).

At 11 A.M.—

Prof. J. Brontë Gatenby, and others: Discussion on Cell Structures.

At 11.15 A.M.—

Dr. C. G. Simpson, and others: Discussion on the Mechanism of Thunderstorms.

Sir William Ellis, Col. Ivor Curtis, and others: Joint Discussion on School, University, and Practical Training in the Education of the Engineer.

At 12 NOON.—

Prof. J. L. Myres: Ancient Geography in Modern Education (Presidential Address to Section E).

At 2 P.M.—

Conference of Delegates of Corresponding Societies.

Dr. Vaughan Cornish, and others: Discussion on the Preservation of Scenic Beauty in Town and Country.

*Friday, Sept.* 7.

At 10 A.M.—

Dr. R. A. Sampson, and others: Discussion on the Photographic Measurement of Radiation.

Dr. J. Vargas Eyre, and others: Discussion on Fermentation.

Sir William Ellis: The Influence of Engineering on Civilisation (Presidential Address to Section G).

Dr. H. E. Magee, Prof. E. P. Cathcart, Capt. J. Golding, and Dr. N. C. Wright: Joint Discussion on Lactation and Nutritional Factors allied thereto.

Dr. Cyril Norwood: Education: the Next Steps (Presidential Address to Section L).

At 11 A.M.—

Prof. T. H. Pear: The Nature of Skill (Presidential Address to Section J).

*Saturday, Sept.* 8.

At 8.30 P.M.—

(In Royal Technical College Hall, George Street.) Prof. E. A. Westermarck: The Study of Popular Sayings (Frazer Lecture in Social Anthropology).

*Sunday, Sept.* 9.

At 11 A.M.—

Official Service in the Cathedral Church of St. Mungo. Preacher: Rev. Dr. Lachlan Maclean Watt.

*Monday, Sept.* 10.

At 10 A.M.—

Prof. A. W. Porter: The Volta Effect: Old and New Evidence (Presidential Address to Section A).

E. B. Bailey: The Palæozoic Mountain Systems of Europe and America (Presidential Address to Section C).

Prof. Allyn Young: Increasing Returns and Economic Progress (Presidential Address to Section F).

Sir George Macdonald: The Archæology of Scotland (Presidential Address to Section H).

At 11 A.M.—

Prof. C. Lovatt Evans: The Relation of Physiology to other Sciences (Presidential Address to Section I).

Prof. F. O. Bower, and others: Discussion on the Size Factor in Plant Morphology.

At 11.15 A.M.

Dr. H. H. Read, Dr. Gertrude Elles, and others: Discussion on Problems of Highland Geology.

At 11.30 A.M.—

Prof. T. H. Pear, Prof. H. Clay, and C. G. Renold: Joint Discussion on the Nature and Present Position of Skill in Industry.

*Tuesday, Sept.* 11.

At 10 A.M.—

Dr. C. J. Davisson, and others: Discussion on the Scattering of Electrons by Crystals.

Sir William Pope, and others: Discussion on Recent Advances in Stereo-chemistry.

Prof. F. E. Suess, and others: Discussion on the Tectonics of Asia.

J. A. Venn, Dr. J. S. King, and others: Joint Discussion on the Incidence of Taxation in Agriculture.

G. E. Briggs, Dr. F. G. Gregory, and others: Discussion on the Interpretation of Growth Curves.

Aims of, and Developments in, Broadcasting. Papers:—(*a*) Sir John Reith: Wireless in the Service of Education. (*b*) Salter Davis: An Experiment in Educational Broadcasting.—Sir Oliver Lodge, W. A. Brockington: Discussion.

At 12 NOON.—

Prof. T. H. Mortensen, Dr. F. A. Bather, and others: Discussion on Bothriocidaris and the Ancestry of Echinoids.

At 2 P.M.—

Conference of Delegates of Corresponding Societies.

At 2.15 A.M.—

Prof. F. E. Fritsch, R. Gurney, and others: Joint Discussion—A Biological Investigation of British Fresh Waters.

Dr. G. S. Carter: The Conditions of Life in a Tropical Swamp: an Investigation of the Swamps of the Paraguayan Chaco (Lantern Lecture).

At 2.30 P.M.—

Prof. E. Taylor-Jones: Spark Ignition (Lecture).

Dr. J. D. Sutherland, and others: Joint Discussion on the Economic Balance of Agriculture and Forestry.

At 2.45 P.M.—

Discussion on the Position of Geography in Scottish Schools.

At 5 P.M.—

Sir John Stirling-Maxwell, Bart.: Forestry in Scotland: Past, Present, and Future (Lecture).

At 8.30 P.M.—

(In Royal Technical College Hall, George Street.) Prof. F. G. Donnan: The Mystery of Life (Evening Discourse).

*Wednesday, Sept.* 12.

At 12 NOON.—

(In Fore Hall, University.) Concluding General Meeting.