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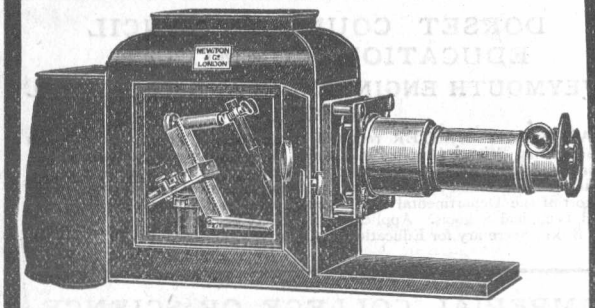

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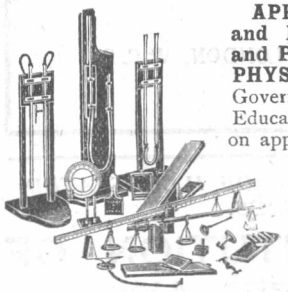

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CHEMICAL SOCIETY RESEARCH FUND.

A meeting of the Research Fund Committee will be held in December next. Applications for grants, to be made on forms which can be obtained from the ASSISTANT SECRETARY, Chemical Society, Burlington House, W., must be received on, or before, Monday, December 2, 1918.

All persons who received grants in December, 1917, or in December of any previous year, whose accounts have not been declared closed by the Council, are reminded that reports must be returned to the ASSISTANT SECRETARY by Monday, December 2.

The Council wish to draw attention to the fact that the income arising from the donation of the Worshipful Company of Goldsmiths is to be more or less especially devoted to the encouragement of research in inorganic and metallurgical chemistry. Furthermore, that the income due to the sum accruing from the Perkin Memorial Fund is to be applied to investigations relating to problems connected with the coal-tar and allied industries.

THE ELECTRICAL RESEARCH COMMITTEE.

APPOINTMENT OF TECHNICAL OFFICER.

The Committee (which is supported by the Research Department, the Institution of Electrical Engineers, and the British Electrical and Allied Manufacturers' Association) requires the services of a gentleman of high scientific and technical attainments as TECHNICAL OFFICER, to direct and supervise, under the Committee, the research work undertaken by it. The commencing salary will be £1000 per annum. Applications (marked on the envelope "Technical Officer"), stating age, qualifications, experience, and other particulars, and addressed "THE CHAIRMAN, the Electrical Research Committee, 1 Albemarle Street, W. 1," should be delivered at that address not later than Friday, December 6.

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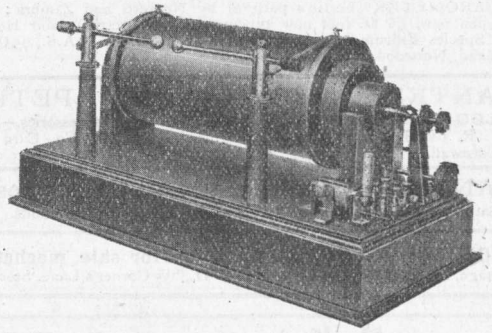

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PRINCIPLES OF RECONSTRUCTION.

NOW that the armistice has been signed and the prospect of peace in the near future is happily assured, it is inevitable that the whole nation should be impatient to get back to its normal activities. Four years of interruption in the ordinary life of a community is a serious break in the regular and ordered continuity of its existence, but whether it is an unmixed evil will depend upon the lessons and experiences to which it has given rise, and upon the extent to which those lessons and experiences are heeded. There has necessarily been a great dislocation of industry, and the forces of production have to a very large extent been made subservient to the demands of war. The immediate problem before us now is how to divert, with the least amount of friction and in the shortest possible time, the enormous amount of energy which has been devoted to the prosecution of war into the manifold channels of civil life and peaceful occupation.

"Business as usual" was a silly and futile cry at the beginning of the war, uttered by thoughtless people with no conception of the grim reality of the struggle into which we had been forced. In a certain sense the cry would be scarcely less futile now, since it is absolutely certain that business in the future will be very different, in many respects, from what it has been in the past. The centre of gravity of the whole system of international trade has been changed. Many years must elapse before the nations of Central Europe will be able to exercise any very great influence upon the world's commerce, and the present chaotic condition of Russia affords no hope that she can resume her pre-war position as a trading nation for some time to come.

The prestige and commercial credit of the larger part of Europe have, in fact, been so profoundly shaken that it is well-nigh impossible to forecast the trend of the world's trade in the immediate future. The plight of Germany and Austria is, of course, further aggravated by the political upheaval which has followed hard upon their military collapse. In such times of social and political stress it is not to be expected that their workers will settle down to the peaceful pursuits of production. The relations of capital and labour, already strained before the war, under the democratic rule which is now supreme in the shattered Empires will probably end in open rupture. The victorious nations, on the other hand, have an opportunity which, if they are wise, they will not be slow to seize. We did not desire this war, and we certainly did not enter upon it with any idea of commercial supremacy, but it would be the veriest folly not to attempt to realise the advantages of the good fortune which our triumph has placed within our reach. Prudence, indeed, should compel us to take occasion by the hand, and grasp the skirts of happy chance. We have spent our treasure without stint in the effort to crush one of the greatest conspiracies against humanity of which history has any record. We have saddled ourselves with a stupendous debt as a consequence, which no indemnity that we are likely to get or any increase of Colonial territory that may fall to our share as an Empire will adequately liquidate. Our only method of meeting the pecuniary obligation we have incurred is by augmenting our wealth by means of trade and commerce, and this can best be done by increasing our production, both in variety and amount.

The future, in fact, rests with labour, and it is upon the sanity and prudence of the workers and their employers that everything depends. The war has been attended with much social unrest, even in those nations which have come out victorious. The workers everywhere demand better conditions of life, a wider intellectual outlook, and a higher standard of comfort, and the nations which have fought the great fight in the interests of humanity sympathise with them in their demands. But as the world is constituted these can be secured only by a better organisation of our economic forces, by increased efficiency in management, greater skill, knowledge, industry, and marketing ability—matters in which the employers are concerned no less than the workers. It will be unspeakably sad if the nation should now throw away its golden opportunity in an internecine strife between capital and labour.

There are anarchical forces at work among us which are bent upon provoking this conflict, and it will require no little ability and courage on the part of labour leaders to counteract the mischievous efforts of those who would take a demoniacal delight in wrecking the industrial welfare of this nation. We believe the great mass of the workers in this country have too much sense to let themselves be infected by the spirit of Bolshevism, which leads to nothing but social chaos. But just as a little leaven leaveneth the whole lump, that pernicious spirit may be very troublesome before it is finally exorcised. What, therefore, is wanted is a reasonable spirit of conciliation on the part of employers and employed, and a determination, honest and sincere, on both sides to find an equitable solution. The spirit should be that of the King's message to his people, delivered on Tuesday in reply to addresses from both Houses of

Parliament. "We have," the King said, "to create a better Britain, to bestow more care on the health and well-being of the people, and to ameliorate further the conditions of labour. May not the losses of war be repaired by a better organisation of industry and by avoiding the waste which industrial disputes involve? Cannot a spirit of reciprocal trust and co-ordination of effort be diffused among all classes? May we not, by raising the standard of education, turn to fuller account the natural aptitudes of our people and open wider the sources of intellectual enjoyment?"

The labour aspect of the matter was touched upon by the Minister of Reconstruction in the peroration of the statesmanlike pronouncement in which he explained to the House of Commons and the country the plans of the Government for the demobilisation of the Army, the re-settlement of officers and men in civil life, and the re-establishment of industry on a normal basis. Lengthy as the statement was, Dr. Addison could only deal with broad general principles, leaving the details to be worked out by the various administrative bodies which are charged with the duty of demobilisation and re-settlement. Considering the suddenness of the chief enemy's collapse, the Minister is to be congratulated on the comprehensiveness of his survey, and on the thoroughness with which the main features of the problem have been thought out in the comparatively short time that his department has been in existence. It says much for our business ability as a people, and for our powers of organisation in a national crisis, that a scheme so elaborate and so far-reaching should have been launched so promptly when the need for it had arrived.

We are, however, only on the very fringe of this great problem. There is still much to do before it is finally solved. However expeditiously the work of demobilisation and re-settlement may be done, the business will necessarily occupy considerable time. It will doubtless tax the energies and the patience of all concerned, and we must be prepared for the "grousing" which is a national characteristic, and not infrequently at times when there is really the least occasion for it. It may be pardoned, however, as one sign of reaction from the intense strain which the nation has suffered during the long and weary years which are past. When a patient begins to grumble, the tactful nurse is assured that the crisis is well past, and that renewed vigour has set in. And this observation reminds us that in the scheme of re-settlement Dr. Addison made no reference to the special case of the medical men. During the four years of war the country has suffered no small amount of inconvenience owing to the calling up of large numbers of medical practitioners for service in the Army. This was inevitable, and as it was necessary the deprivation was borne with patience and resignation. To what extent the national health has suffered it is impossible to say, but there is good reason to believe that the great mortality from the recent epidemic of "influenza" might have been largely obviated had medical advice and skill been more readily available. It is notorious that in some districts medical men were utterly unable to cope with the outbreak, owing to the fewness of their numbers. Its virulence would appear to be declining, but it is only scotched, not killed, and with much of the winter still before us, with food and fuel still short, and with the consequent lowering of the general vitality, it is a paramount necessity that the medical men should be released and re-settled as promptly as possible.

AN AMERICAN CHEMICAL DIRECTORY.

Annual Chemical Directory of the United States. Second edition, 1918. Pp. 534. (Baltimore, Md.: Williams and Wilkins Co., 1918.)

THE present issue of this work, of which the first edition appeared in 1917, differs only in certain minor details from the plan and arrangement of its predecessor. Its contents are grouped under nine main divisions or chapters. Chap. i. contains a list, in alphabetical order, of all chemical substances, made or imported, necessary for laboratory, technical, and industrial purposes, with the names of manufacturers and dealers placed geographically, first by States, and then by cities, and grouped alphabetically. The retailers, dealers, and agents are distinguished, so far as possible, from the manufacturers by an asterisk.

Chap. ii. consists of an alphabetical arrangement of the names of manufacturers and dealers under the alphabetical order of the States and their cities. Chap. iii. gives a list of chemical and chemical engineering apparatus, mechanical equipment, and machinery used in chemical works, arranged alphabetically and in general accordance with the method adopted in chap. i. as regards chemical products.

Chap. iv. consists of an alphabetical list of manufacturers and dealers in such apparatus and machinery, arranged on lines similar to those of chap. ii. Chap. v. gives the names (1) of American analytical and consulting chemists, and (2) of chemical engineers, listed geographically and grouped alphabetically as in the preceding chapters. Chap. vi. is a list of (1) industrial laboratories, (2) institutional laboratories, (3) Federal and State laboratories, (4) municipal laboratories, and (5) commercial laboratories. Chap. vii. gives the official names, arranged alphabetically, of technical and scientific societies concerned with the study of pure and applied chemistry, both in the United States and abroad. Chap. viii. deals with publications relating to

chemistry, pure and applied, emanating from the various societies and publishing agencies, and contains a list of the more important books which have appeared in 1917–18. Chap. ix. consists of notes and news of important developments which have occurred since the first edition was published.

On the value of a work of this kind to all engaged in the practical pursuit of chemistry, whether as teacher or technologist, or even as dealer or agent, we have already dwelt in a notice of the first edition, and we expressed a regret that nothing exactly similar to it was to be found in our own country. Under the changed conditions due to the war, and owing to the quickened appreciation of the value of science, both pure and applied, to the national welfare, and to the greater recognition of the importance of co-operation and co-ordination of national effort, it can scarcely be doubted that such a work would be of the greatest service to those concerned in the chemical arts in this country, and would become practically indispensable. That such is the case in America with the present work seems to be obvious from the character of the new edition, in which apparently no pains have been spared in order to render it complete and comprehensive, and as convenient in use as possible.

From the last chapter, on "News and Notes," we extract a few items which are of interest at the present time as serving to show with what energy America is dealing with the conditions arising out of the war. She has largely developed the synthetic ammonia industry. Processes are being worked by the War Department and the Department of Agriculture, and the Air Nitrates Corporation has been officially appointed by the first-named Department to manufacture ammonium nitrate. The New York City Department of Health Laboratories are producing large quantities of antitoxins, and arsphenamine is being manufactured by the Dermatological Research Laboratories in Philadelphia, the Takamine Laboratory in New York, and what was formerly the Farbwerke Höchst Co. of New York City. The supply of hypnotics and anæsthetics of all kinds is no longer under German control.

In 1917 there were seventy concerns in the United States with benzol-recovery plant. The estimated production of benzol in 1917 was 35,000,000 gallons. The Midland Chemical Co., Michigan, is producing large quantities of bromine. Through the efforts of the United States Bureau of Mines and the American Chemical Society a complete detailed census has been taken of more than 15,000 American chemists. A number of American manufacturers of dyes are employing from twenty-five to seventy-five chemists in their research departments. The American dye industry has now invaded the market in European and Allied countries, South America, Canada, Japan, and India. It is estimated that in the early part of 1918 there were more than 150 firms actually producing "anilines" in the United States. The drug and chemical markets quote weekly nearly one hundred "crudes" and "intermediates," and more than two hundred dyestuffs are available in the United States market. The capital invested in the American dyestuff industry is estimated at 250,000,000 dollars, which is much above the amount of the total capital of the seven leading German companies in 1914. Up to the present, American chemists and manufacturers have placed on the market 75 per cent. of the dyestuffs formerly imported, and it is claimed that by the end of 1918 all necessary colours will be manufactured in the country.

When the war broke out in August, 1914, there were only six factories, employing possibly 350 to 400 operatives, manufacturing coal-tar colours, with an approximate production of 3000 tons. American dyestuffs in 1914 depended almost entirely upon the mere assembling of "intermediates" delivered from German sources. The total annual consumption of synthetic colours in 1914 in the United States was about 27,000 tons. To-day there are probably fifty responsible manufacturing establishments producing dyestuffs in America, and the production is well above 35,000 tons, all made from American coal-tar. In the classes of dyes which, if imported, would be dutiable at 30 per cent. *plus* 5 cents a pound, American manufacturers have shown remarkable progress. The production is so far in excess of the home needs that during the fiscal year 1917 American-made dyes were exported to the value of 11,709,287 dollars. Thus the exports exceeded the pre-war imports in total value, although not in tonnage or in the variety of the dyes. With a view to the protection of their interests in the economic war which is bound to follow, the American manufacturers have established a Dyestuff Manufacturers' Association. Other German industries, such as scientific and laboratory glassware and chemical and electrical porcelain, have been assailed in like manner, and America is now independent of imported supplies.

In 1915 the National Exposition of Chemical Industries was organised in order to foster the growth of chemical industries in America. It has now become an institution in the chemical industrial affairs of the country. The expansion of the Exposition is indicative in a measure of the growth of the chemical industries. In 1915 the number of exhibits was eighty-three; in 1916, 188; and in 1917, 323. In 1915 the visiting attendance was 63,000; in 1916, 80,000; and in 1917, 111,514.

Evidence of the astonishing influence of the war in quickening American energy and enterprise is seen in almost every department of chemical activity. At the end of 1917 practically every "intermediate" of importance was being produced in the country; the production of phenol in 1917 was more than double that of 1916. More than 200 plants are making sulphuric acid in the States, and the production of the present year will be 1,500,000 tons greater than in any previous year.

Germany has already had a rude awakening, but she has yet to realise the full measure of the economic ruin which awaits her.

ELECTRICITY AND HEALTH.

Studies in Electro-pathology. By Temp. Major A. White Robertson. Illustrated. Pp. viii + 304. (London: George Routledge and Sons, Ltd., 1918.) Price 12*s.* 6*d.* net.

THIS book begins with the thesis that civilisation is a mistake because it is a negation of the "wild," the law of which is "Thou shalt be fit or thou shalt die." But we are justified in asking, What is "fitness"? The author appears to have left the development of the brain altogether out of consideration. Do music and painting count for nothing? The statement is made that "suffering has come with the law of the artificial"—that is, the civilised. If we are to accept this we must hold that all existences prior to civilisation were devoid of consciousness. Disease is certainly not absent from wild animals or men, and when the author says that it has increased enormously owing to civilisation, we must remember that the conditions producing it can and must be done away with, and this without abolishing civilisation itself. Moreover, is not the increase spoken of apparent merely and due to improved means of detection? It may be doubted whether the physician is the best judge as to the extent of the increase.

The conclusion of the book is that we must go back to the "law of the wild." How? By living in accordance with the theories of the essentially electrical nature of all physiological and pathological phenomena familiar to some of us in connection with the name of Mr. A. E. Baines. The effects of light are now added on account of their electrical nature. It is true that in the far distant future all phenomena may possibly be explained on the basis of the electrical structure of the atom; but no man living can do this, and the author's attempt can only be described as premature, a fact for which he cannot be held responsible. The book shows an extensive acquaintance with literature, although the quotations are apt to be rather disconnected and their relation to the argument not always obvious. The inner meaning attached to many of these quotations appears to be due to the electrical obsession of the author, who is not always consistent. On p. 57 he inclines to the view that enzymes are "forces"; on p. 115 he speaks of phosphorus as their essential factor, apparently, however, forgetting that a very active pepsin has been prepared free from phosphorus.

The reader must be warned against accepting without question the statements contained in the book. Mr. Baines's remarkable experimental results are quoted without criticism. No attempt is made to answer the objections that have been brought against them, and it is not to be expected that they will be believed until they have been described in such a way that others can repeat them. This applies especially to such experiments as that referred to on p. 231, where a boiled potato is made to sprout by the application of an electrical current. The electrical obsession is indicated also by the view taken that the function of the waxy or fatty layer on the surface of plants or animals is to prevent escape to the air of electrical charges.

The author holds the view that the constitution of "vitamines" is that of phospho-lipines, and his remarks about "quick" food must be referred to on account of the possible mischief that they may do. "Quick" food is that which has a particular electrical reaction, when tested by the method of Mr. Baines, on account of the presence of insulating lipoids. It is the only kind of food that is to be taken. Cold storage destroys this property, as also does over-cooking. But the remarks made as to the misleading nature of calorie values raise doubt as to the competence of the author to advise on problems of nutrition. The application of the theories to medical and surgical practice consists in the addition of a phospho-lipine, lecithin, or similar substance to Mr. Baines's "dielectric oil" or liquid paraffin.

W. M. B.

THE RADCLIFFE FOUNDATIONS.

Dr. John Radcliffe: A Sketch of his Life, with an Account of his Fellows and Foundations. By Dr. J. B. Nias. Pp. 147. (Oxford: At the Clarendon Press, 1918.) Price 12*s.* 6*d.* net.

DR. JOHN RADCLIFFE, a very successful Court physician at the time of William III. and Queen Anne, was one of the most generous of all the numerous benefactors of Oxford, for he left most of his large fortune to the University. He covenanted that a portion of it should be used to endow two travelling fellowships, to be held by Oxford medical graduates for the space of ten years, and he made a special proviso that at least half of this period should be spent by his fellows "in parts beyond the sea, for their better improvement." Radcliffe's idea was an excellent one, for few medical men could fail to broaden their outlook and increase their experience by visiting the most noted medical schools in foreign countries. At the same time the period of ten years is too long for most men, and so from 1859 onwards the tenure of the fellowships was reduced to three years. The list of fellows includes many distinguished names, and of those elected under the new foundation nearly twenty at the present moment hold appointments on the staff of one or other of the London hospitals. The book under review gives only brief records of living fellows, but detailed biographies of the deceased fellows of the old foundation.

The other foundations under Dr. Radcliffe's will include the imposing Radcliffe Library, or "Camera." For the first century or more after it was built this library was stored with books of all kinds, but from 1811 onwards they were restricted to scientific and medical subjects. In 1861 these science books were transferred to the recently built "Museum," whilst the library itself is now used as an annexe to the Bodleian Library.

Another notable foundation bearing Radcliffe's name is the observatory. This institution was not contemplated in Radcliffe's will, but it was founded in 1772 by the trustees out of the trust

funds, at the request of leading members of the University. At the time of its erection the observatory was one of the largest and best-equipped in the world, and its equipment has been well maintained by the recent addition of a splendid telescope of 24-in. aperture for photographic work, and one of 18-in. aperture for visual work, on the same mounting. Just previous to the foundation of the observatory the trustees sanctioned the building of the Radcliffe Infirmary, which has ever since remained the chief county hospital.

In addition to a description of the Radcliffe foundations, Dr. Nias (himself an ex-travelling fellow) gives a brief but interesting biography of Radcliffe. The book contains numerous portraits and illustrations, and is beautifully printed and produced, but it is to be feared that its circulation will be limited by its somewhat excessive price.

H. M. V.

OUR BOOKSHELF.

Elements of the Electromagnetic Theory of Light. By Dr. Ludwik Silberstein. Pp. vii+48. (London: Longmans, Green, and Co., 1918.) Price 3*s.* 6*d.* net.

THIS little volume is re-written from the author's Polish treatise on electricity and magnetism (3 vols., Warsaw, 1908–13). It is a compact *résumé* of the main results of the electromagnetic theory of light in so far as it can be carried without reference to the electron theory. The main purpose seems to be to present the subject to the English reader in vectorial notation, following the symbolism of the author's "Vectorial Mechanics" (Macmillan, 1913). It would have added to the usefulness of a book designed for beginners in the subject if a short exposition of the meaning of the notation had been prefixed, an addition which would have helped to familiarise the rising generation with a very important calculus.

A useful historical survey of earlier æther-theories is given in the second chapter.

The Exploitation of Plants. By Various Writers. Edited by Prof. Oliver. (The Imperial Studies Series.) Pp. vii+170. (London: J. M. Dent and Sons, Ltd., 1917.) Price 2*s.* 6*d.* net.

PROF. OLIVER has done a useful piece of work in bringing together, within the compass of a small volume, a series of lectures on "The Exploitation of Plants in the Service of Man," which was delivered at University College, London, in 1917. In such a collection it is inevitable that there should be differences in relative values, but the standard of the best is very high. Amongst those which strike us as particularly good are the contributions of Prof. Oliver himself, and that of Dr. Willis, formerly director of the celebrated gardens at Peradeniya. As might perhaps have been anticipated, these are concerned with the reclamation of waste lands and with the rubber industry respectively. Both are characterised by first-hand knowledge and that indefinable but very real quality that attaches to pioneer work. Dr. Balls contributes a suggestive article on cotton and its problems, but here and there he is inclined, perhaps, to assume a more extensive technical acquaintance with the subject on the part of the reader than the latter could actually justify.

One essay is markedly egotistical, and the instructed reader will find some entertaining "information" in the lecture dealing with the plant as healer. Amongst other curious statements, the account therein given of the cinchona enterprise in Ceylon manages in a few lines to convey a thoroughly misleading impression of the causes which led to the collapse of that particular industry in the island.

But a book of this kind should, after all, be judged on its merits as a whole, and while it must be admitted to contain some dross, the greater part of it is good, and the best is really first-rate.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The Perception of Sound.

I DO not think that Helmholtz's theory of audition, whatever difficulties there may be in it, breaks down so completely as Dr. Perrett represents (NATURE, November 7). According to him, one consequence of the theory would be that "when a tuning-fork is made to vibrate, no note can be heard, but only an unimaginable din." I cannot admit this inference. It is true that Helmholtz's theory contemplates the response in greater or less degree of a rather large number of "resonators" with their associated nerves, the natural pitch of the resonators ranging over a certain interval. But there would be no *dissonance*, for in Helmholtz's view dissonance depends upon intermittent excitation of nerves, and this would not occur. So long as the vibration is maintained, every nerve would be uniformly excited. Neither is there any difficulty in attributing a simple perception to a rather complicated nervous excitation. Something of this kind is involved in the simple perception of *yellow*, resulting from a combination of excitations which would severally cause perceptions of red and green.

The fundamental question would appear to be the truth or otherwise of the theory associated with the name of J. Müller. Whatever may be the difficulty of deciding it, the issue itself is simple enough. Can more than one kind of message be conveyed by a single nerve? Does the nature of the message depend upon how the nerve is excited? In the case of sound —say from a fork of frequency 256—is there anything periodic of this frequency going on in the nerve, or nerves, which carry the message? It is rather difficult to believe it, especially when we remember that frequencies up to 10,000 per second have to be reckoned with. Even if we could accept this, what are we to think when we come to nerves conveying the sensation of light? Can we believe that there are processes in action along the nerve repeated 10^{15} times per second?

I do not touch upon the anatomical matters treated by Sir T. Wrightson and Prof. Keith, or upon the phonetic evidence brought forward with authority by Dr. Perrett.

RAYLEIGH.

Zeiss Abbe Refractometer.

IN an interesting note by Mr. Churcher communicated to the Physical Society of London (Proc. Roy. Soc., vol. xxx., part iii., April 15, 1918) on the occasion of my paper on refractometers, it is pointed out that it had been observed that the Zeiss Abbe refractometer fails when measurements are required of liquids having an index exceeding 1·52. This Mr. Churcher stated to be due to the substitution of a crown prism of refractive index 1·52 for D in the place of the dense flint prism formerly used as lower or illuminating prism.

The fact that Messrs. Zeiss had changed their procedure with regard to the material of this lower prism in certain instances was of great interest to me, and I have been on the look-out for an instrument having the singularities described. Hitherto I have been unable to find any Zeiss refractometer having the defect mentioned.

If, therefore, any other of your readers possess such an instrument, I should be greatly obliged if they would let me know; and if they are aware of any special purpose for which the instrument should have been so made, I should greatly appreciate it if they would communicate the information to me.

F. SIMEON.

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75A Camden Road, N.W.1.

British Thermometers.

IN an article printed in the catalogue of the British Scientific Products Exhibition (p. 47) I directed attention to the fact that Beckmann thermometers of British make were not then procurable. It will interest scientific workers to know that good thermometers of this type are now manufactured in this country, and may be procured through the ordinary dealers.

CHAS. R. DARLING.

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RESEARCH ON HEALTH AND DISEASE.

THE outbreak of influenza has directed attention to what ought to have been sufficiently clear before—namely, the vital necessity for much more attention being given to the provision of adequate scientific inquiry into the causes of diseases. The question, indeed, is all one with that of research on other scientific problems, and most of the remarks that follow apply, with the appropriate changes of titles, to scientific investigation in general.

The provision for matters relating to disease is closely linked with the establishment of the proposed Ministry of Health. Although a part of the activity of such a body would be the important one of co-ordinating the various departments and authorities connected with the health of the nation, it would be a fatal defect if the equally important one of making full and generous provision for advance by systematic research were left out of sight. Since the functions of the Ministry of Health must of necessity demand the assistance of many and various branches of science, it would seem that those at its head should be men of the widest knowledge and sympathy. It is doubtful whether it would be the wisest thing for the Ministry to be given over entirely to the medical profession, as has been assumed in some quarters. The medical profession would, of course, be largely represented, but the most effective way of getting work done on any particular problem would be to appoint a special committee consisting of heads of laboratories and representatives of institutions where similar research is being carried on. These men would be in touch with the capacities in existence and the capabilities of those actually at work. Such committees should be able to advise the granting of funds by the various bodies having them at their disposal, such as the Department of Scientific and Industrial Research, the Medical Research Committee, and so on.

It is a question whether the Ministry of Health need itself finance research. The multiplication of departments doing this is apt to lead to overlapping and to waste of valuable resources. The grants made on the advice of the committees suggested above might well be limited to the payment of actual laboratory expenses, inclusive of assistance when necessary. The really important thing is that there should be men always at work and ready to take up problems of urgency when they appear. It is unnecessary in this place to insist on the fundamental importance of what is often called abstract research in science. It is but rarely that work directed to a definite limited practical object leads to really valuable permanent results. Take the case of influenza. The mere knowledge that the disease is associated with the presence of Pfeiffer's bacillus is not enough. We must know the conditions which are favourable to the growth and virulence of this organism, and again what changes in the body render it a prey to the attacks of this and other agents. All this implies a far greater knowledge of the general biology of micro-organisms and of the physiology of the animal body than we yet possess. Researches of this kind must always be provided for and in continuous, uninterrupted course. They lead to direct practical applications, frequently making special investigation unnecessary, or at least rendering such work comparatively simple.

But, as is universally agreed, the number of such workers at the disposal of the nation is grievously inadequate. Why is this the case? There can be no doubt that it is due to the fact that no permanent careers in sufficient number are open to men who are attracted to research work, especially when of a character not directly connected with immediate practical applications. This must be remedied and without delay. In that branch of science with which the writer is more particularly acquainted, it often happens that a man with talent for research is obliged to devote himself to medical practice because he can see no reasonable prospect of a future career to support himself and his family. The only way to remedy such a state of affairs is to provide permanent research posts at an adequate salary. Grants for limited periods are of no real use, and the Beit fellowships, valu-

able as they are, are open to serious criticism in this respect. At the end of his tenure the holder is left stranded. There must be some security of tenure. No good work can be done under perpetual anxiety for the future. To a very large degree the need could be most effectively met by liberal grants to universities and other teaching institutions to enable them to increase their staff and the salaries paid on condition that at least half time was free for research. At the same time, the teaching itself would greatly benefit and class fees could be reduced to limits permitting all capable of benefit to obtain it, while the performance of some amount of teaching is of value in preventing too narrow an outlook, of which there is danger in the pursuit of what must, of necessity, be a more or less limited objective. The money must be at the disposal of the university, since only their colleagues can possess satisfactory knowledge of the capabilities of the staff. Of course, inspection would be advisable and profitable.

However this may be, there can be no doubt of the urgent and vital necessity for the generous provision in some way of permanent adequately paid posts for men who wish to devote their lives to research. We have every reason to be proud of our achievements in pure and applied science, but how much greater might they not have been if the services of so many talented workers had not been lost in the past?

One aspect of the matter must be insisted upon. The demands of those unacquainted with the nature of scientific work suggest that they expect, say, a cure for influenza to be discovered in a week or two. It must be made clear that no accurate scientific work can be done in haste. If inaccurate, it is worse than useless, because it misleads and often results in the loss of much later work based on it. A great advantage of work carried on without the limitation of a direct practical object is that the most promising course of investigation often reveals itself in the actual progress of the work itself, so that the most valuable result may be quite different from the problem originally attacked.

At the present time there are special circumstances that require attention. The number of men trained in scientific methods has not only been reduced by death during the four years of war, but the outlook for the future is serious on account of the gap of four years in the training of men who should have been available now. It will be difficult or impossible for many of those returning from military service to devote three or four years to training at an age when it may be necessary for them to be earning a livelihood. It would seem to be a question for serious consideration whether some provision in the nature of scholarships should not be made to enable those who desire it to continue their scientific training. The funds necessary might with reason be regarded as forming a part of the cost of the war to be paid by the enemy.

W. M. BAYLISS.

WAR-TIME BEEF PRODUCTION.

OF the many changes imposed by the war upon British agriculture, few have aroused greater misgivings amongst practical men than the restrictions imposed upon meat production by the reduction of supplies of imported feeding-stuffs. During the many years of abundant and cheap supplies of these materials before the war it became the normal practice of the cattle-feeder to feed lavishly with the view of turning out the fat beeves of prime quality which have always been the special pride of the British farmer. The economy of the practice was frequently called in question, and results of experimental investigation were not wanting to supply evidence that the standard of feeding which represented the upper limit of economy was not very high. Recent controversies, however, have revealed how little practice had been affected by the teachings of the economist before the shrinkage of food supplies occasioned by the war rendered so-called "high" feeding physically impossible.

Before the war a daily allowance of 8 lb. to 10 lb. of "oilcake" per head was quite usual, so that it is little wonder practical men were seriously alarmed last winter when the fiat went forth that the available supplies of feeding-stuffs would not provide more than 1 lb. to 2 lb. for the purpose. That such a drastic reduction in the food ration must result in a great decrease in meat production and the disappearance of all but inferior qualities of beef was regarded in practical circles as self-evident. Even the scientific adviser of the farmer, though less pessimistic as to the magnitude of the effect, found himself very inadequately equipped with data which would enable him to assess the probable meat output on the restricted diet. The matter being so obviously of great economic importance, steps were at once taken to secure trustworthy information, and during the winter of 1917–18 experiments on a considerable scale were carried out under the auspices of the Boards of Agriculture for England and Scotland, and the Irish Department of Agriculture. The results of these experiments are now available in a summary prepared by Prof. T. B. Wood, and published in the August issue of the *Journal of the Board of Agriculture*. The experiments were carried out at two English, two Scottish, and three Irish centres with groups of eight to twenty cattle at each, a total head of ninety-five cattle being included in the tests. At each centre the cattle were given roots and straw *ad lib.*, supplemented with only 1½ lb. per head per day of undecorticated cotton-seed cake.

With the lavish feeding of peace-time, cattle of the type used would commonly increase in weight at the rate of about 12 lb. to 20 lb. per week. In these experiments the average weekly gains at the different centres ranged from 6 lb. to 17 lb. per week, five of the results falling within the narrow range of 8 lb. to 10 lb. per week. The proportion of dressed carcass to live weight was certainly not

up to the 60 per cent. of the prime fat steer, but at an average of 56 per cent. was still high enough to secure a place in the first grade of quality. What these figures mean in terms of beef output is demonstrated by Prof. Wood by a comparison with the results of pre-war experiments, from which it would appear that the decrease in oilcake consumption from 8 lb. to 1½ lb. per head per day only reduces the liveweight increase by 3·3 per cent., and the meat output by 9 per cent. The results show further that from the point of view of profit the high cake ration would assuredly be a mistake at the present time, since for each extra pound of beef produced 13 lb. of cake costing about 2*s*. would be consumed.

Even more far-reaching conclusions as to the desirability of aiming at a lower stage of fatness in beef production under present conditions are arrived at by Mr. K. J. J. Mackenzie and Dr. F. H. A. Marshall from investigations of which a summary is given in the September issue of the same journal. These conclusions are based upon data obtained with ninety-two beasts of different degrees of "ripeness" specially selected for the purpose, weighed and slaughtered under conditions permitting of exact observation. The observations were extended further to the edibility of selected portions of the carcass and the proportion of waste involved in their consumption. From the data obtained the conclusions are drawn that the ordinary method of judging the condition of a beast by "handling" may often lead to serious errors of judgment as to its fitness for the butcher, generally resulting in far too many beasts being kept beyond the most economic time for killing; that beyond a certain point further increase in weight does not contribute effectively to the meat supply, being mainly waste fat; and that no serious complaint on the ground of quality can be brought against the meat from the half-fat beast, the consumption of which is attended with the minimal quantity of waste.

On certain points of detail the practical man will doubtless find these observations not entirely convincing, but the general support they afford to the policy of retrenchment in cattle-feeding can scarcely be questioned. C. C.

STATE ASSISTANCE TO THE DYE INDUSTRY.

A MEMORANDUM (Cd. 9194, price 2*d*.) has just been issued by the Board of Trade giving details of the scheme for the allocation and administration of the funds provided by Parliament for assistance in the development of the dye industry. It is pointed out that the primary object of the financial assistance to be given is to make the British textile users of dyes independent of German dyestuffs, and to enable the manufacturers to bring down the cost of production to a point at which competition with the large-scale industry of Germany will be commercially possible. Loans and grants of money are to be given to assist in the provision of buildings and plant, and for the maintenance of a system of research. These funds are additional to and independent of the moneys already advanced to the firm known as British Dyes, Ltd. There are dyes which at the present time are not being manufactured in this country at all, or are being made in quantities insufficient for the reasonable needs of dye users, and in this direction especially encouragement is needed.

As to the work of research distinct from the technical routine of manufacturing operations, it is now recognised as an inherent part of the industry, and that it properly enters into the cost of production, since experience shows that in normal times a constant flow of new colours or varieties of colours is necessary for the maintenance of those dye-using trades which are subject to outside competition. It is also acknowledged that, while continued research must be carried on, it does not follow that commercial advantages may be immediately secured. The administration of the scheme will be carried out by (1) a loan and grant committee, (2) a trade and licensing committee, (3) an inspector of research, and (4) an inspector of accounts.

The business of the trade and licensing committee will be to determine what colours and intermediate products shall be licensed to be imported into the country after the war, and in what quantities, and to advise the Commissioner as to the colours and intermediates the manufacture of which should be specially encouraged, and the order of their importance. The committee will consist of four representatives of colour users and four representatives of dye manufacturers under an independent chairman appointed by the Board of Trade.

The inspector of research will occupy an important and somewhat difficult position. It is obvious that he must be a highly qualified "organic" chemist with special knowledge of the production of intermediates, as well as dyes. By his reports to the Dye Commissioner he will practically control the work that goes on in all the research laboratories connected with the works, and as the connection between the experiments actually in progress and the ultimate bearing of the results on industrial operations is often not very obvious, a good deal of patience and discretion will need to be exercised.

Conditions relative to the rate of interest to be charged on loans and the amount to be set aside for depreciation and obsolescence of plant and buildings, as well as for the repayment of the loans, are set forth in the memorandum.

COMMERCIAL AVIATION.

THE subject of commercial aviation is one that has attracted a great deal of attention during the latter phases of the war, and now that hostilities are at an end it has become a matter of the first importance. A vast organisation has been created in order to provide the necessary machines and men for the needs of the Royal Air Force, and it seems almost certain that the full military output of which we are now capable will

not be required in times of peace. If, however, aviation is to take a prominent place in the commerce of the future, an outlet will be at once found for the energies of designers and manufacturers of aircraft.

There are many indications that the aeroplane will soon become an important factor in international trade, though it is at present impossible to forecast the extent of such developments. The *Times* of November 15 reports that Mr. Holt Thomas intends to institute a passenger service between London and Paris as soon as circumstances permit. Machines that had been designed for bombing work over German territory are to be used, and it is hoped to make the complete journey in three hours and a half, the actual flying time from aerodrome to aerodrome being two and a half hours. The price of the tickets will be fifteen guineas per passenger, and the service will be a daily one, weather permitting.

Close on this announcement comes the news that a record flight has been made over London by a Handley-Page machine carrying forty passengers, together with fuel for a six hours' flight. This remarkable achievement, in which the previous record number of passengers has been doubled, should do much to convince the sceptic of the possibility of an effective aeroplane passenger service. It appears likely, however, that one of the greatest commercial uses of the aeroplane will be the carrying of international mails, where the increased speed of transit would be a great asset to commercial activities.

The *Times* of November 16, which reports the above record passenger flight, also gives an account of a speech by Lord Weir, made at the opening of the exhibition of enemy aircraft at the Agricultural Hall. Lord Weir, in referring to commercial aviation, expressed his opinion that while the possibilities are great, the probabilities are not so great. A period of pioneer work must be expected, and he hoped that the State would be able to render much assistance to those manufacturers whose thoughts were turned to the new problems involved. It is earnestly to be hoped that such will be the case, and there seems little doubt that if our unique facilities for aeronautical experiment and research can be applied to the new problems of commercial aviation, the pioneer period will not be a very long one, and results of great importance will soon be reached. The development of aerial intercourse between the nations should do much to keep them in closer touch one with another, and thus aid in the world's progress towards the desired goal of universal peace.

NOTES.

THE following is a list of those to whom the Royal Society has this year awarded medals. The awards of the Royal medals have received the King's approval:—The Copley medal to Prof. H. A. Lorentz, For.Mem.R.S., for his distinguished researches in mathematical physics. The Rumford medal to Prof. Charles Fabry and Dr. Alfred Pérot (jointly) for their contributions to optics. A Royal medal to Prof. Alfred Fowler, F.R.S., for his distinguished researches on physical astronomy and spectroscopy. A Royal medal to Prof. F. G. Hopkins, F.R.S., for his researches in chemical physiology. The Davy medal to Prof. F. S. Kipping, F.R.S., for his studies in the camphor group and among the organic derivatives of nitrogen and silicon. The Darwin medal to Dr. H. F. Osborn for his valuable researches on vertebrate morphology and palæontology. The Hughes medal to Mr. Irving Langmuir for his researches in molecular physics.

WEATHER information is now again allowed to appear in the columns of the newspaper Press, and the Meteorological Office has, from last Monday, resumed the issue of its official forecasts. It must necessarily be some time before the circulation of the various weather reports is in pre-war order. By the action of the Government the issue of much of the ordinary weather information was suspended at the end of September, 1914, and from May 1, 1915, the Meteorological Office ceased to issue weather forecasts; for some time afterwards, so far as current weather is concerned, only the observations of sunshine, rainfall, and temperature from the health resorts were issued, and these, after a short period, were also stopped. The action was taken in order that no useful hint should be given to aid Germany's air-raids. During the last few months of the war the censorship of the weather was so severe that no mention of the weather was allowed in the newspaper Press. The Weather Office has contributed information of the highest value to the Air Service, Navy, and Army throughout the period of the war. There is an opportunity now for much greater usefulness than prior to the war, and information will doubtless be eagerly sought for by the aerial services. If a journey to India is undertaken by aircraft it would probably be fairly ideal in the summer, the surface winds being favourable, and by passing over the Arabian Sea use can be made of the area of low barometric pressure situated over the northern portion of India. In the winter, however, the strong southerly surface winds blowing round the high-pressure area over Asia would be embarrassing, and probably the upper-air current would prove more favourable. Meteorological problems will have to be grasped by the flying experts, and knowledge gained relative to the upper air must be made public, just as in the past the seaman has acquired knowledge of air and sea currents at the sea surface.

WE sympathise with Lord Sudeley's protest, in a letter to the *Times* of November 15, against "such a long delay as six months being permitted to elapse before our museums are once more at full swing." The sooner they resume their full activities of acquisition, investigation, and instruction, the better. It is with elementary and popular education that Lord Sudeley is chiefly concerned, and he rightly directs attention once again to the presence of our soldiers from the Dominions, and we would add those from the United States, so many of whom wish to see these great institutions. Yet if Lord Sudeley thinks that a return to peace conditions can be "a matter only of weeks," he is over-sanguine. It is easier to pull down than to build up, and, even with a full staff, the replacement of the numerous objects that have been removed—some to considerable distances—with their proper ordering and labelling, would take months rather than weeks. But the staffs are not complete; many men will never return; many cannot yet be spared from their military and other national duties. Their work cannot be done by new and untrained men, still less by stopgaps. None the less, the task of

restoration is already in progress: the Science Museum was reopened some weeks ago; the British Museum has arranged a war-time exhibition, really all the more pleasant for being not quite so overwhelming. Let us progress steadily, but let us progress surely and strongly. It is not to pre-war conditions that we hope to see a return. We must go further forward. Above all things, increased staffs are demanded if our museums are to fill that place in national reconstruction which they are in other respects both fitted and anxious to fill.

PROF. DAVID E. LANTZ, assistant biologist on the Biological Survey, U.S. Department of Agriculture, died of pneumonia on October 7 at Washington, D.C. He was chiefly engaged in investigations of the economic relations of mammals.

MR. WM. B. BRIERLEY, of the Pathological Laboratory, Royal Botanic Gardens, Kew, and formerly lecturer in economic botany to Manchester University, has accepted the appointment of mycologist to the new Institute of Phytopathological Research, Rothamsted Experimental Station, Harpenden.

THE *Times* correspondent at Stockholm announces that the Swedish Academy decided on November 11 to award the Nobel prize for physics for the year 1917, in reserve from last year, to Prof. C. G. Barkla, professor of natural philosophy in the University of Edinburgh, for his work on X-rays and secondary rays. The prize in physics for 1918 and that in chemistry for 1917 and 1918 have been reserved.

WE are informed that new and unexpected claims of his profession have made it impossible for Mr. H. M. Langton to undertake the office of secretary of the National Union of Scientific Workers. The executive committee has therefore decided to leave the office vacant for the time being, and has appointed Dr. Norman R. Campbell chairman of the executive, and Mr. Eric Sinkinson assistant secretary. All correspondence should be addressed to the assistant secretary at 14A Albert Bridge Road, S.W.11.

IN view of the alarming and contradictory reports of the present epidemic of influenza that have appeared in the public Press, the Royal College of Physicians of London has issued an authoritative memorandum in the public interest. It is considered that the present epidemic is essentially identical with previous epidemics. It is suggested that the causative virus may be a micro-organism beyond the range of microscopic vision, but the present epidemic has no relation to plague, as some have suggested. Valuable hints are given with regard to prevention and to general treatment if infection occurs, and it is stated that no drug has yet been proved to have a definite preventive or curative action.

INFLUENZA continued to maintain its virulence over England, according to the Registrar-General's return for the week ending November 9, but the general deaths seemed to warrant the assumption that the epidemic had reached its climax, and there appears a good prospect that it is on the wane. For London the deaths from influenza were 2433, which is 25 fewer than for the week ending November 2. The deaths for the respective ages were from 0 to 5 years, 13 per cent.; 5 to 20 years, 17 per cent.; 20 to 45 years, 50 per cent.; 45 to 65 years, 14 per cent.; 65 to 75 years, 4 per cent.; and above 75 years, 2 per cent. In the five weeks ending November 9 the total deaths in London from influenza were 6598, of which 6147 occurred in the last three weeks. In the whole five weeks of the epidemic the influenza deaths compared with the total deaths from all causes were for ages 0 to 5 years, 36 per cent.; 5 to 20 years, 65 per cent.; 20 to 45 years, 67 per cent.; 45 to 65 years, 37 per cent.; 65 to 75 years, 21 per cent.; and above 75 years, 10 per cent. The influenza deaths for the five weeks were 48 per cent. of the total deaths from all causes, pneumonia 12 per cent., and bronchitis 5 per cent. In Paris, with about three-fourths of the population of London, the deaths from influenza in the week ending October 26 were 1263, whilst in London, for the corresponding period, the deaths were 1256. The drier and much colder weather during the past week may tend to the disappearance of the epidemic.

DR. AUGUSTUS F. R. HOERNLE, C.I.E., the eminent Oriental scholar, died at Oxford on November 12, aged seventy-seven years. He was attached to the Church Missionary Society at Meerut from 1865 to 1870, when he was appointed principal of the Cathedral Mission College, Calcutta, and afterwards principal of the Calcutta Madrasah. He acquired a wide knowledge of Sanskrit and Hindi, and his "Comparative Grammar of the North Indian Languages" and his "Comparative Dictionary of the Bihari Language" are works of authority, used to much advantage by Sir G. Grierson in his linguistic survey of India. Dr. Hoernle paid much attention to the medicine of ancient India, and his most important works were his translation of the birch-bark codex discovered by Col. Bower at Kucha, in Khotan, in 1890, and his report on the MSS. collected by Sir Aurel Stein and other explorers in Chinese Turkestan. The death of this eminent philologist is a serious loss to Oriental learning.

WE derive from the Meteorological Office Circular No. 29 the following particulars of the work of Dr. Walter de Watteville, who died on October 3 at sixty years of age:—Dr. de Watteville was a native of Berne, Switzerland, and had been many years in practice at Kingussie. He was one of the earliest supporters of the open-air treatment for the cure of tuberculosis, and was the director of a sanatorium where much valuable work has been done. Keenly interested in various departments of science, Dr. de Watteville had since 1895 maintained a second-order station at Kingussie, more than 800 ft. above sea-level. We owe entirely to his enthusiasm a satisfactory set of climatological normals for Upper Speyside, and a demonstration of the fact that this region, which has long been popular as a summer resort, affords, even amidst the rigours of a Highland winter, an atmosphere eminently favourable for the treatment of tubercular complaints.

WE learn from *Science* that Mr. Henry Suter, author of "A Manual of the New Zealand Mollusca," who died in Christchurch, N.Z., on August 1, was born at Zurich in 1841, and went to New Zealand in 1886 to engage in farming, but soon relinquished the idea, and devoted most of his time to studying the indigenous mollusca of the antipodean country. In 1913 he produced his "Manual," which was published for him by the New Zealand Government. It contains the diagnoses of 1079 species, 108 sub-species, and 100 varieties of New Zealand molluscs. Two years later the Government published his atlas to the "Manual." This has seventy-two plates, containing many figures of molluscs from Mr. Suter's own drawings. In later years he gave special attention to Tertiary molluscs of New Zealand, and in 1916 the Geological Survey Department published as a bulletin a work by him on "The Tertiary Mollusca of New Zealand." His death leaves New Zealand without a recognised conchologist.

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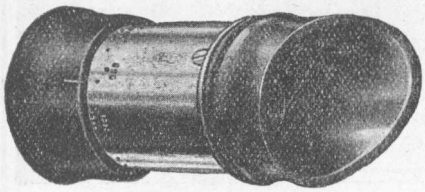

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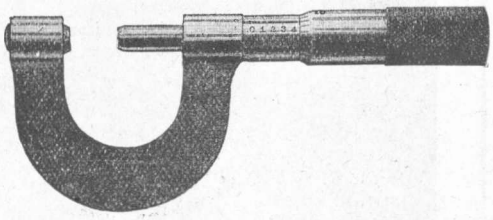

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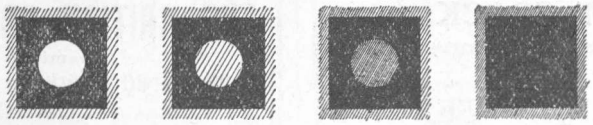

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NOTE.—Sometimes, after apparently disappearing, the colour comes back. If it remains, screw out again until it vanishes. It takes from ½ to 1 minute for the eye to get accustomed to the dark.

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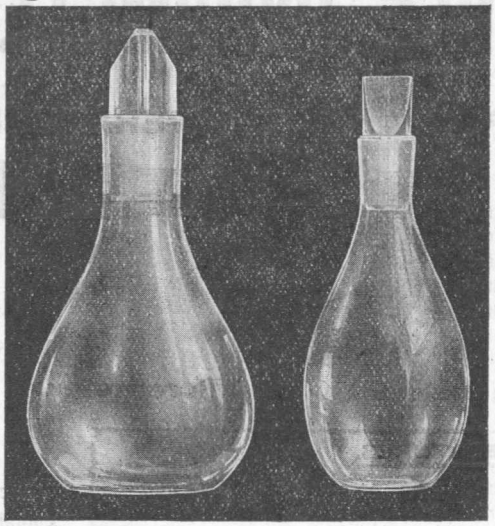

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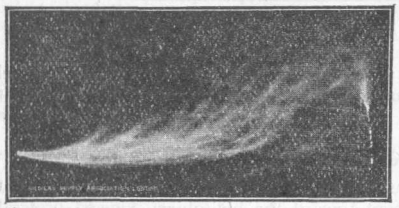

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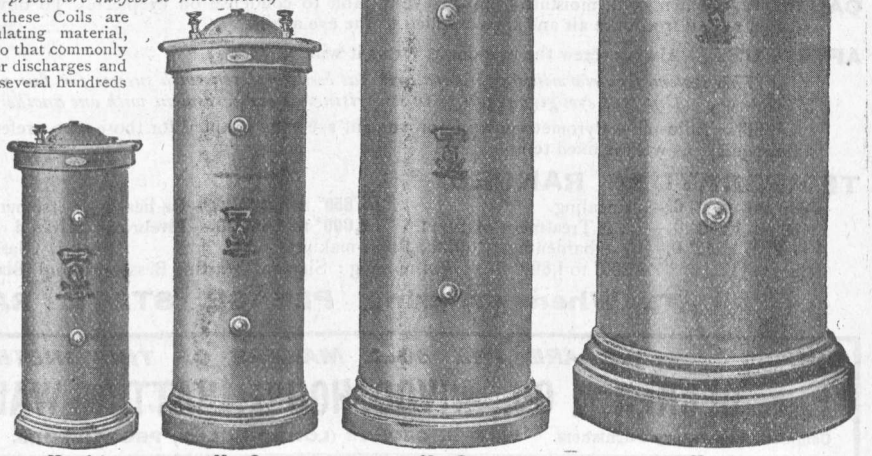

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by the Industrial Reconstruction Council, a second series has been arranged for January, February, and March of next year. The first conference, under the title of "Reconstruction or Restoration?" will deal with the general principles which should guide us during the difficult transition period, and will be opened by Major H. J. Gillespie on January 14. The other meetings will discuss "The Workers' Interest in Costing," "The Place of the Merchant in British Industry," "Welfare Work," "Wages and Conditions of Employment in Relation to Future Industrial Prosperity," and "Industry and Educational Reconstruction." No tickets will be issued, but all those who intend to be present are asked to inform the Secretary, I.R.C., 2 and 4 Tudor Street, E.C.4, who will be glad to send a full prospectus of the series on application.

THE British Scientific Instrument Research Association, one of the earliest associations formed under the scheme of the Department of Scientific and Industrial Research, has secured premises at 26 Russell Square, W.C.1, where offices and research laboratories will be equipped. The first chairman of the association was Mr. A. S. Esslemont, whose recent lamented death has been a severe loss to the association. The council has elected Mr. H. A. Colefax, K.C., as chairman to fill the vacancy. The vice-chairman is Mr. Conrad Beck, to whose energy and personal influence is largely due the successful formation of the association. Almost all the leading optical and scientific instrument manufacturers are members. The Department of Scientific and Industrial Research is represented by Major C. J. Stewart, Capt. F. O. Creagh-Osborne, R.N., Mr. S. W. Morrison, Col. R. E. Home, R.A., and Mr. Percy Ashley. The council has recently co-opted as members of its body the Hon. Sir Charles A. Parsons, F.R.S., and Prof. J. W. Nicholson, F.R.S. Sir Herbert Jackson, K.B.E., F.R.S., has been appointed director of research, and Mr. J. W. Williamson secretary of the association.

MR. WILLIAM LLEWELLYN PREECE, the eldest son of the late Sir William Preece, whose death, at the age of fifty-two, occurred in London on November 10, was educated at King's College School and the Hanover Square School of Electrical Engineering. In 1898, after having spent twelve years in the Midland Railway Co.'s telegraph department, he joined his father's firm (now Preece, Cardew, Snell, and Rider) as a consulting engineer. Sir William Preece had for many years previously held the appointment of consulting engineer to the Crown Agents for the Colonies, and Mr. Preece on joining the firm took charge of the branch of the practice dealing with telegraph and telephone matters in the principal Colonies and Dominions, including those under the Crown Agents and High Commissioners for South Africa and New Zealand. He had made a special study of wireless telegraphy, and was responsible for the wireless plant established in many of our distant Colonies; he was one of the expert witnesses examined by the Select Committee of the House of Commons appointed to inquire into the Post Office contract with the Marconi Co. for the proposed stations of the Imperial Wireless Chain. At the time of his death Mr. Preece held a commission in the R.N.V.R., and was employed at the Admiralty. He was a member of the Institution of Civil Engineers and also of the Institution of Electrical Engineers, and was serving on the council of the latter body at the date of his death. He read a paper in 1915 before the latter body on "Telephone Troubles in the Tropics," and had also at various times written many papers on Church matters, in which he was deeply interested, for private circulation.

SIR HERMANN WEBER, the distinguished physician, who died on the day of the signing of the armistice, was in his ninety-fifth year, and had practised in London for three-quarters of a century. He was a true lover of England; his desire was to live to see the victory of the Allies and the end of the war. To those who knew him he represented the very best and most beautiful aspect of that Germany which was. He died as gently as he had lived. He was one of those rare men whose lives are made up of all friends and no enemies; and that, not because he was negative or poor-spirited, but because he was honourable, courteous, pure in heart, unselfish. He was a man of culture and a great collector of Greek coins, and was known as an expert on this subject. Above all, he was a wise and far-seeing adviser. It was he who taught us the saving power of the Engadine for consumptive patients; he thus helped to bring about the open-air treatment of that disease. On questions of climate and of health resorts Sir Hermann Weber was the first, and one of the greatest, authorities in London. He was a member of the Alpine Club; he knew the meaning of fresh air; he was still an Alpine climber at eighty. He could still, in his ninety-fifth year, walk his seven or eight miles a day, walking fast, and preferring to walk bareheaded. He was in that splendid circle of Victorian physicians and surgeons whose names are as household words to many of us; he outlived them all. His length of days is not to be ascribed to any force of abstinence; he was "anti" nothing; merely, he lived a very temperate, diligent life. The secret of longevity is not altogether explicable; we live so long as we were originally wound up to live. But we may at least believe that peace of mind and a quiet enjoyment of the very best sort of things have something to do with a man's continuance.

MR. W. AIRY has published an interesting paper entitled "On the Ancient Trade Weights of the East." His object has been to present a simplified account of the ancient weights of the East, not including those of China and Japan, and to illustrate their interrelations. He finds that practically all Eastern weights may be referred to one or other of the following systems:—The Egyptian kedet system, based on a kedet of 140 grains; the Egyptian shekel system, based on a shekel of 245 grains; the Phœnician shekel system, based on a shekel of 220 grains; the Babylonian and Assyrian systems, based on a shekel of 254 grains; the Greek Æginetan system, based on a shekel of 254 grains; the Greek Solonian system, based on a drachma of 67·5 grains; and the Roman system, based on a libra of 5050 grains.

MESSRS. G. A. NATESAN AND CO., Madras, have issued short biographies of two well-known Indian men of science, Sir J. C. Bose and Dr. P. C. Rây. The former, after receiving some elementary education at a Bengali "patshala," or village school, went to Christ's College, Cambridge, and there laid the foundations of the scientific training which led to his investigations of the transmission of excitations in plants like the mimosa, developed in his important work on "Plant Response." Dr. P. C. Rây was trained under Tait and Crum Brown at Edinburgh, and became professor of chemistry at the Presidency College, Calcutta. His most important work has been the foundation of an Indian chemical school and the establishment of the Bengal Chemical and Pharma-

ceutical Works, now a flourishing concern. It is well that these two men of science are at hand, qualified to assist in the industrial development of India, which cannot now be long postponed.

SOME interesting notes by Mr. E. C. Chubb on the whales landed at the whaling station at Durban appear in the Annals of the Durban Museum (vol. ii., part 2). These were taken during the whaling season of 1914, since when, unfortunately, the "fishing" has been suspended, though it will be resumed, no doubt, at no distant date. A female of the blue whale (*Balaenoptera musculus*) is recorded here which was 90 ft. in length, and it is evident that, for the present, some uncertainty must obtain in regard to records of the capture of the "seihval" (*B. borealis*), since this species is not readily distinguished from the South African *B. brydei*. From the stomach of a sperm whale, obtained off Durban in 1913, a shark, 10 ft. in length, was taken. A number of excellent photographs add much to the value of this paper.

THE Monilia diseases of fruit-trees are some of the most serious of those with which present-day fruit-growers have to contend. In spite of the considerable amount of work which has been done on them, our knowledge of their specific symptoms and detailed etiology has remained to a considerable extent incomplete. During recent years, however, thanks to the careful work carried out at Wye College by Mr. E. S. Salmon and Mr. H. Wormald, important advances have been made in the elucidation of these diseases. In the *Annals of Applied Biology* (vol. iii., No. 4) Mr. Wormald published the results of a very thorough study of a blossom-wilt and canker of apple-trees due to a species of Monilia clearly different from *M. fructigena* (the cause of the well-known rot of apples), which he refers to *M. cinerea*, Bon. More recently Mr. Wormald has published in the same journal (vol. v., No. 1) an equally illuminating account of a "wither-tip" disease of plum-trees which occurs in Kent, and probably elsewhere. This disease is also caused by *M. cinerea*. The interesting point is that, although the two fungi which attack apple- and plum-trees respectively are morphologically indistinguishable, yet their pathogenic characters are dissimilar. Hence it is now proved that amongst the Monilias, just as amongst the "rusts" and the "mildews," biologic forms or physiological strains exist. In the case of the two Monilias referred to, these strains can be distinguished, not only by their behaviour with regard to specific hosts, but also by means of cultural and biochemical methods.

THE regulations for the supply of spectacles to the German Army have given a great impetus to the general desire to carry standardisation of spectacle parts still further. According to the *Central-Zeitung für Optik und Mechanik* (August 20), military spectacles must have lenses of 38·2 mm. diameter and be interchangeable. Only ten types are permitted. Standardisation is still desirable in frames, screws, etc., of which only one size should be permitted.

A WRITER in *L'Elettrotecnica* for September 25 pleads for an intensive system of re-afforestation in Italy in view of the future industrial requirements of that country. It is suggested that suitable trees be planted in the neighbourhood of watersheds for the production of charcoal by electric power, as Italy may be obliged to have recourse to charcoal in place of coke for steel-making. Some figures are given showing the power required and the yield of charcoal and by-products possible.

PAPER yarn of from 1 to 5 mm. diameter is in use in Germany as a substitute for jute. Paper yarn from parchment paper is woven into belts for driving light machinery. According to *Zeitschrift für angewandte Chemie* for August 2, when treated with 1 per cent. solution of tannin the yarn is rendered soft and flexible to the touch and its strength increased by 49 per cent. The addition of gelatine gives a hard, firm touch to the yarn and an increased strength of 25 per cent. When wet its strength is reduced by only 15 per cent. Neutralised aluminium acetate added to the tannin solution gives the yarn a strong, elastic touch and increases its strength 44 per cent. The average water-content of the yarn is about 38 per cent.

Elektrotechnische Zeitschrift for August 20 gives particulars of a number of new scientific institutions in Germany to improve the methods of using raw materials for industrial and war purposes. The Kaiser Wilhelm Institute for Research on Iron will deal with scientific research on iron. An institute bearing a similar title will deal with the selection of suitable research workers and the provision of grants to enable them to carry on their work. There is a further institute for biological science. A research institution for lignite and mineral oil is attached to the Technische Hochschule, Berlin, towards the cost of which 750,000 marks have been subscribed; while a parallel institute has been affiliated with the Royal Mining Academy of Saxony, the work at which will include research on ferro-alloys and calcium carbide. The Kaiser Wilhelm Institute for Military Science will work in conjunction with the best scientific and military experts to promote the development of science and technology for war purposes. There will be sections for chemical raw materials for munitions, chemical war materials (powder, explosives, gases, etc.), physics (which will include ballistics), technical methods of transportation, aeronautics, etc. South German textile manufacturers have founded an institution for textile research. Present investigations at this institution are concerned with all kinds of paper, cellulose, and fibres for textile purposes.

THE September issue of the Proceedings of the Tokyo Mathematico-Physical Society contains a paper by Mr. M. So on some interesting observations he has made in the physical laboratory of the Tokyo Electric Co. on the annealing of glass. In the first instance a newly drawn glass fibre is heated slowly in an electric furnace and its length observed. It increases as the temperature rises, but at a temperature in the neighbourhood of 400° C. it begins to contract, and at about 500° C. becomes plastic. Next, when a short cylinder of the glass between crossed Nicols is heated, the interference rings show little change until a temperature of 400° C. is reached, and then widen and disappear at about 500° C. Lastly, when the glass is slowly heated or cooled, the curve of temperature change shows that over the plastic range of temperature there are absorption and liberation of heat, proving that some change of state of a constituent of the glass takes place at that temperature. The first two effects vary with the nature of the glass, and are not exhibited by annealed specimens. The third effect is found in both annealed and unannealed glass.

IT is well known that the changes effected in the surface of glass that can be revealed by the deposition of moisture or by using the glass as the basis of a photograph, and in other ways, are sometimes very persistent. Mr. J. H. M. Davidson, of Adelaide, records in the *British Journal of Photography* for November 1 a "To Let" notice originally

painted in whiting and water that has survived for more than twenty-five years, in spite of the window-cleaning that it has been subjected to. He suggests that the effect is due to molecular changes. Mr. Julius Rheinberg says that his experiments "made during the last years on the introduction of metals into the surface-layer of glass have convinced him more and more that we should regard glass as a substance full of *ultra-microscopic* pores." He suggests that material left in these pores, which would sometimes resist cleaning processes, may form the nuclei or condensation centres when the latent image is rendered visible. Mr. Rheinberg is well known among men of science interested in microscopical and photographical matters, and as he is the maker of the graticules and micrometer and other scales exhibited at the British Scientific Products Exhibition recently arranged by the British Science Guild, his opinion is of special interest. Some of these scales, etc., have the gradations made photographically in untarnishable metal *in* the surface-layer of the glass itself, and thus need no cover-glass to protect them.

THE stoppage of supplies of organic developing agents from Germany led to the supply of many "metol substitutes." Several of these have been examined in the research laboratory of the Eastman Kodak Co., and they have communicated their methods of analysis and some typical results to the *British Journal of Photography* for November 8. Some contained a small proportion of metol. One contained metol 10 per cent., hydroquinone 18·5 per cent., the rest being cane-sugar and sodium sulphite. Another was simply pyrogallol with three times its weight of sodium sulphite. Some were boldly labelled "metol" without the word "substitute." Two such did not contain a trace of methylated product, though one was labelled "hydrochloride of methyl-*p*-amino-*m*-cresol, guaranteed 96·3 per cent. pure." Another was half hydroquinone, and contained sodium sulphite, potassium iodide, and sodium carbonate. Of developing agents that did not claim any special relationship to metol one was half starch and moisture. There is also given a long list of adulterants and useless additions that Dr. H. T. Clarke, the analyst, has found in various commercial developing agents. Although such stuffs as those mentioned may be on the market, there is no need to use them, because reputable firms are making the genuine developing agents and marketing them under their proper names. But it behoves those who use developers to be on their guard.

A FEW months ago Messrs. Pictet and Sarasin described the production of lævoglucosane by the distillation of cellulose or starch under diminished pressure. This body is of interest, since it can be converted into *d*-glucose and thence into alcohol. In *Helvetica Chimica Acta* (No. 3) M. Pictet shows that the reverse process is possible up to a certain point, lævoglucosane being readily transformed into dextrin by re-polymerisation. This change is brought about by simply melting the lævoglucosane in the presence of platinum black, which acts as a catalyst; the transformation is complete in a few minutes. As regards the product, this approximates to certain of the achroodextrins, but has a notably lower rotatory power. In the same number of the *Acta* there is another interesting instance of catalytic action. M. F. Reverdin shows that the benzoylation of certain aromatic derivatives is greatly facilitated by carrying out the operation in the presence of a small quantity of sulphuric acid. Resorcin, alizarin, amino-anthraquinones, and trinitro-*para*-anisidine are some of the compounds which can thus be readily benzoylated.

OUR ASTRONOMICAL COLUMN.

THE PLANET SATURN.—This attractive telescopic object is now coming favourably into view in the evening hours, rising on November 25 at 10h. 34m. and on December 25 at 8h. 35m. p.m. The southern surface of the rings is visible, but the angle subtended by the minor axis is growing less as the planet's motion is directed southwards.

Surface phenomena, of somewhat similar nature to those affecting Jupiter, are visible on Saturn, but are more difficult to detect, and probably less frequent in their manifestation. Further study of the markings is desirable, and especially with regard to their rates of motion in different latitudes. Mr. Denning writes that from a number of white and dark spots placed in the planet's north temperate zone in 1903 he deduced a mean rotation period of 10h. 37m. 56·4s. This differs considerably from the period ascertained from a white equatorial spot seen by Prof. Asaph Hall in 1876–77, which gave 10h. 14m. 23·8s. In 1793–94 Sir W. Herschel made some observations of certain inequalities in a southern quintuple belt on Saturn, and found the period 10h. 16m. 0·44s. If any spots or other irregularities in the belts are detected during the few ensuing months, their transit times across the central meridian should be taken with the view of redetermining the rate of rotation. During the remainder of the present year the planet will be in a position about $1\frac{1}{2}^{\circ}$ from Regulus in Leo, and the configuration will be an attractive one for naked-eye observers.

THE ORIGIN OF COMETS.—Prof. Strömgren contributes an article on this subject to *Scientia* for August last. For some years past he has been studying the effect of planetary perturbations on those comets for which hyperbolic orbits have been found; his conclusion is that the excess of the eccentricity above unity can in all these cases be explained by the perturbations—in other words, that the primitive orbit was elliptical, and that the comets in question are original members of the solar system, not visitors from without. This conclusion is indeed fairly obvious *a priori*, since the relative velocities of the stars are of the order of several miles per second, and any body entering the sun's sphere of influence with such a speed would have an orbit of a decidedly hyperbolic character, whereas the eccentricity of the orbits in question is very little in excess of unity.

The remainder of the article is occupied by speculations on the cause of the prevalence of elliptical orbits of immense periods; the conclusion is that the matter now forming the planets and comets was formerly distributed as a diffused nebula over a region immensely larger than that bounded by the present planetary orbits, but excessively tenuous in the outer portions; any slowly moving fragments in these outer regions would approach the centre under gravity, their orbits being long ellipses, almost parabolic. Prof. Strömgren makes a novel suggestion to explain the absence of cometary matter in the interstellar spaces. It is now generally accepted that there is a tendency to equipartition of energy among the stars, the smaller masses having the greater speeds. On this view small cometary masses would attain such high speeds that they would be expelled from the stellar system; those alone would remain that were within the domains of individual stars.

MINOR PLANETS.—The fifth planet of the Trojan group, discovered last year and designated 1917 CQ, was reobserved by Prof. Wolf on October 5. Its magnitude was 14·5. Prof. Wolf has given it the name Priamus.

THE OCCLUSION OF GASES IN METALS.

ON Tuesday, November 12, the Faraday Society held a discussion on the above subject, attended by a very representative gathering of the various aspects of it, theoretical and experimental. After a foreword by the president, Sir R. Hadfield, on the great war, the discussion was opened by Prof. Alfred W. Porter, who emphasised that the term "occlusion" includes, in reality, a number of phenomena: chemical combination, simple or compound solid solution, surface adsorption accompanying solution, surface condensation unaccompanied by solution, and inclusion of gas forming blowholes visible to the naked eye or microscope. The difficulty of distinguishing between these several types was illustrated by the case of the occlusion of hydrogen by palladium, the nature of which, even at the present day, is still an unsettled problem. Amongst phenomena due to occlusion are the passivity of iron and the associated fact of the embrittling of iron by caustic soda. But there are other phenomena of more theoretical interest, such as the Volta effect, which has often been attributed to condensed layers of gases. By the experiments of O. W. Richardson and of Langmuir on thermionic emissivity, the question of the origin of the Volta effect has been completely reopened.

In connection with the brittleness associated with occlusion in iron and other metals, the opener endeavoured to elicit an expression of opinion as to the nature of brittleness, illustrating his remarks with the well-known behaviour of cobbler's wax, which is exceedingly plastic under the action of small forces of long duration, but is as brittle as glass when struck a sharp blow. He laid stress on the necessity for paying attention to the time element in specifying brittleness.

Mr. Cosmo Johns followed on the technical side with a paper on the properties of metals as affected by their occluded gases. He distinguished between gases which are absorbed as such and those which are formed as a result of reactions between non-gaseous constituents during the cooling of the metals in question. It is known that molten copper and iron dissolve more hydrogen than when those metals are solid. A molten mass saturated with hydrogen at a particular partial pressure will, during freezing, become supersaturated with the gas. Some of this must be entrapped between the growing crystals and exist as macroscopic or microscopic gas enclosures, though this is probably not the only method by which occlusion occurs. Probably it is the inter-crystalline, amorphous matter that is chiefly concerned, and brittleness will be due to the change in this produced by the gas. He attributed the CO_2 and CO occluded to reactions between dissolved oxide of iron and the carbon in the steel at the particular temperature when iron oxide, being thrown out of solution as freezing progresses, becomes concentrated in the mother-liquor between the growing crystals and reacts with the carbon which has not suffered the same concentration. He urged that all our knowledge of the properties of metals merely relates to metals containing occluded gases, and not to pure metals themselves.

Dr. Thomas Baker gave a description of experiments made to discover the relation, if any, between the temperature of evolution of gas and the critical points of steel. He finds that with hard steels the evolution of hydrogen reaches a maximum rate at 600° C., and below this temperature constitutes the greater part of the gas given off. Carbon monoxide is slowly evolved from the beginning, and reaches its maximum rate at 688° C. With soft steel there is a further point of maximum evolution of hydrogen and carbon monoxide at 786° C.

Dr. McCance spoke on the balanced reactions in steel manufacture, particularly with reference to the open-hearth process. Dr. Hatfield pointed out the large influence which silicon has upon occlusion.

Dr. Rosenhain emphasised that all liquids are brittle, but, as the opener afterwards pointed out, it would be better to say all bodies. Mr. C. V. Boys, referring to the spitting of silver on solidification, stated that he had found that to avoid loss of silver through spitting in cupellation it was necessary to cool it very slowly; and he asked if this was due to the evolution taking place over a range of temperature, and not all precisely at the solidification point. It could not be due to differences of temperature in the solidifying mass, because a considerable amount of undercooling takes place, and the solidification, when it occurs, is a very rapid process, the whole mass rising practically instantaneously to the melting-point.

Sir T. K. Rose dealt with the bearing of Le Chatelier's principle upon the change of the concentration of dissolved gases with temperature. Prof. N. T. M. Wilsmore pointed out that he had recently observed that the diminution of solubility of gases with rise of temperature, so far as data go, is peculiar to water as solvent, and that, even in the case of water, there seems to be a minimum at a moderate temperature (see the data in the last edition of Landolt-Börnstein). This important observation is quite contrary to the belief usually held. The exceptional character of water may be attributed to the variation in its degree of association.

Prof. H. E. Armstrong laid stress on the artificiality of distinguishing dissolution from combination; dissolution *is* combination.

Dr. R. E. Slade directed attention to the bearing of the eutectic point of $Ag—Ag_2O$ at about 6° below the melting-point of silver; and Drs. Harker and Rayner described interesting experiments with very large masses of molten silver.

Dr. Gwyer was in doubt as to the reason for the proportionality of solubility in some cases to the square root of the pressure, apparently omitting to notice the bearing of the Nernst-van't Hoff law of distribution when the molecular association is different in the free and dissolved states.

Many other interesting points were made by various speakers. The openers reserved their detailed replies to the printed discussion, where these points will be dealt with.

GEOLOGY OF THE PERSIAN OILFIELDS.

AN interesting paper on the geology of the Persian oilfields by Messrs. H. G. Busk and H. T. Mayo was read at the meeting of the Institution of Petroleum Technologists on October 15. Three areas are treated: the Bakhtiari country, in which the only oilfield worked as yet is situated; the Ahwaz-Pusht-i-Kuh country; and the Qishm Island and Persian Gulf region. The first of these is described in most detail. The rocks are divided into three series: The Asmari, Eo-cretaceous, at the base consists of massive limestones 2000 ft. or more in thickness. It is succeeded by the Miocene Fars series, more than 7000 ft. thick, divided into three groups: the lower, formed of some 3500 ft. of massive gypsum, shales, clays, and intercalated beds of detrital limestone; the middle, 1000 ft. of clays, shales, intercalated gypsum, limestone, and sandstone; and the upper, 2700 ft. of clays, shales, and intercalated red and brown sandstones. The Fars series is overlaid by the Bakhtiari series of Pliocene age, of which the lower group,

13,000 ft. or more of clays, sandstone, and conglomerate, is regarded as of lacustrine origin; and the upper, 2000 ft. of massive conglomerates, as torrential. The oil is found in the lower Fars group, the detrital limestones forming the reservoir; at Maidan-i-Naftun the wells all flow under strong pressure, and after ten years of remarkable production show no signs of exhaustion.

The geological history of the region seems to be one of extraordinary interest. The strata, from the base to the top of the Fars series, were deposited in a quiescent basin, and the thickness of beds between different horizons remains very constant. At the close of the Fars period folding began; the strata were thrown into open folds, and the overlying Bakhtiari series varies greatly in thickness, being thickest in the synclines, and least over the anticlines; towards the close of the period the synclines became filled up with sediment, and the upper Bakhtiari conglomerates spread over the whole. Then, according to the authors, a series of earth movements set in, continuing to the present and giving rise to a very complicated series of structures; fan, or, as they call it, Omega, structure was developed, and a series of thrust-faults which came right up to the surface and were partly determined by accidents of surface relief. In some cases the folds are completely overlaid by one overthrust extending beyond the next, and at Maidan-i-Naftun this is said to have been prevented only by the action of the Karun River, which flows for some miles in a gorge 800 ft. deep between the Tembi thrust-fault, which hades towards the oilfield on one side, and the back fault of the next fold, which hades in the opposite direction. The authors believe, in short, that the faulting and folding of this region were not only superficial, but also of recent date and continued, with a gradual relaxation, to the present day; they regard the surface features as largely due to the movements caused, to some extent, as determining this faulting, and consider that the advancing fronts of the overthrust blocks have been worn away by surface denudation, concomitantly with their advance by the action of the tectonic processes.

The Ahwaz-Pusht-i-Kuh region presents much the same features, with less intense disturbance; but in Qishm Island the identification of the rock series with that of the Bakhtiari country is doubtful, and the structure is very different, the rocks being disposed in a series of gentle domes along an axis running through the length of the island, these domes being subsidiary to a larger dome, exposing an inlier of the Eocene Hormuz series. Four explanations of this dome are discussed: that it is due to the intersection of two open folds of different dates, that it is of the same nature as the salt domes of Texas, that it is due to a laccolitic intrusion, and that it is due to the compression of the softer Miocene strata against a pre-existing boss of Eocene, round and against which they were deposited. No opinion is offered as to the relative probability of these, but the general features seem more in consonance with some cause analogous to the second and third, though the material to which the local uplift was due may have been neither salt nor a plutonic intrusion. Neither this nor the Ahwaz-Pusht-i-Kuh district has proved oil-bearing in a commercial sense, though indications have been found and both are being tested.

We may express a hope that, the absolute embargo on publication having been lifted, more of the large amount of geological information which is in possession of the Anglo-Persian Oil Co. and of the Indian Government may be made accessible. There can be no commercial reason for secrecy, as the company has a monopoly of the whole country, and the political reasons have been largely, and may soon be completely, removed. The value of publication will be great, as the region is one of extraordinary interest both in its structural aspect and as regards its bearing on the principles which underlie the origin and distribution of petroleum.

THE CONSTITUTION OF THE EARTH'S INTERIOR.[1]

THE problems of the interior of the earth are primarily of a physical character, and, in the final appeal, only to be decided by mathematical treatment; but this, in its turn, must be based on observation, and, therefore, it comes that this discussion is prefaced by a statement of the results which have been obtained by the sciences of observation. The preparation of this statement is simplified by the fact that the problems fall naturally into two tolerably distinct groups: (1) those relating to the outermost layer, amounting at most to 1 per cent. of the radius, and (2) those of the deeper portions, extending to the centre.

The latter may be taken first. Records of the transmission of mass waves set up in connection with earthquakes show two well-marked groups representing two forms of wave-motion, presumably the longitudinal and transverse, and a steady increase of the rate of transmission, with no very marked break in regularity, up to a distance of about 120° from the origin. Beyond that the first phase, of longitudinal waves, shows a decrease in velocity, and the second phase, of transverse waves, which, though so conspicuous at lesser distances, are no longer represented in their typical form, but are replaced by a record of different character, probably not due to any form of wave which has followed the direct path from the origin, and markedly delayed from the time at which they should have arrived had the same relative rate of propagation been maintained as at lesser distances. The depth reached by waves emerging at 120° from the origin is about half the radius from the centre of the earth, and the conclusion to be drawn is that down to that depth the material of which the earth is composed is sufficiently rigid against stresses of short duration, and sufficiently isotropic to permit the transmission of the two forms of elastic waves and to give rise to their separation by reason of the different rates of travel. Further, it seems that down to a depth of half the radius there is no marked change in the character of the material, but at greater depths there is a change in physical character to a material, or form of matter, which is no longer able to transmit the distortional waves, or, if capable, can only do so with a great diminution of intensity and at about half the rate in the lower layers of the outer shell; in other words, the material in the central nucleus has a very low degree of rigidity, even against stresses of only a few seconds' duration. The limit between the central nucleus and outer shell lies between four-tenths and five-tenths of the radius, measured from the centre of the earth; the transition between the two is apparently gradual, and not sufficiently abrupt to give rise to reflection of the waves at the junction of the two.

Turning to the outer layers, we have, next the surface, partly material which has been disintegrated by the processes of surface denudation, transported, deposited, and resolidified, and partly rock which has not undergone these processes, but is thoroughly cooled and solid in every sense of the word. These

[1] Synopsis of the opening of a discussion at a meeting of the British Association Geophysical Committee on November 19, by R. D. Oldham, F.R.S.

rocks have been subject to very considerable mass-movements and deformation, the displacements amounting in extreme cases to as much as ten miles in the vertical and one hundred miles in the horizontal direction. The ultimate cause of these movements is unknown; they can only be directly observed in the outermost skin, and are probably taken up in a different form in the deeper layers, but require that beneath the outer solid layer—which for convenience, and because some name is required, is commonly called the crust—there must be material which has some of the properties of a fluid, but not necessarily more than the power of change of form when exposed to stress of sufficient magnitude and duration. The thickness of the outer crust has been estimated by several distinct lines of deduction, all of which agree in giving a figure of about twenty-five miles, and this may be taken as indicating the order of its magnitude. The only means of arriving at any idea of the nature of the transition from the crust to the underlying material is in the reflection of earthquake waves; this is ordinarily treated as taking place at the surface of the earth, but there are grave difficulties in the way of accepting this interpretation. A more probable one is that reflection takes place at the under-surface of the crust, indicating a somewhat abrupt transition from the solid and rigid crust to the more yielding layer below. Whether this is a separate layer or merely the outermost part of the shell capable of transmitting both forms of elastic waves is still unknown.

The general result is that three distinct divisions can be recognised in the interior of the earth:—(1) The outer crust of solid matter possessing a high degree of rigidity, whether against permanent or temporary stress, of comparatively small thickness amounting to about $\frac{1}{2}$ per cent., and not more than 1 per cent., of the radius; (2) a shell of material of thickness about one-half of the radius which has a high rigidity as against stress of the duration involved in the production of the tides, or of shorter duration, but, in the outer part at least, a comparatively low power of resistance to stress of secular duration; and (3) a central nucleus of material which has a very low degree of rigidity, even against stress of only a few seconds' duration. The transition from the first to the second of these three divisions is somewhat abrupt, sufficiently so to give rise to reflection; between the second and third the passage is more gradual, and lies at about four-tenths or five-tenths of the radius from the centre of the earth. These three divisions may be further reduced to two—the outer layer, which in geology is known as the crust, not from any implication of the nature of the rest of the earth, but merely in recognition of a difference in character; and the central core, consisting of the rest of the earth.

HYDRO-ELECTRIC POWER SUPPLY.[1]

LARGE works have been established for supplying Bombay with water-power for its numerous mills and factories, which have hitherto used steam-power, to the extent of more than 100,000 h.p. Coal in most of India is too expensive to allow competition with other countries for many products, though the raw materials are grown or found in India, and labour is cheap and docile, while highly educated Indians abound. To Bombay coal has mostly to be carried about 1200 miles.

The water-power now provided is very much cheaper than power from coal or oil, gives a better "drive," and frees Bombay from the clouds of deleterious smoke which the poor Indian coal gives.

The works take advantage of the very heavy rainfall on the precipitous edge of the Western Ghats, about 2000 ft. above, and about forty miles from, Bombay. As the rain falls only during three or four months of the year and the watercourses are dry all the rest of the year, it was necessary to store water sufficient to give about 100,000 h.p. for ten or twelve hours a day during about nine months of the year.

Three lakes are formed by four masonry dams, ranging from nearly $\frac{3}{4}$ mile long and $34\frac{1}{2}$ ft. high to nearly $1\frac{1}{2}$ miles long and 96 ft. high. Two of these form a "monsoon" lake of sufficient capacity to provide power during the longest "breaks" in the monsoon, and thus give an uninterrupted supply of power for three months and more. The other lakes are for storage, and maintain the power during the eight or nine months in the year when no rain falls.

The monsoon rain on the Western Ghats, though always heavy, is very variable in amount. The least annual amount during the last forty-eight years was 82 in. on the edge of the Deccan plain, and the greatest amount during the past eleven years, in which special gauges have been fixed, on hilltops as well as in plains, is 546 in., which fell in a little more than three months, 460 in. falling in about two months. The minimum fall of 82 in. is very exceptional, and the maximum given may be equally so. The combined available capacities of the two storage lakes is about 10,100,000,000 cubic ft., whilst the water required to give 100,000 h.p. ex turbines for nine months, allowing for the great loss by evaporation and by soakage and for friction in the pipes and turbines, is 6,700,000,000 cubic ft. The excess capacity is given owing to the very variable amounts of the monsoon rains, so as to carry on the balances in years of excessive rainfall to make up for the occasional short monsoons. It was arrived at by assuming the works had been completed forty years ago, there being one rain-gauge record covering that period—which includes four minimum years' fall—and deducting from each year's supply the amount which would have been used, lost by evaporation, run to waste, or carried on to the next year, which gives the excess capacity required for a sufficient number of years.

The amount of 546 in. measured at one hill station in the lakes catchment is not more than has been measured in two or three out of the past fifty odd years at Cherrapunji, in the Assam Hills, which has the heaviest rainfall hitherto known; but there rain falls during seven months of the year, so that the amount measured for this work for that particular year may claim to be the heaviest rainfall ever yet measured.

The works are notable for the following reasons:—They are the largest of the many similar hydro-electric works which have been constructed during the past ten or twenty years, taking into consideration the great head used, combined with the large discharge of water. The first is equal to about five times the height of St. Paul's Cross, and the latter is greater than the summer flow of the River Thames during five months. They are also the first works to store water for power for use during about three-fourths of the year. One of the masonry dams, taking the exposed face area, is probably the largest yet constructed. The works are probably unique, considering the very heavy rainfall and the very steep rocky slopes, giving the greatest discharge perhaps ever recorded. The catchment area of the two lakes is only $16\frac{1}{2}$ square miles, while of this the full lakes area is about $7\frac{1}{2}$ square miles.

The water is led from the monsoon lake and from

[1] Abstract of a paper on "The Tata Hydro-electric Power-supply Works, Bombay," by Mr. R. B. Joyner, read at the Institution of Civil Engineers on November 19.

the two storage lakes, which are joined together by a tunnel a mile long, by two ducts, together 4·63 miles long, to the forebay at the top of the great precipitous scarp which forms the western boundary of the Deccan plateau. From there the two lines of steel pipes are taken down the steep slopes and precipices to the power-house, about 1750 ft. below the forebay, the length of single line being about 2·33 miles. The pipes at the top are 82½ in. in internal diameter, and at about two-thirds of the total height down the diameter is 72 in. Here they are joined by a double swan-neck pipe, from which eight smaller pipes are led down to the power-house, their diameter being 3½ ft. at the top, and 3 ft. 2 in. at the bottom. The thickness of the metal at the top of the large pipes is ⅜ in., and at the bottom of the small pipes 1¼ in.

Each of the lower smaller eight pipes supplies a Pelton-wheel turbine, designed to give a maximum of 13,500 h.p. with automatic regulation devices.

The works described are the first to be undertaken of a number of similar works proposed by the author, he having shown that it is financially possible in India to store water for use during eight or nine months of the year, and give power at a much cheaper cost than by the use of coal, oil, or spirit from vegetable products; likewise cheaper than power from the wind, sun, or tides. Not only that, but the water after use is available for irrigation, so valuable in a country without a drop of rain for a large part of the year. This would ensure the growth of the raw materials required for finished products on which the country is now so dependent upon other countries. It would also supply the factory workers or others with food and drink, and help to prevent famines, besides doing much to regularise the rainfall. Such power will provide electric traction for raw materials to, and finished products from, the factories, as well as light for them and neighbouring towns, produce fertilisers, and give the great heat required for the smelting of ores. Many industries would then be self-contained, and India could compete with Europe, America, or Japan for its finished products, and would become less dependent upon its agriculture, which the varying seasons render somewhat capricious.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

EDINBURGH.—The University, which as yet has no professor of geography and only one lecturer on the subject, as compared with three professors and five lecturers in branches of history, has recently so far recognised its growing importance as to institute a diploma in geography, based on regulations involving a thorough and far-reaching study of certain aspects of geographical science. The diploma is intended for graduates in arts or science prepared to devote an additional *annus academicus* to the subject, and capable of passing an examination of somewhat high standard. The limited number of courses in pure geography available in the University under present conditions has made it necessary to have recourse extensively to other departments, and the aim of the regulations appears to be to induce students to specialise either in historical and economic geography or, but less markedly, in mathematical geography. A special feature is the stress laid upon economic ethnography, defined as the study of the influence of geographical environment on the life of the most important peoples. The regulations give much less scope to graduates whose tastes lie in the direction of physical geography in the wide sense, and, in view of the contributions which Scotland has made to oceanography and meteorology, it is remarkable that neither of these subjects finds a place in the list. Further, geology, which, especially in its physical aspects, has always had so many adherents in Scotland, is represented only by one optional course, and, like general geography, does not appear among the subjects of the diploma examination; nor does any branch of biology find a place there. Should it be found possible later to enlarge the department by the addition of new lecturers, the present diploma might fittingly become one in economic geography.

THE Aitchison memorial scholarship, founded in memory of the late Mr. James Aitchison, and tenable at the Northampton Polytechnic Institute for two years, 1918–20, has been awarded to Mr. V. C. Milligen, Goodmayes, Essex.

WE learn from the *Times* that the council of Clifton College has just received the sum of 1000*l.* from an old Cliftonian, Mr. W. J. Leonard, for the establishment of a leaving scholarship to Oxford and Cambridge in chemistry, physics, or biology, in memory of the mastership at Clifton of Mr. T. W. Dunn, assistant master and house master at Clifton from 1868 to 1878. While the scholarship is to be given to enable boys of good promise to pursue the study of natural science at the old Universities, it is only to be awarded to a candidate who has been in the sixth, or at least the fifth, form on the classical side.

THE Labour Party at its meeting on November 14 at the Royal Albert Hall to open the election campaign of the party adopted the programme drawn up by its executive committee. Of the twenty demands contained in the manifesto one deals with education, and runs as follows:—"A national system of education, free and effectively open to all persons, irrespective of their means, from the nursery school to the university; based on the principle of extending to persons of all ages, without distinction of class or wealth and without any taint of militarism, genuine opportunities for the most effective education on a broad and liberal basis, and the provision for teachers of all kinds and grades of salaries, pensions, training, and opportunities of advancement commensurate with the high social importance of their calling." No exception can be taken to the reasonableness of the ideals inspiring this statement, but it must be borne in mind frankly that not every boy and girl can benefit from a course of higher education, and that all that it is wise to insist upon is that every child shall have the opportunity of developing his intellectual powers to their fullest extent, and that social distinctions shall not be a bar to merited educational advancement.

A REPORT on the work of the Manchester Municipal College of Technology for the years 1913 to 1918 has just been published. The issue of annual reports was interrupted in 1914. The college has made its principal contribution to the task of winning the war by supplying the Army and Navy with men whose character and intelligence owe a great deal to their university training. It has supplied to the Royal Engineers, as well as to the technical branches of the Navy, Army, and Air Force, men whose training as engineers, chemists, or other technologists has enabled them to render effective service. In addition to supplying men, the college has undertaken war-work of different kinds. So great, indeed, have these new activities been that, despite the large reduction in the number of students, more research work has been done in the college during the past four years than in any other equal period of its history. The buildings and equipment have been improved in various ways during the period under review. In the

summer of 1916 five new research rooms were equipped. Of these the most important is the new coal-tar products and dyestuffs research laboratory, furnished with a specially constructed electrically heated oven for giving variable and positive degrees of temperature. The increase in the expenditure of the college has been partly met by larger Government grants. In the year 1910–11 the grant received amounted to 11,895*l.*, while that received during 1915–16 was 16,646*l.*, including a special war grant of 1250*l.* Since 1902 commercial tests and investigations which could not be carried out elsewhere in or near Manchester have been undertaken by the college. The financial value of this work in 1914 was 398*l.* 14*s.* 6*d.*, whereas in 1917 it reached 2946*l.* 6*s.* 6*d.*

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 14.—Sir J. J. Thomson, president, in the chair.—A. **Mallock**: Sounds produced by drops falling on water.—G. H. **Hardy** and S. **Ramanujan**: The coefficients in the expansions of certain modular functions.—The Hon. R. J. **Strutt**: The light scattered by gases: its polarisation and intensity.—Dr. F. **Horton** and Ann C. **Davies**: An investigation of the ionising power of the positive ions from a glowing tantalum filament in helium. The ionising power of the positive ions from a glowing tantalum filament in helium has been investigated by a modification of the method due to Lenard. The positive ions were accelerated through a piece of platinum gauze into the ionisation chamber, and were there retarded by an opposing potential difference between the gauze and a movable collecting electrode, this retarding potential being constant during a series of experiments, and always greater than the greatest accelerating potential used in that series, so that none of the positive ions reached the collecting electrode. It was found that an increasing current was obtained in the ionisation chamber (the electrode collecting a negative charge) when the potential difference accelerating the positive ions was gradually raised above 20 volts. This result is similar to that obtained by Pawlow, and by Bahr and Franck, who concluded that helium atoms are ionised by the collisions of positive ions moving with 20 volts velocity. The experiments described in the paper have shown that the observed increasing current, with increasing accelerating potentials above, about 20 volts, is mainly due to the positive ions liberating electrons from the walls of the ionisation chamber which they bombard, and that the positive ions do not ionise the helium atoms even when they collide with velocities up to 200 volts.

Physical Society, October 25.—Prof. C. H. Lees, president, in the chair.—Discussion on the case for the ring electron. Dr. H. S. **Allen** discussed the arguments in favour of an electron in the form of a current circuit capable of producing magnetic effects. Then the electron, in addition to exerting electrostatic forces, behaves like a small magnet. The assumption of the ring electron removes many outstanding difficulties:—(1) There is no loss of energy by radiation as in the case of a classical electron circulating in an orbit. (2) Diamagnetic atoms must have a zero resultant magnetic moment. This is difficult to account for with electrons in orbital motion. (3) The ring electron gives a good explanation of the facts of paramagnetism, including the experimental results of K. T. Compton and Trousdale, and of A. H. Compton and O. Rognley obtained by X-ray analysis. (4) The asymmetry of certain types of radiation can be accounted for (A. H. Compton). (5) The effect of the magnetisation of iron upon its absorption coefficient for X-rays observed by Forman is explained. (6) The small amount of ionisation of gases produced by X-rays may receive an explanation. (7) Grondahl claims to have found evidence for a magnetic electron in certain thermo-electric effects. (8) Webster has given a method of deducing Planck's radiation formula by making certain assumptions as to the internal mechanism of Parson's "magneton." (9) It is suggested that Bohr's theory as to the origin of series lines in spectra may be restated so as to apply it to the ring electron. The essential points of the quantum theory and Bohr's equations may be retained, even if his atomic model be rejected. (10) If radiation is due to pulsations in a ring electron, the Zeeman effect may be deduced by reasoning similar to that first employed by Lorentz. (11) The scattering of streams of electrons from the sun due to electrostatic forces would be to some extent diminished. (12) Parson has shown that many of the problems of chemical constitution and stereochemistry may be solved by a magneton theory of the structure of the atom. *Stationary* valence electrons are possible. (13) The forces of cohesion in a solid are similar in nature to chemical forces, both sets of forces having an electromagnetic origin. The questions of the mass and magnetic moment of such a ring electron were discussed. It was pointed out that the adoption of this hypothesis would lead naturally to the acceptance of an atomic model with a magnetic core, as previously suggested by the speaker.

Mineralogical Society, November 5.—Sir William P. Beale, Bart., president, in the chair.—Dr. G. F. Herbert **Smith** and Dr. G. T. **Prior**: A plagionite-like mineral from Dumfriesshire. Specimens of antimony-lead ore collected by Lieut. Russell from Glendinning Mine contained small cavities lined with tiny black crystals, measuring less than 0·4 mm., and mostly less than 0·2 mm., across. Some resembled in habit the crystals of plagionite from the Hartz Mountains described by Lüdecke. Measurements made on the three-circle goniometer showed the crystals to belong to the semseyite end of the group, and the result of a chemical analysis of the compact material of which the crystals form part corresponded approximately with the formula $5PbS.2Sb_2S_3$. Semseyite has not previously been recorded from the British Isles.—Lieut. A. **Russell**: The chromite deposits in the Island of Unst, Shetlands. The bottle-shaped mass of serpentine which runs through the centre of the island from north to south contains chromite uniformly distributed, but varying greatly in character, being at times massive, but generally granular. More than thirty quarries are known, but only six of them have been worked to any extent. The associated minerals include kämmererite (abundant in one quarry), uvarovite, copper, hibbertite, brucite, calcite, talc, and magnetite. The rocks other than the serpentine are poor in minerals.—Dr. G. T. **Prior**: The nickeliferous iron of the meteorites of Bluff, Chandakapur, Château Renard, Cynthiana, Dhurmsala, Eli Elwah, Gnadenfrei, Kakowa, Lundsgård, New Concord, Shelburne, and Shytal. The percentage of nickeliferous iron and the ratio of iron to nickel in the several instances were found to be respectively 5, 6½; 8, 0; 8½, 6½; 6, 6; 3½, 3½; 6½, 7½; 21½, 12½; 8, 6; 8½, 7; 10, 8; 10½, 10; 7½, 6½.

Zoological Society, November 5.—Prof. E. W. MacBride, vice-president, in the chair.—Dr. J. F. **Gemmill**: The cause of the ciliary action in the internal cavities of the Ctenophore (*Pleurobrachia pileus*).—Dr. R. T. **Leiper**: Diagnosis of helminth

infections from the character of the eggs in the fæces. Dr. Leiper stated that, by examination of the fæces of a living animal, the extent and specific nature of most helminthic infections could be accurately determined, and the method had been applied successfully as a routine practice in the case of man, rabbit, dog, cat, and pig, and was apparently capable of indefinite extension. The eggs of parasitic worms were constant in character and of great systematic importance. The ground-plan of the eggshell indicated the genus, or even subfamily, to which the parasite belonged, and specific differences were found in slight but constant peculiarities in relative length and breadth, and in the conformation of excrescences on the surface of the shell.—Dr. R. T. **Leiper**: The "new" rabbit disease. Examination of a large number of rabbits shows that the chief cause of mortality is a coccidial invasion of the intestinal wall or of the lining of the bile-ducts. According to Fantham and others, the causal agent in both types of disease is *Eimeria stiedae*, but Dobell holds that the intestinal lesion is due to a distinct species. In many cases changes in the liver attributed to coccidiosis were the result of infection with *Cysticercus pisiformis*, the larval stage of the dog tapeworm (*Taenia serrata*). Large swellings in the region of the head and neck, suspected to be cancerous, were due to *Coenusus serialis*, the larva of the dog tapeworm *Taenia coenurus*. Of relatively small economic importance are infections with the threadworm (*Oxyuris ambiguus*) and the tapeworm (*Ctenotaenia leuckarti*). There is some evidence that a bacterial infection may occasionally be the cause of death. The coccidial infections pass from infected to healthy animals through the fæces. When freshly passed, the coccidial oocysts are not infective. They only become so after a period of delay, in which certain developmental changes take place. These changes proceed more rapidly in dry than in wet fæces. Prevention depends upon the systematic periodical removal and destruction by burning of all pellets and contaminated bedding, and the use of some fluid which will destroy such oocysts as remain in the hutch. Although several cases of coccidial infection in man have been recorded, Dobell maintains that in none of these cases is *Eimeria stiedae* the causal agent. There would appear, therefore, to be no risk of infection to man. The cystic stages of the tapeworms of the dog appear to occur chiefly in those rabbits fed with dandelions and other greenstuffs collected from the roadsides, where the vegetation is especially liable to contamination with fæces of dogs which have acquired their infections from eating uncooked rabbit offal.

Linnean Society, November 7.—Sir David Prain, president, in the chair.—The late Dr. E. A. Newell **Arber** and F. W. **Lawfield**: The external morphology of the stems of Calamites, with a revision of the British species of Calamophloios and Dictyocalamites of Upper Carboniferous age. This paper dealt with the external morphology of Calamites and their reception into the new form genus—Calamophloios—previously erected by Dr. Arber. No systematic endeavour to differentiate specimens showing the external surfaces of Calamites has previously been made, although the attempt was long overdue. By further inquiry it was hoped to correlate the various species of Calamophloios with those species restricted to pith-casts, and a beginning had already been made in this paper.—Mrs. **Arber**: The "law of loss" in evolution. It appears to be a general rule that a structure or organ once lost in the course of phylogeny can never be regained; if the organism afterwards has occasion to replace it, it cannot be reproduced, but must be constructed afresh in some different mode. The author proposes to term this principle the "law of loss." This law is obviously not susceptible of direct proof, but an attempt is made to show that, if used as a working hypothesis, it throws light on a number of structural features the interpretation of which presents difficulties on other theories. Some time after the author had deduced the "law of loss" from a comparative study of living plants, she learned that zoologists had already arrived at very similar conclusions regarding vertebrates from a study of their palæontological history. Dollo's "law of irreversibility" covers much the same ground as the "law of loss." The fact that the same principle has been recognised independently for plants and for animals—in one case through a study of comparative morphology, and in the other through a consideration of actual historical evidence derived from fossil records—seems to be an indication of the validity of the law.

Mathematical Society, November 14.—Annual meeting.—Prof. H. M. Macdonald (retiring president) and afterwards Mr. J. E. Campbell (new president) in the chair.—Prof. H. M. **Macdonald** (retiring president): Presidential address.—Prof. M. J. M. **Hill**: The use of a property of Jacobians to determine the character of any solution of an ordinary differential equation of the first order, or of a linear partial differential equation of the first order.—Prof. H. J. **Priestley**: The roots of a certain equation in spherical harmonics.—J. **Hodgkinson**: A detail in conformal representation.—T. A. **Broderick**: The product of semiconvergent series.—Dr. W. P. **Milne**: A simple condition for co-apolar triangles.

EDINBURGH.

Royal Society, October 28.—Dr. Horne, president, in the chair.—The president delivered an opening address on the endowment of scientific and industrial research.—Dr. T. S. **Patterson** and Mr. K. L. **Moudgill**: Researches in optical activity: the temperature rotation curves for the tartrates at low temperatures. By the piecing together of evidence of different kinds, general temperature-rotation curves for the tartrates have been arrived at. These graphs show maxima and minima, and also a region of intersection. The influence of temperature changes, of change of solvent, of change of concentration, or of change of constitution appears to be to displace the whole series of graphs in one direction or the other, with, of course, accompanying minor alterations. The present paper describes the investigation of the temperature-rotation curves for tartrates at the low temperature end of the diagram, where a deep minimum is shown to exist.—Miss M. G. **Haseman**: Amphicheiral knots. This is a continuation of a former communication on amphicheiral knots, and contains, among other things, the description of two amphicheiral knots of twelve intersections which had formerly escaped notice.—Dr. C. G. **Knott**: Further note on the propagation of earthquake waves. Following up the investigations given in a former paper (see NATURE, February 21, 1918), the author directed attention to the curious sinuous form of seismic rays which emerge at an arcual distance of from 60°–80° from the epicentre, and reach a depth of about a quarter of the earth's radius. This sinuosity proves that in the neighbourhood of that depth the velocity of propagation, after increasing with the depth, begins to diminish, but this diminution does not seem to continue to greater depths.

MANCHESTER.

Literary and Philosophical Society, October 29.—Mr. W. Thomson, president, in the chair.—Prof. C. A. **Edwards**: The hardness of metals. Prof. Edwards gave an account of various methods of making hard-

ness determinations, and described a new apparatus which was designed for making hardness tests at high temperatures. He also gave data showing that the hardness of pure solid elements is a periodic function of their atomic weight.

SYDNEY.

Royal Society of New South Wales, September 4.—Mr. W. S. Dun, president, in the chair.—W. G. **Woolnough**: The Darling peneplain of Western Australia. The physiographic feature in Western Australia called by Jutson the Darling peneplain repeats in many respects the characters of the Blue Mountain uplands of New South Wales. It extends as a monotonous, laterite-covered plateau from the steep escarpment twelve miles east of Perth for nearly four hundred miles through the eastern goldfields. The monotony of the surface is interrupted by occasional hills representing residuals of a pre-existing plateau from which the Darling peneplain has been eroded, and by long, shallow valleys, forming the great wheat-belt of the State, which have been carved out of its surface by rivers.—Prof. C. E. **Fawsitt** and A. A. **Pain**: Experiments on the behaviour of iron in contact with sulphuric acid. The very slow action of concentrated sulphuric acid on steel is only accelerated to a moderate extent by dilution with several per cent. of water. For instance, 85 per cent. of acid has only a very slightly greater action than 94 per cent. of acid. The rate of action increases rather suddenly when diluting from 85 per cent. to 80 per cent. of acid, and again from 70 per cent. to 65 per cent. of acid. The electrical potential of iron with respect to concentrated sulphuric acid falls noticeably after the iron has been lying in the acid for a few minutes. The original potential is largely restored by exposing the iron for a few minutes to the air.—H. G. **Smith**: The resinous earth occurring at the head of the Nambucca River, N.S.W. This paper records the results of an investigation of the earth from two localities. It is shown that the ready ignition is due to the presence of the resin the earth contains. That it is of organic origin is indicated from the results of the analysis. The presence of nitrogenous products, as well as of phosphoric acid and a small amount of benzoic acid, also supports the conclusion.

BOOKS RECEIVED.

A Manual of Chemistry. Theoretical and Practical. Inorganic and Organic. By Dr. A. P. Luff and H. C. H. Candy. Sixth edition. Pp. xix+745. (London: Cassell and Co., Ltd.) 12*s.* net.

Petrol and Petroleum Spirits: A Description of their Sources, Preparation, Examination, and Uses. By Capt. W. E. Guttentag. Pp. xi+135. (London: E. Arnold.) 10*s.* 6*d.* net.

Surgery at a Casualty Clearing Station. By C. Wallace and J. Fraser. Pp. xi+320. (London: A. and C. Black, Ltd.) 10*s.* 6*d.* net.

Folk-lore in the Old Testament: Studies in Comparative Religion, Legend, and Law. By Sir J. G. Frazer. 3 vols. Vol. i., pp. xxv+569; vol. ii., pp. xvi+571; vol. iii., pp. xviii+566. (London: Macmillan and Co., Ltd.) 37*s.* 6*d.* net.

Civic Biology. By Prof. C. F. Hodge and Dr. J. Dawson. Pp. viii+381, with plates. (London: Ginn and Co.) 7*s.* net.

Projective Geometry. By Profs. O. Veblen and J. W. Young. Vol. ii. Pp. xii+511. (London: Ginn and Co.) 21*s.* net.

Industrial Electrical Measuring Instruments. By K. Edgcumbe. Second edition. Pp. xvi+414. (London: Constable and Co., Ltd.) 16*s.* net.

Junior Grade Science. By G. A. Watson. Pp. ix+181. (London: Macmillan and Co., Ltd.) 3*s.* 6*d.*

DIARY OF SOCIETIES.

THURSDAY, NOVEMBER 21.

ROYAL SOCIETY, at 4.30.—W. Stiles and Dr. F. Kidd: (1) The Influence of External Concentration on the Position of the Equilibrium attained in the Intake of Salts by Plant Cells; (2) The Comparative Rate of Absorption of various Salts by Plant Tissue.—G. Marinesco: Recherches Anatomo-Cliniques sur les Névromes d'Amputations douloureux: Nouvelles Contributions à l'Etude de la Régénération nerveuse et du Neurotropisme.

LINNEAN SOCIETY, at 5.—E. S. Goodrich: A Fatherless Frog, with remarks on Artificial Parthenogenesis.—Miss Muriel Bristol: A Review of the Genus Chlorochytrium, Cohn.—A. S. Kennard and B. B. Woodward: The Linnean Species of Non-marine Mollusca that are represented in the British Fauna, with Notes on the Specimens of these and other British Forms in the Linnean Collection.

ROYAL SOCIETY OF ARTS, at 4.30.—Sir Everard im Thurn: The Present State of the Pacific Islands.

INSTITUTION OF MINING AND METALLURGY, at 5.30.—R. R. Kahan: Refining Gold Bullion with Chlorine Gas and Air.—A. Yates: Effect of Heating and Heating and Quenching Cornish Tin Ores before Crushing.—R. J. Harvey: The Development of Galena Flotation at the Central Mine, Broken Hill.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—J. H. Shaw: The Use of High Pressure and High Temperature Steam in Large Power Stations.

INSTITUTION OF MINING AND METALLURGY, at 5.30.

MONDAY, NOVEMBER 25.

ROYAL GEOGRAPHICAL SOCIETY, at 8.—Arnold Hodson: Southern Abyssinia.

TUESDAY, NOVEMBER 26.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 5.—F. G. Parsons: Anthropological Observations on German Prisoners of War.

WEDNESDAY, NOVEMBER 27.

ROYAL SOCIETY OF ARTS, at 4.30.—Lord D'Abernon: Drink Control in Various Countries.

THURSDAY, NOVEMBER 28.

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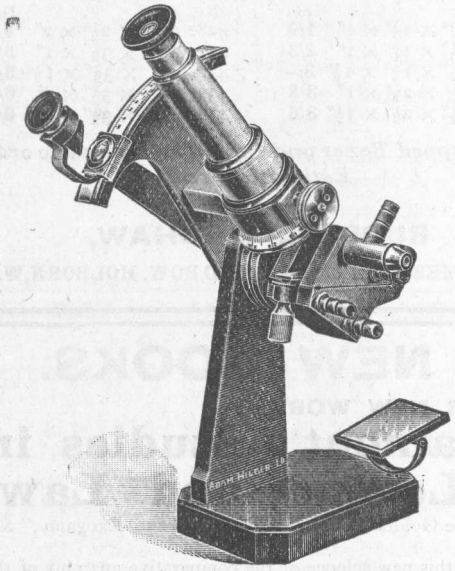

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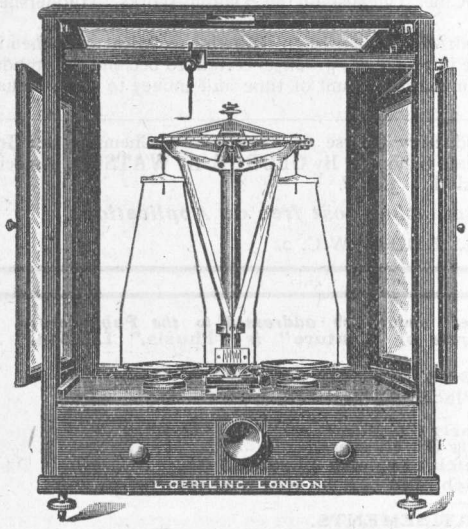

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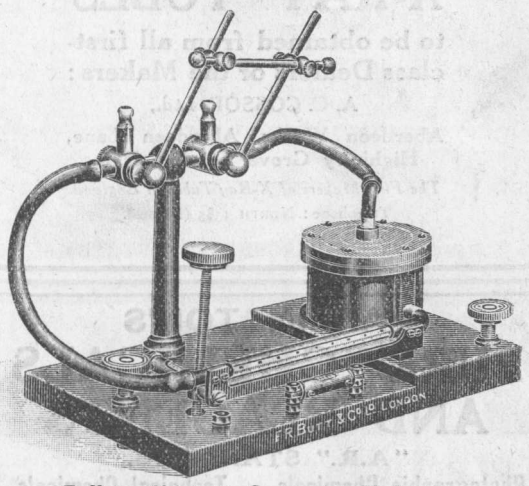

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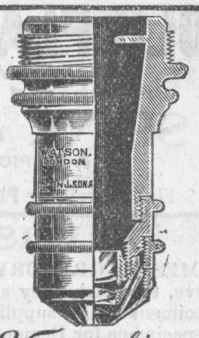

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