THURSDAY, APRIL 18, 1918.

A MINISTRY OF HEALTH.

STUDENTS of public health have long been aware of the fact that the application to the general community of the methods of preventing and curing disease is seriously incommensurate with our knowledge of these methods. Tuberculosis we believe to be an almost, if not entirely, preventable disease, yet it is still the largest single cause of death; rickets, probably an exclusively environmental disorder, produces defects and deformities persisting through life in a large proportion of the poorer classes; infant mortality is probably exactly double what it would be if we could place every infant in a healthy environment; Sir George Newman has told us that a million school children suffer from physical or mental deficiencies, which render attempts to educate them almost useless, yet here also the physique and healthiness of the average public-school boy prove once more that the elementary-school child is the victim of pernicious surroundings.

When we turn to curative measures we find that the refinements of modern medicine, the skill of the specialist, the use of instruments of precision, and the scientific methods of diagnosis are, to a large extent, only available to the masses through the hospitals, and though these institutions are rendering services of the utmost value to the nation, they are very far from being able to meet the demand for their help owing to their limited accommodation.

The relative inefficiency of the public health and medical services in this country has been to a considerable extent concealed by the fact that since the middle of last century there has been a great decline in disease and a considerable fall in the death-rate. This improvement followed the work of Chadwick, Southwood Smith, Farr, Simon, and other pioneers of modern sanitation, and synchronised with the steady advance in the methods of disposal of sewage, removal of refuse, and provision of pure drinking water. It is no disparagement to these great names to say that modern scientific opinion tends to attribute to natural causes a larger share in the disappearance or diminution of diseases than a previous generation or even the uninstructed public of to-day would be prepared to allow. The remarkable decline in typhoid we owe almost certainly to sanitary effort, but biological influences, not yet fully understood, probably led to the disappearance of typhus, while a process of natural immunisation seems to have had at least as much to do with the decline of tuberculosis as improvements in environment and food-supply. The object of these remarks is to point out that, while we should not belittle the achievements of the past, there is distinct danger of attributing too much to our efforts and of surveying our labours with unmerited complacency. Certainly at the present day there is much in our public health administration which calls for censure rather than for praise.

In these circumstances the proposal to form a Ministry of Health is highly satisfactory, and if Dr. Addison, Lord Rhondda, and others concerned with or interested in the Bill take full advantage of their opportunities they can produce a measure of great social value. The important thing is to see that we are not satisfied with mere names or with a simple rearrangement of existing authorities, but that the scope of public health administration is widened, and that we get to grips with the bedrock causes of disease and with the means of their prevention and cure. So far as is generally known at present, the main object of the Bill is to unite or co-ordinate existing authorities, and we have heard of prolonged negotiations as to whether the Insurance Commissioners, the Local Government Board, or an entirely new body is to form the Ministry. Increased co-operation between the central administrative authorities will be all to the good, for there is no doubt that their present relative isolation leads to much delay, confusion, and unnecessary expense; but we must not suppose that departmental reorganisation, desirable though it is, will have much effect by itself in improving public health. The history of public health legislation in this country shows that two important principles should be observed if the mistakes of the past are to be avoided.

The first principle is to maintain and extend scientific research in all branches of medicine and public health. This at once raises the question of what is to be the position of the Research Committee in regard to the new Ministry. It is not yet known whether the Committee is to form part of the Ministry, but it is generally understood that the Bill immediately to be introduced is of comparatively limited scope and provides for the gradual absorption of various departments as may be found expedient. We would earnestly plead that the Research Committee should be left either entirely outside the Ministry, or, if united to it, should be practically independent and uncontrolled by any administrative branch of the Ministry. Scientific research, to be of any value, must be unfettered. Moreover, the Research Committee must have the right to investigate the results of measures taken by any branch of the Ministry and

to indicate where these measures have failed to achieve their object. At the present time there is more than a tendency in many of the reports issued by Government departments responsible for public health administration to give an unduly favourable picture of the results of their work.

Another function of the research department of the Ministry should be to examine critically all proposed public health legislation. Too often have purely popular views of the causation and prevention of disease formed the basis of public health Acts, and often these views have had little scientific foundation, with the result that much time has been wasted and money uselessly spent. It is too much to hope that the Minister of Public Health will always be a member of the medical profession, but at least we may hope that the political Minister will be assisted by a professional director at the head of the administration, with an expert committee of the highest standing, and that future public health Bills will be presented to Parliament only after they have been thoroughly examined and criticised by this committee. Thus only shall we avoid repeating the failures which have been so conspicuous in recent public health legislation.

The second principle is concerned with the relation of the Ministry to local public health authorities. Here we may be anticipating, for no hint has yet been given that the local authorities are to be touched by the Bill. Yet the limitation of reform to the central authorities (if it is to be so) must be quite temporary, for without reorganisation of the local bodies which are administering public health measures the value of the Bill will be very small. It is, indeed, arguable that the start should have been made with the local authorities, leaving the reorganisation of the central departments for later consideration. A complete and really effective scheme, however, demands the co-ordination of the local sanitary authority, the insurance committee, the board of guardians, the pensions committee, and other authorities which are engaged in some form or other with public health and medical services. At present the overlapping and independent working of these bodies is productive of more confusion and delay and constitutes a greater evil than the lack of co-ordination among the central authorities. Probably the best plan would be to replace or unite all these bodies in one local authority, which in county boroughs would be the borough council, and in counties the county council, exercising some of its powers through the urban and rural district councils. The creation of entirely new local public health authorities has also been advocated.

Closely associated with this question is the proper division of power between the central and local authorities. Here, as in so many other social activities, two schools of opinion exist: one which advocates increased central control, mainly for the reason that it considers local control unsatisfactory and desires to subject the authorities to a process of "gingering up"; while the other is in favour of a large measure of decentralisation which would give local authorities increased powers at the expense of the central departments. The holding of the balance fairly between these views demands nice judgment, but in our opinion a great deal is to be said for decentralisation. In the first place, the larger local authorities, as, for instance, the councils of the great towns, now display a sense of responsibility for their duties and a keenness in providing healthy conditions within their area which fully justify confidence being placed in them. Indeed, the complaint is often heard that the obligation local authorities may be under to submit their proposals to a central body for approval is a serious cause of delay and inefficiency. Secondly, the local incidence of disease and the causes of disease vary so widely from place to place that a large element of elasticity in the preventive measures is necessary if appropriate remedial steps are to be taken. Centralisation of authority tends towards an undesirable uniformity over the whole country. If, on the other hand, local authorities can act on their own initiative they are in a position to establish just those systems of prevention and forms of treatment which the local circumstances demand.

The proposal to form a Ministry of Health was first made many years ago, but it has required the stimulus of a great war to bring it into being. The difficulties before the Ministry—at any time great—are now all the greater in the circumstances in which it begins its task. The supreme fact is that the introduction of this Bill definitely marks the assumption of responsibility by Government for the health of the people, and as such it will be welcomed by all who have the nation's well-being at heart.

ALCOHOL, ITS USE AND ABUSE.

Alcohol: Its Action on the Human Organism. Pp. xii + 133 + Appendix and Index x. (London: H.M.S.O., 1918.) Price 2*s.* 6*d.* net.

THE form of this little volume is a welcome innovation in Government reports, attracting, instead of repelling, the reader. Its object is to present the conclusions arrived at by a committee of the Liquor Control Board after a cold and dispassionate examination of the effects of alcohol. No statements are made without exact

scientific evidence, which is clearly explained. On account of the moderation of the general tone of the book, it will probably fail to please extremists of both camps, neither of whom will be able to derive much comfort from its pages. Although the authors have been unable to find evidence of an injurious action of moderate doses, well diluted and at such intervals as to ensure the elimination of a previous dose, on the other hand they show that its action is bad when taken otherwise than as mentioned, and that it is devoid of beneficial effect in any form whatever, except in certain abnormal states to be referred to below. This point in its favour is somewhat depreciated, however, when it is pointed out that even moderate doses involve some impairment of the higher nervous functions. In one or two places the impression is given that an attempt is being made to make out the best case for it, and, on the whole, the reviewer finds himself somewhat surprised that so little is actually made out on its behalf.

The names of the committee should be given in order to show how competent it was to treat the problem in its various aspects without prejudice. They are: Lord D'Abernon, Sir Geo. Newman, Prof. Cushny, Dr. H. H. Dale, Capt. M. Greenwood, Dr. W. McDougall, Dr. F. W. Mott, Prof. Sherrington, and Dr. W. C. Sullivan.

The first chapter is devoted mainly to the explanation of certain terms used and to physiological preliminaries, which are, indeed, remarkably well done. It is pointed out that there is no mutual exclusion between the properties of a food and of a poison or drug; a substance, such as alcohol, may be both. The nature of alcohol as a food is discussed in the second chapter. It is oxidised almost completely and can afford energy for muscular work, as well as heat. But it cannot be stored, as fat and carbohydrate are stored. It has no kind of accessory action on metabolism. On account of its drug action it can only be used as a food in a restricted manner. In fact, recent work by E. Mellanby (as yet unpublished) has shown that the amount oxidised is the same whether work is done or not. It is therefore not a true foodstuff.

The chief action of alcohol is on the nervous system, and is dealt with in the third and fourth chapters. It is purely narcotic and not really stimulant. The feeling of well-being is due to the blunting of the higher faculties and the general loss of control. Its effect on the performance of all kinds of muscular acts is to delay the rate at which they are done and to reduce efficiency by impairment of skill. In this respect and in those described in the succeeding chapters, if any effect at all is produced, it is a lowering of functional activity. The nervous mechanisms themselves are sensitive to quite small quantities.

In the fifth and sixth chapters it is shown that moderate doses have no appreciable effect on digestion, respiration, or the heart. Larger doses paralyse or depress them all. The stimulant action in fainting is said to be due to an irritant effect on the mouth, precisely similar to that of ammonia on the nose. Although pure alcohol has no effect on digestion in moderate doses, certain wines appear to be deleterious. An interesting question is that of the feeling of warmth produced by it. This is really due to dilatation of skin blood-vessels, the sense-organs sensitive to temperature being situated in the skin. The actual result is a more rapid loss of heat. But here we come across circumstances in which, from the point of view of comfort, alcohol has something in its favour. If a man, after exposure to cold, is taken to warm surroundings, it can do no harm to give him the feeling of warmth, since any heat he loses is supplied from the outside.

The valuable chapter on chronic alcoholism and the cautious discussion of statistical data do not admit of a brief abstract.

On p. 127 we are told that where an emergency calls for the highest powers of perception and judgment, together with prompt action, alcohol is unequivocally detrimental, but that there are cases where a sedative action may be of advantage. Such cases, amongst others, may be when excessive fatigue results in absence of appetite or inability to sleep. These states, of course, are abnormal and ought not to occur.

On the whole it seems to the reviewer that if a man knowing nothing about the question were to pick up this volume he would scarcely be tempted to commence the consumption of alcohol. A careful study of this excellent survey of the facts is to be recommended to everyone who takes an interest in the welfare of his fellow-men, and it is to be hoped that its price will not tend to restrict the wide diffusion that the book ought to have.

W. M. BAYLISS.

TWO AERONAUTICAL BOOKS.

(1) *Airfare of To-day and of the Future.* By E. C. Middleton. Pp. xv+192. (London: Constable and Co., Ltd., 1917.) Price 3*s.* 6*d.* net.

(2) *A Dictionary of Aircraft.* By W. Erskine Dommett. Pp. 52. (London: Electrical Press, Ltd., 1918.) Price 2*s.* net.

(1) THERE are two classes of aeronautical literature: books written by those who thoroughly understand their subject, and intended for the serious attention of those engaged in the industry, and books written to supply the popular demand for sensational literature on a new subject. The latter class generally show a lack of knowledge of the technical side of the subject, as is the case in the first of the works now under review. "Airfare of To-day and of the Future" is a jumble of ideas set down without attempt at law and order, and the technical matter is very often in serious error. For instance, the range of action of aircraft is stated to be about 150 miles, although the book bears the date 1917. The author has very hazy notions of stability, for he states on p. 19 that "in a cloud an aeroplane loses stability, which frequently ends in a nose-dive"! The nose-dive is, of course, due to the

pilot's loss of his sense of direction, and not in any way to changed stability of the machine. Further, on p. 22 we find: "The main condition that supplies stability to aircraft is 'lift,'" a statement that surely needs no criticism! The author appears to possess a sense of humour, for on p. 13, after cautioning the reader against the erroneous expression "knots per hour," he states that "a knot is equal to 6080 ft." The photographs illustrating the work are passable, but the diagram on p. 83 is not. It purports to illustrate the trajectory of a bomb dropped from an aeroplane, but the tangent to the trajectory at the moment the bomb leaves the machine is *vertical* instead of *horizontal*! Such errors as those in the volume under review need stern criticism, as they are liable entirely to mislead the unsuspecting reader who takes up the subject for the first time. Incidentally, there is scarcely a page of the book free from grammatical error.

(2) Mr. Dommett's "Dictionary of Aircraft" is a very different type of work, and although some of the definitions are somewhat weak, the generality are good and convey a concise idea of the meaning of the terms defined. The book is likely to be most useful to the non-technical reader, as it is scarcely full enough to be regarded as a work for technical reference. There are one or two errors which need correction; the density of air is given as 0·807 lb. per cub. ft. instead of one-tenth of that amount. Under the heading "dynamic similarity" we are referred to "similarity," but no discussion of the term appears under this latter head. The definition of dynamic stability might well be expanded, as this is a term little understood by many readers of aeronautical works. Despite these few minor faults, the work should be of considerable utility, especially to the casual reader who wants a brief definition of technical terms. The price seems a trifle high for a paper-covered handbook of fifty-two pages, even in war-time!

LIQUID FUELS.

Liquid Fuels for Internal-combustion Engines: A Practical Treatise for Engineers and Chemists. By H. Moore. Pp. xv+200. (London: Crosby Lockwood and Son, 1918.) Price 12*s.* 6*d.* net.

THE rapid development of the internal-combustion engine has considerably changed our methods of power production, and liquid fuels for such engines being the most recent development, it is not surprising that their scientific study is still incomplete in respect to this method of application. The author considers it likely that the employment of liquid fuels for steam raising will entirely give place to their use in internal-combustion engines. Referring to the use of engines of the Diesel type for propelling ships, the author says that this is at present prevented through insufficient experience in building engines of very large size and of building them of low weight in proportion to the power they develop, but these difficulties, he says, are by no means insurmountable. Inexperience will be a vanishing factor, but the weight is by no means a factor to be easily overcome, being dependent on the high initial working pressures these engines require. Few engineers would care to predict the displacement of the steam turbine by Diesel engines for the high power demanded in modern battleships of even moderate size. Indeed, on the American coast there have been already cases where Diesel engines have been displaced by steam.

The liquid-fuel engine has, however, established itself firmly for a number of purposes, and the extension of the use of such engines has led to a serious shortage of suitable fuels. As the author points out, by suitable methods supplies can be enormously augmented, but the future development of these engines may be seriously retarded unless steps are taken to provide additional amounts. He instances the heavier grades of petrol, so that a larger proportion of the crude oil is available, the use of heavier fractions in vaporising engines, and the use of coal-tar products in Diesel engines

The book is divided into three parts, the last section, which comprises nearly one-half, dealing entirely with methods of examination of liquid fuels, embodying the author's experience in the laboratory of one of the largest firms of Diesel-engine manufacturers. This section will prove of considerable value to chemists engaged in fuel work.

The first part deals briefly with the raw materials which furnish the different classes of fuel—petroleum, coal tar, shale and lignite oils, etc. Part ii. deals with the fuels classified under the three types of engines in which they are applicable; those fitted with carburettors (petrol motors), those fitted with simple vaporisers (paraffin motors), and those of the Diesel and semi-Diesel type, which are fitted with fuel pumps and atomising devices. Such a method of treatment is open to objection, for many fuels are applicable to engines of more than one type—kerosene, for example, to each type. Necessarily this method leads to considerable overlapping.

Throughout the book generally there is evidence of the author's practical familiarity with the various fuels and the important characteristics to be considered in their examination. The volume will prove a serviceable guide to engineers and chemists interested in this rapidly developing phase of the fuel problem.

OUR BOOKSHELF.

Educational Reform. Speeches delivered by the Rt. Hon. H. A. L. Fisher. Pp. xvi+101. (Oxford: At the Clarendon Press, 1918.) Price 1*s.* net.

THE President of the Board of Education, who has by common consent done so much to stir and enlighten the public interest in the cause of education by his numerous addresses in all parts of the country, has wisely resolved to issue in this cheap and accessible form a selection of his principal speeches, two of which he delivered in the House

of Commons, the first on the occasion of presenting the Education Estimates in April, 1917, and the second on the introduction of the first Education Bill in the following August. He has accompanied the publication by a highly illuminating preface of sixteen pages, in which is resumed all the more important features of the revised draft of the Education Bill of 1918, and of the chief points of his many speeches in support of his reforms, characterised by a felicity of phrase and diction which will go far to hearten supporters of the measure and even to conciliate and win opponents. Mr. Fisher's addresses are instinct with a broad humanity and a spirit of real helpfulness. He is a man consumed with the idea that the welfare of the child is the nation's most vital concern, and his arguments and pleadings rest "upon the right of human beings to be considered as ends in themselves, and to be entitled, so far as our imperfect social arrangements may permit, to know and enjoy all the best that life can offer in the sphere of knowledge, emotion, and hope." In this faith he goes forward on his high mission, confident that he will win the support of all who desire the highest well-being of the nation.

Microscopic Examination of Steel. By Dr. Henry Fay. Pp. iv+18+Fig. 1+photographs 55. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1917.) Price 6*s.* net.

THIS little work was originally issued by the United States Ordnance Department for the use of inspectors of ordnance material, and has now been published as a guide to others engaged in the inspection of steel. A very brief account of the equilibrium diagram of the iron-carbon alloys is given, and the reader will find it necessary to supplement this by reference to fuller treatises, in order to understand the series of photomicrographs, mostly of excellent quality, which compose the greater part of the book. The entire account of the metallic constituents of both annealed and hardened steels is compressed into five pages, and although the statements are terse and accurate they can convey a definite meaning only to readers who are to some extent prepared by previous study of the subject. It would have been well to mention the fact that only carbon steels are dealt with, otherwise such statements as that "commercially martensitic steels are unimportant on account of their extreme brittleness, and they are found only rarely," are liable to mislead. Alloy steels are met with by most inspectors in the course of their work, and a word of warning is necessary that structures which are unusual in pure carbon steels may be quite normal in some commercial products.

A few details of methods of polishing and etching are included, but we miss a reference to the newer copper reagents, which render such good service in indicating the segregation of phosphorus. A detailed description of three defective steels which failed in practice illustrates the usefulness of metallographic methods in the control of material, although a considerable amount of experience is required before it is possible to interpret aright the indications of the microscope. For the purpose of acquiring such experience, the reader is recommended to examine a number of steel specimens, the heat treatment of which is definitely known, before attempting the study of abnormalities. C. H. D.

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.*]

Long-range Guns.

SEVERAL correspondents have rightly pointed out that the ranges given in my short article on this subject in NATURE of April 4 are twice as great as would be given by the stated initial velocities. The heading of the velocity column should have been "Horizontal Component of Initial Velocity," not "Initial Velocity." The horizontal component, where there is no resistance, is constant for the whole range.

At the end of the article I referred to the elliptic orbit of the projectile. The elements of the ellipse are easily found. Since, at the vertex of the trajectory, the weight of the projectile is just balanced by centrifugal force, and since the radius of curvature of an ellipse at the end of the major axis is b^2/a, $b^2/a=v^2/g'$, where v is the velocity in apogee and g' the earth's attraction at that distance; also, since $b^2=a^2(1-e^2)$, it follows that $e=1-v^2/R'g'$, where R' is the apogee distance of the projectile from the centre of the earth, and

$$b=R'\sqrt{\frac{1-e}{1+e}}.$$

A short table of v and b is appended.

If $R'=R+H$, R being the earth's radius and H the greatest height of the trajectory above the earth's surface, and if, also, θ is the angular distance between the major axis of the ellipse and point where the orbit cuts the surface of the earth, the range is $2R\sin\theta$, θ being determined by the equation

$$\cos\theta=\frac{1}{R}\left(R'-\frac{H}{e}\right).$$

If the projectile has a horizontal velocity v at the surface of the earth, the table gives the approximate value of the minor semi-axis of the elliptic orbit.

v ft. per sec.		b miles	
1,000	...	158	
2,000	...	279	
3,000	...	462	
4,000	...	620	
5,000	...	780	
25,900	...	Earth's radius	Circular orbit

A. MALLOCK.

6 Cresswell Gardens, S.W.

The Motion of the Perihelion of Mercury.

I AM obliged to Mr. Harold Jeffreys for his friendly criticism (NATURE, April 11, p. 103), but my suggestion was not one of a resisting medium pure and simple, but of a resistance greater at perihelion than aphelion, and therefore synchronous with the planet's orbital

period. Mr. Jeffreys will surely admit that a periodic disturbance of this kind, acting parallel to the minor axis of the orbit, would certainly affect the longitude of perihelion, without affecting the eccentricity; though whether the amount of resistance to be expected, say from matter in the Zodiacal light, is sufficient to make the effect appreciable may well be doubted. Moreover, I had not thought of the resisting medium as revolving in a planetary manner. I am inclined to attribute much more importance to my other suggestion based on the electrical theory of matter (*Phil. Mag.* for August, 1917). Nevertheless, a periodic resistance hypothesis is peculiarly applicable to Mercury, (*a*) because of its nearness, (*b*) because of the eccentricity of its orbit. OLIVER LODGE.

Relativity and Gravitation.

A MATHEMATICAL friend with whom I have been discussing Prof. Eddington's paper on "Relativity and Gravitation," recently published in NATURE, has made what appears to me to be an interesting suggestion. Prof. Eddington states that if a current of æther were moving vertically (say) with a velocity of 161,000 m./sec., a rod 8 ft. long, when placed transversely to the stream (*i.e.* horizontally), would, when turned vertically, be only 4 ft. He also says that this contraction would be unobservable because the retina of the eye would have similarly contracted in a vertical direction. Suppose, however, that the rod in its two positions were observed, not directly, but by means of a mirror inclined at an angle of 45°, by a spectator lying on his back on the floor of the room? His retina, being horizontal, would, *ex hypothesi*, have undergone no contraction at all. Both images of the rod, in its horizontal and vertical positions, would fall on this horizontal retina. If the experiment could be performed the contraction of the rod ought to be evident, and afford direct proof of the Lorentz-Fitzgerald hypothesis. Is there any flaw in this reasoning?

H. H. O'FARRELL.

IT is interesting to examine Mr. O'Farrell's plan for defeating the conspiracy to conceal the change of length of the rod; but the resourcefulness of the conspirators is equal to the occasion. A compensation will take place in connection with the reflection of the light from the moving mirror. Light rebounds from a fixed mirror as though it were a billiard ball rebounding from a perfectly elastic cushion. If the cushion were moving with a great velocity the angle of rebound would naturally be modified. That is only an analogy, but it will perhaps show that we cannot apply the rules of elementary optics to the formation of images by a mirror moving through the æther. A mathematical discussion, on the basis of Huygens's principle, shows that a change of size of the image will be introduced which compensates for the change of size of the rod. It may be remarked that in order to deflect the ray from the horizontal to the vertical direction the mirror, although apparently inclined at 45° to the horizontal, would actually (in terms of the "real" space) be inclined at 26·6° ($\tan^{-1}\frac{1}{2}$); this illustrates how the laws of reflection become modified in the conditions postulated.

A. S. EDDINGTON.

Elliptical Haloes.

THE accepted explanation of the haloes of 22° radius which are seen surrounding the sun and moon implies that they are exactly circular in form. About two years ago, however, I noticed a halo which appeared to be elliptical with the major axis vertical. I was unfortunately unable to take any measurements on that occasion, but on March 18 last a lunar halo, which was visible for a considerable time during the evening, also appeared to possess a decided, though slight, ellipticity. That this deviation from the circular form was not an illusion I was enabled to verify by noting the positions of Capella and γ Geminorum relative to the ring.

At 7.30 p.m. Capella appeared to be exactly upon the inner edge of the halo, while γ Geminorum was within the ring at a distance from it, which, as nearly as I could judge, was a quarter of the moon's diameter. From these data I find that the radii of the halo measured from the centroid of the illuminated disc of the moon through these two stars were 22·8° and 21·4° respectively. Assuming that the halo was elliptical with the major axis vertical, I deduce values of 23·3° and 21·4° for the semi-major and semi-minor axes. I am aware that a more or less complete halo the major axis of which is horizontal is occasionally seen surrounding the 22° halo, but records of haloes elongated vertically are rare. In 1908 Prof. Schlesinger noticed one the axes of which were about 7° and 4°.

Sir Napier Shaw informs me that very little is done in this country on the shapes of haloes, so that this letter may serve to direct attention to the desirability of obtaining accurate measurements. J. B. DALE.

Craigness, New Malden, Surrey, April 10.

Abnormal Catkin of Hazel.

IN February last one of my students, Miss M. Benson, brought me a flowering branch of the hazel (*Corylus Avellana*) in which one of the male catkins had a group of female flowers at the base. The other catkins were entirely male, but this one had eight female flowers, all of which appeared to be normal in structure; they were arranged like the male flowers on the same axis, but the bracts had the pointed shape of those of the ordinary female flower, and no other peculiarity was perceived. It would seem that this is the adoption of the arrangement which is the normal one in Castanea, but such cases appear to have been rarely observed in this species of Corylus, although known to occur in *C. tubulosa*. The bush was one growing on the bleak heathy moorland of Sutton Coldfield. W. B. GROVE.

Birmingham.

VOLCANIC STUDIES.[1]

THE death of Tempest Anderson in 1913, when returning from a voyage to the volcanoes of the East, removed a very familiar figure from scientific circles. For years he had made a special study of recent volcanoes, and as he was a very highly appreciated lecturer and delighted to expound his subject to popular audiences, there were very few who take an interest in geology and geography who had not had the pleasure of listening to him. He was a skilful and enthusiastic photographer, and his lectures were illustrated with beautiful lantern slides; hence it is probably correct to say that no one did more to inform the public on the subject of volcanoes during the twenty years before his death. At the Royal Geographical Society, the Geological Society, the British Association, and many local societies he was always sure of a warm welcome; and his

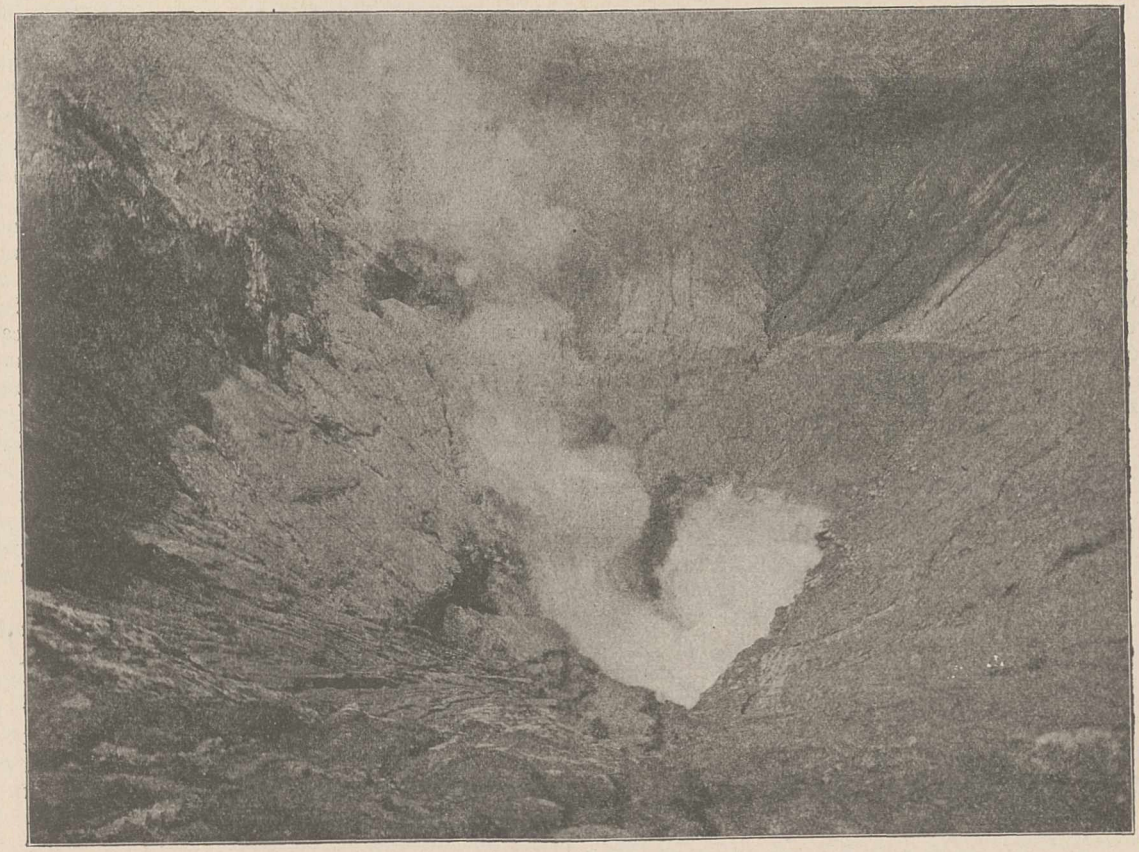
[1] "Volcanic Studies in Many Lands." Being Reproductions of Photographs taken by the Author. By Dr. Tempest Anderson. The Text by Prof. T. G. Bonney. Second Series. Pp. xv+88. (London: John Murray, 1917.) Price 15s. net.

lectures, racy with humour and crowded with adventure, were always counted among the principal features of the session's programme.

We owe to Tempest Anderson also several important contributions to the literature of volcanic geology, including a report to the Royal Society on the West Indian eruptions of 1902 and papers on the eruptions of Savaii and of Guatemala. But he was ever more ready with the camera than with the pen, and it is well known to his friends that he had an enormous number of negatives of active and extinct volcanoes, and his mind was richly stored with facts concerning them. He was a true enthusiast. When news arrived of an important eruption in Java or Savaii it was not long before Tempest Anderson had completed his arrangements to visit the spot and get some good photographs. No difficulties, dangers, ill-health, or expense daunted him; and though neither young nor very robust, he always succeeded.

This memorial volume has been edited by Prof. Bonney, one of his oldest friends, whom he always recognised as his guide and master in his investigations. It appears as the second part of a volume with the same title issued in 1903, and contains eighty-one photographs with descriptive text. A short biographical notice by Mr. G. Yeld is reprinted, with some additions, from the *Alpine Journal*. The photographs and descriptions take us over a very large field. Vesuvius, Etna, the Liparis, St. Vincent, Martinique, Mexico, Guatemala, Savaii, Hawaii, Java, Krakatau, and Luzon receive illustration in turn. Prof. Bonney's notes contain many particulars extracted from Tempest Anderson's field notes, and the book is full of interest, not only to the professed man of science, but also to all who admire beautiful or striking scenery and desire to understand its origin.

Most of the photographs are very well reproduced, though they are not all of equal merit, but this can be understood by anyone who knows the difficulty of getting good negatives on tropical expeditions and surrounded by the fumes of active volcanoes. The most interesting subjects are Krakatau as it was in 1913, Tarawera in 1913, Savaii, and (best of all in our opinion) the terrible volcanoes of Java. Some of the views taken in earlier years have been already published, and where so much was available we question whether it was advisable to reproduce them. The text is very clear and admirably suited to the pictures, but we would take exception to the explanation of the "bread-crust" bombs on p. 42. The cracked crust is due, not to the contraction of the crust or the interior, but to the expansion of the



Java. Bottom of the crater of Bromo. From "Volcanic Studies in Many Lands."

interior after the crust had hardened. Hence the resemblance to a loaf of bread, and the name. We should have welcomed also a list of Tempest Anderson's scientific papers as an appendix to the book; but the numerous references in the foot-notes to the text help to fill the gap. In paper, printing, and general get-up the volume does credit to the publisher, and as a tribute to the memory of a devoted man of science and a warm-hearted friend we hope that it will meet with a wide circle of readers. J. S. F.

SCIENCE FOR SECONDARY SCHOOLS.[1]

EVERY discussion of the educational policy to be followed in view of the present unrest lays stress on the failure of our educational methods and the paramount importance of scientific training. There are certain persons who, quite justly, point out that scientific method can be pursued in all departments of knowledge, and they conclude, not so justly, that on this account it matters little what subjects form the foundation of a liberal education; indeed, they go so far as to insist that the classical humanities are a better basis of such education than the technics of pure science can be, because in the study of mankind the experience gained from the history of the rise and fall of nations has a practical value which is essential to a stable social system.

There is no doubt that the educated mature mind may be enabled, by observation and study which follow the period of school-life, to apply the method known universally as scientific method to the problems which arise in every profession and business; but reflection will show that the very term "scientific method" denotes that such method has been drawn from special study of what are known as scientific subjects. It is not denied that it is desirable that every man and woman should acquire this method, but what is not generally appreciated is that it is a quicker, an easier, and a surer course to acquire the method through a sufficient study, carefully laid out, of such scientific facts as have laid the foundation and proved the value of scientific method. It is by such a course, begun early and carried out during the whole of the school-life, that the pupil can be led in his accompanying studies to apply the method which is not always appreciated by his teachers of those subjects.

If this is admitted to be the case it will remain to consider what sciences are essential to bring about the desired result in the pupil's mind. In deciding this momentous question there are many possibilities that should be taken into account, and the method itself insists on a survey being taken of what the schools have so far found it possible to do and what subjects have been found to appeal most strongly to the immature mind.

[1] British Association for the Advancement of Science. Report on Science Teaching in Secondary Schools. Pp. 85. (London: Offices of the Association, Burlington House, W.1, 1917.) Price 1s. net.

Here the British Association Committee has done a very useful work. The report under consideration starts by showing that the discussion is not a new one arising from the conditions into which we have been led by the war. In 1860 a Royal Commission reported on the nine public schools for boys, and recommended that the two principal branches of chemistry and physics, with further courses in physiology and natural science, should be taught in all schools for boys. The British Association in 1866 appointed a committee "to consider the best means of promoting scientific education in schools," and a report was made on "the experience gained at Rugby and Harrow, and described the position of science-teaching at Oxford and Cambridge and in French and German schools." The subject claimed attention again at the meetings in 1888, 1889, and 1890, and the need that was felt that teachers should have assistance in formulating and preparing courses of lessons led to the presentation of outlines of courses in chemistry.

Since that time a great deal has happened: science-teaching has been introduced into many schools both for boys and girls, not, however, as a part of organised arrangements for general education, but as a sort of appendix to, or in some cases a substitute for, other means of education. And in the absence of co-ordination for a well-thought-out scheme of education the teaching of science has been specialised in such a way that its influence as a part of general education has been lost. A survey of the position of science as a part of education by those who are well acquainted with the subject is therefore an important contribution to the problem that has now to be faced again as it was in 1866.

A very noteworthy part of the report is section iv., which deals with method in science-teaching. It draws distinctions between the different aspects of the teacher's appeal to the pupil under the designations of the "wonder motive" or curiosity, the "utility motive" or instinct of power, and the "systematising motive" or the instinct of reason. It lays stress upon the importance of the appeal to natural curiosity and the sense of power; it concludes with the following weighty passage:—

> Lastly, we must recognise that the "systematising motive" is one that has long been worked in our schools beyond its natural strength. Not infrequently teachers of some experience express the doubt whether boys and girls are capable of studying science before the age of fifteen or sixteen. Still more often university professors of science express the wish that their students might come to them with minds unperverted by the teaching of the schools. Whatever truth these pessimistic suggestions contain is probably accounted for by the failure of teachers to mould their instruction in conformity with the natural development of children's minds. The young man (or woman) who teaches science in schools from the point of view of the university often achieves with the best intentions a disastrous amount of harm. The mischief will not be prevented until it is universally recognised that the

logical theory of a science should be not the *terminus a quo* of instruction, but the *terminus ad quem*.

In the proper adjustment of the pupil's work, to use these three appeals for the purpose of education is the urgent problem of the teaching of science to which this committee has addressed itself. To this end curricula for schools of different types, the supply of science teachers in State-aided schools, the academic qualifications of headmasters, and the methods of inspection and examination are all discussed in a very readable and useful report.

THE FUTURE OF SCIENCE IN WALES

THE recently issued Report of the Royal Commission on University Education in Wales will, there seems no doubt, mark the beginning of a new era in higher education in the Principality. Into the past history of the University and colleges and the causes which led to the setting up of a Royal Commission we cannot enter here. We are concerned with the future and, more especially, with the provision to be made for the development of scientific and technological training.

From the very first it was recognised that "science, especially in its applications to arts and manufactures, should occupy a prominent place in the curriculum of the colleges," and provision was made by all three colleges in Wales for the teaching of pure science. The further development of teaching and research in pure science is left to the reorganised University and colleges, which, it is hoped, will be provided with ampler funds for this purpose. We learn, however, that, "as the requirements in pure science became satisfied, the special needs of the neighbouring localities began to claim the attention of the colleges"; and the demand has arisen for the further development of teaching and training in applied science. It is earnestly to be hoped that, as a result of the recommendations made by the Commission, the University and colleges of Wales will be able to develop their work in these branches to a level unsurpassed by any other British university.

As regards the prominence of the demand for increased provision for technological and vocational studies, wise words of warning are spoken by the Commissioners which all interested in true University education and in the highest development of our industries would do well to ponder and lay to heart:—

> Although it is right that the universities should be looked to as schools of preparation for professional life, it would be fatal if they allowed preoccupation with this task to weaken their hold upon the principle that they are intellectual trustees for posterity, keeping safe and, where possible, adding to the stock of universal knowledge which the past has entrusted to their care. . . . Some people have been inclined to complain that the universities turn out graduates who with all their attainments are not always immediately serviceable in commerce and industry: a right view of what a university training seeks to do for its students would suggest to such people that even their own utilitarian aims would not be really served by importing a more definitely technical element into the university student's course. As year by year commerce and industry become more complex and far-reaching in their ramifications, the value of a sound grasp of principles grows more indispensable to those concerned in their higher operations, and any loss on this side would be but ill made up by a slightly earlier familiarity with the specialised technique of a particular trade or calling, which after all is easily and rapidly acquired by a mind properly grounded in principles.

We commend these words to the careful attention of the people of Wales.

In Mid and North Wales, which are largely agricultural in character, we find that in the colleges of Aberystwyth and Bangor agriculture has for long been included among the subjects of the college curricula. But with regard to the fuller development of their agricultural departments which both colleges desire to promote, important pronouncements are made by the Commissioners. The present three years' degree course, it is maintained, which is primarily based on science, is inadequate for teachers and experts, because the student does not obtain that thorough grounding in pure science which would qualify him to undertake fruitful research work after he has obtained his degree. Such a student would do better to obtain his degree in one of the pure science departments and then pass over to the agricultural department for some general training in agriculture, coupled with investigation in his special subject. He requires, in fact, at least a five years' course, and his agricultural training should in the main be post-graduate. Since for this purpose elaborate provision of staff and equipment is needed, such advanced training should be concentrated at a single college. For the working farmer a new type of degree course is required, based more upon economics and history than upon pure science, and this course should be provided at all constituent colleges undertaking agricultural teaching and advisory work. A department of animal pathology should be established as part of the College of Medicine at Cardiff.

With regard to forestry, future developments will depend on the policy of the Government in respect to afforestation. It is, however, laid down that forestry should in the main be treated as a post-graduate subject, and, for reasons of economy, should be associated with the post-graduate department of agriculture at whichever college this department may be located.

In South Wales, as is natural, the demand is mainly for further development in technological training in engineering, mining, and metallurgy; and a scheme has been drawn up for the constitution of a faculty and board of technology. According to this scheme, which is accepted in its broad outlines by the Commission, the Municipal Technical College of Swansea would become recognised as a fourth constituent college of the University; and, subject to the fulfilment of certain conditions designed to secure a satisfactory

standard, post-secondary institutions and departments doing advanced work might be recognised as providing part of the courses for a distinct technological degree which the University would establish.

By the institution of this new faculty and board, on which the local industries would be represented, it has been sought to meet "the strong feeling of distrust entertained towards the University and centralised control by certain industrial and commercial interests in South Wales." In relation to the University this new faculty and board "should have all reasonable liberty to bring their special knowledge and experience to bear on what will often be local problems, but they cannot claim to be given a greater degree of independence than that enjoyed by a constituent college. It is conceivable, for example, that individuals or associations may desire to place large sums of money at the disposal of the board, and that by these means, or in other ways, the faculty and board of technology might be able to give a bias to the general development of the colleges or to the character of courses for degrees which would be contrary to the general principles upon which our recommendations are framed and inconsistent with any real control on the part of the University or the colleges." The Commissioners utter this warning :—

> But there is a serious danger lest short views should be taken of the true function of the university, and of the nature of the contributions to the common good which it is most fitted to make. Great advances in the application of science to industry have often been made possible by the discoveries of students who had no such object in view, but were impelled simply by the desire to extend the bounds of knowledge and solve some problem in the realm of pure science.

With regard to the development of medical studies it is recommended that the proposed National School of Medicine should be organised as an independent constituent college of the University governed by a council and senate of its own. Towards the erection of the necessary buildings the sum of 90,000*l.* has been promised by a private donor, and the gift of a further sum of 30,000*l.* has recently been announced for the endowment of a chair of preventive medicine.

On the financial side it is recognised that, in order to carry out all the legitimate developments of the work of the University and its colleges, an additional annual income of about 100,000*l.* will be necessary, to be raised by increased local subscriptions and private gifts and by a proportionate increase of the Government grant; and it is held that increased remuneration and provision for superannuation for the teaching staffs of the colleges constitute a foremost claim on such increased revenue.

The principles and recommendations put forward by the Commissioners afford an excellent opportunity for renewed effort, and if the people of Wales will rise to the height of their opportunity, higher education in science and technology is assured of a bright future in the Principality.

ANATOMICAL NOMENCLATURE.

AT a recent meeting of the Anatomical Society of Great Britain and Ireland steps were taken to clear up the chaos which has overtaken the nomenclature employed by human and vertebrate anatomists in this country. In 1889 the Anatomical Society of Germany appointed a commission to prepare a revised nomenclature—one which was finally adopted by the society when it met at Basle in 1895, and hence known as the "Basle Nomina Anatomica," usually spoken of as the B.N.A. nomenclature. The majority of British anatomists have never favoured or accepted the B.N.A. nomenclature, not because of its origin, but because of its intrinsic defects. The French and Italian anatomists also refused to adopt it. Unfortunately, the Basle terminology has been adopted in our leading English text-books on human anatomy, while the majority of teachers have continued to use the terminology which is native to Britain. The result has been to introduce a state of chaos bewildering to the pupil as well as to the teacher.

The resolution passed unanimously by the Anatomical Society at its meeting in King's College on March 1 is a definite pronouncement against the adoption of the Basle nomenclature by British anatomists. The terms of the resolution were as follows :—

> This society sees no reason for departing from the use of the old nomenclature as the recognised medium of description for employment in anatomical text-books and departments or by medical men in general. On the other hand, it thinks there are very good reasons to be urged against the adoption of any other nomenclature for this purpose.

NOTES.

THE Bakerian lecture of the Royal Society will be delivered on Thursday, April 25, by Sir Charles Parsons, on "Experiments on the Production of Diamond." Sir Charles Parsons will also describe his experiments on the formation of the diamond at the eighth annual May lecture which he is to give before the Institute of Metals on May 2. In view of the special character of the occasion, the council of the Institute of Metals has decided to make this an open meeting. Persons desiring to be present should apply —enclosing a stamped and addressed envelope—for cards of invitation to Mr. G. Shaw Scott, 36 Victoria Street, S.W.1.

THE council of the Royal Society has appointed a committee to investigate and report on the possibility of obtaining and replacing food materials and other necessaries by the utilisation of natural products not hitherto generally employed for such purposes. Suggestions as to such products and the means of organising their collection should be addressed to the secretary of the Natural Products Committee, Royal Society, Burlington House, Piccadilly, London, W.1.

THE secretary of the Decimal Association informs us that at the annual meeting of the Associated Chambers of Commerce held on April 9 and 10 a motion was adopted urging the Government to pass into law the Decimal Coinage Bill prepared by the Executive Council of the Associated Chambers of Commerce in

conjunction with the Institute of Bankers and the Decimal Association. It is understood that Lord Southwark will introduce the Bill into Parliament at the earliest possible moment.

THE possibility of an aerial mail has often been commented upon in these columns, and it is very interesting to note that a company has actually been formed in Norway for the purpose of establishing a mail service between Aberdeen and Stavanger. This trip was made just before war broke out by Capt. Tryggve Grau in about five hours' flying, and it is estimated that the mail services will reduce this to four and a half hours with modern machines. An extension of the system to Christiania and Copenhagen is contemplated, and it is hoped that letters leaving Aberdeen in the morning would be delivered in both these cities in the afternoon. The company has already a share capital of 150,000*l*., and a representative is now in England negotiating with the Government for a solution of the problem. The value of such a mail service would be very great at a time when the oversea service is so seriously hampered by the German submarine campaign, and the satisfactory establishment of the contemplated Norwegian service would undoubtedly soon lead to a general use of the aeroplane for rapid international communication.

WE learn from *Science* that by joint action the United States Secretaries of War and the Navy, with the approval of the Council of National Defence, have authorised and approved the organisation, through the U.S. National Research Council, of a Research Information Committee in Washington with branch committees in Paris and London, which are intended to work in close co-operation with the officers of the Military and Naval Intelligence, and the function of which shall be the securing, classifying, and disseminating of scientific, technical, and industrial research information, especially relating to war problems, and the interchange of such information between the Allies in Europe and the United States.

FOR the duration of the war and one year afterwards (according to *L'Economista d'Italia* for April 2) there has been established at the Italian Ministry of Commerce and Labour an office entitled "Office of the Committee for Chemical Industries," which will fulfil the following functions:—It will (1) act as the executive body for all the deliberations of the Committee for the Chemical Industries; (2) compile statistics bearing on the Italian production of chemical and pharmaceutical supplies, especially in regard to raw materials; (3) collect information relative to the progress of industrial chemistry abroad; (4) publish information of interest to the Italian chemical industry; (5) investigate any new measures or modifications of measures proposed in Italy or abroad of interest to industrial chemistry; (6) take any necessary preliminary steps to get Parliament to adopt the best measures to secure the most effective collaboration between science and the chemical industry; (7) take any other steps necessary to the interests of the chemical and pharmaceutical industry of the country.

AN account of the outbreak of pneumonic plague in China is given by a correspondent in the *Times* of April 12. The epidemic, which commenced last December, has a firm hold on a part of the Mongolian plateau and in the high-lying part of North Shansi, but so far has not spread to the populous centres in North China. It was not until pressure had been brought to bear upon the Chinese authorities that precautionary measures were taken; these consist in quarantining those who come from infected districts, and the immediate isolation of the sick and their treatment by masked attendants. The course of the epidemic is traced, and it is surmised that marmots have been the source of infection. The mortality has been considerable, but exact figures are lacking; in the Suiynan district 1500 deaths were reported up to the beginning of February.

THE first meeting of the Inter-Allied Scientific Food Commission was, we learn from the *British Medical Journal*, held in Paris on March 25 and the following days. At the first sitting the Commission was received by M. Boret, the French Minister of Agriculture and Food. In his opening address M. Boret pointed out that the object of the conference is to study the best means of utilising the very small food resources at the disposal of the Allies so as to effect an equitable distribution of the available food supplies among the Allies, having proper regard to the facts of physiology and political economy. The Commission agreed to establish a permanent central secretariat in Paris, M. Alquier being appointed secretary. In addition to the central secretariat it was agreed that a secretary to the Commission should be appointed in each of the Allied countries. The Commission considered important questions relating to the minimum food requirements of man, and to the production and distribution of food supplies. The Commission will reassemble at intervals, in Paris or in some other of the Allied capitals. It will probably meet next at Rome towards the end of this month. The formation of the Commission was decided upon at an inter-Allied conference held in Paris last November, when it was resolved that the Commission should consist of two delegates each from Great Britain, France, Italy, and America. The delegates appointed from the various countries were:—Great Britain: Prof. E. H. Starling and Prof. T. B. Wood; France: Prof. Ch. Richet and Prof. E. Gley; Italy: Prof. Bottazzi and Prof. Pagliani; America: Prof. R. H. Chittenden and Prof. Graham Lusk. The Commission is empowered to make any propositions to the Allied Governments which it thinks fit.

THE President of the Local Government Board recently appointed a Committee, under the chairmanship of Sir John Tudor Walters, "to consider questions on building construction in connection with the provision of dwellings for the working class in England and Wales, and to report upon methods to secure economy and despatch in the provision of such dwellings." The Committee has approached the Department of Scientific and Industrial Research with the request that the Department would make arrangements to undertake any research work which might be found desirable to assist in the prosecution of these inquiries. The Advisory Council for Scientific and Industrial Research accordingly appointed a Committee consisting of Mr. Raymond Unwin (chairman), Mr. R. J. Allison (on the nomination of the First Commissioner of H.M. Office of Works), Mr. P. A. Crosthwaite (on the nomination of the Local Government Board), Mr. W. H. Humphreys, and Mr. Seebohm Rowntree, with Mr. E. Leonard, of the Local Government Board, as secretary. In order that the services of suitable technical advisers should be at the disposal of this Committee, Mr. Tabor, an engineer of the London County Council, has been appointed by the Department technical officer to the Committee, while, with the concurrence of the Board of Education, the services of Mr. Hugh Davies, H.M.I., have also been made available. The terms of reference to the Committee are as follows:—"To make arrangements for carrying out researches on building construction instituted by the Department at the instance of the Local Government Board Committee or otherwise, to be responsible under the council for the direction of such researches, and

to deal with such other matters as may be referred to them from time to time by the council."

MR. MACPHERSON, Parliamentary Under-Secretary for War, in a written reply to Mr. Lynch, who asked in the House of Commons whether it is possible to construct a gun capable of throwing a projectile eighty miles or more, and, if so, whether steps have been taken in consequence, has stated that it is possible to construct such a gun, and that the necessary steps have been taken.

REPLYING to a question as to the ages of the small-pox patients now being treated in the hospitals of the Metropolitan Asylums Board, and the vaccinal condition of each patient, Mr. Hayes Fisher, President of the Local Government Board, has given the House of Commons the following information:—The condition as to vaccination of the thirty-four cases in question at the time of exposure to infection was as follows:—Under five years of age, four cases, all unvaccinated. Between five and fifteen years, ten cases, all unvaccinated. Between fifteen and twenty-five years, four cases, all unvaccinated. Between twenty-five and thirty-five years, six cases, all vaccinated, none revaccinated. Above thirty-five years of age, ten cases, all vaccinated, of which two are stated to have been revaccinated several (more than twenty) years previously. Of the total thirty-four cases, fifteen were vaccinated or revaccinated after exposure to infection.

Engineering for April 12 comments upon the memorandum issued recently from which it appears that the net cost of the Army in 1916–17 was 587,796,567*l.*, of which enormous total the sum of 285*l.* was appropriated to inventors. The disproportion recalls Falstaff's famous reckoning, where one poor halfpenny-worth of bread figured as an item amongst an intolerable deal of sack. The remark has often been heard that this is an engineers' war, but the above account would convey the impression that the authorities are as reluctant as ever to encourage the application of original thought to the improvement of our material of war. Fortunately, engineers and scientific men have actively exerted their patriotic efforts without consideration of personal profit, and hence, whilst the account may state truly the amount paid for ideas, it affords no criterion for estimating the actual value of the services rendered by inventors, which have in many cases been given gratuitously.

BY the death at the age of seventy-three of Prof. Paul Vidal de la Blache France has lost her foremost geographer. For many years Prof. de la Blache held the chair of geography at the Sorbonne, where his lectures had attracted students from many countries. He was one of the first to introduce causal treatment into geography, and, emphasising always its human side, to raise it to the rank of a scientific study. He was the author of numerous geographical works, and for several years had been one of the editors of the *Annales de Géographie*. Of his many works the best known is probably his "Atlas général Vidal de la Blache," which appeared in 1890 and succeeding years. This atlas, which contains about 137 maps, including fifty-two historical maps and many insets, is the standard French atlas. Many of the maps are marked by great ingenuity of conception, and several are unique to this atlas. Prof. de la Blache also showed much interest in historical geography, and among his earlier works was one on Marco Polo. His last work, published in 1917, entitled "France de l'Est," discussed the geographical basis of the history of Alsace-Lorraine. Prof. de la Blache was a member of the French Institute.

MR. GEORGE MITCHELL SEABROKE, who died suddenly on April 1—his seventieth birthday—was educated at Rugby School in the house of Mr. J. M. (now Canon) Wilson, under the headmastership of Dr. Temple. No doubt he owed much to Canon Wilson's inspiring teaching, both of science and mathematics, as well as a personal friendship which lasted his whole life. On leaving school he was articled to Mr. M. H. Bloxam, solicitor and clerk to the magistrates of the Rugby Petty Sessional Division, to whose practice and clerkship he succeeded in 1871. Mr. Seabroke's scientific and mechanical tastes showed themselves in early youth. There was, and probably is still, a model steam engine which he constructed in the 'fifties, preserved in the cabinet of physical apparatus in Rugby School. At the same time he was interested in astronomy, and requiring an instrument more powerful than a 3¼-in. refractor, he invented and constructed a machine for grinding and polishing glass specula. This enabled him to construct a 9-in. reflecting telescope, still preserved as a supplementary instrument in the Temple Observatory, and chiefly used for spectroscopic work. Of the Temple Observatory of Rugby School, founded by the energy of Canon Wilson in 1871, Mr. Seabroke was the first curator, a position which he held until his death. In 1870 he was elected a fellow of the Royal Astronomical Society, and contributed to the publications of the society papers on spectroscopic observations on the motion of the fixed stars in the line of sight and on the micrometric measure of double stars. He took an active part in the formation of the British Astronomical Association. He was elected on the first council, was president 1910–12, director of the double-star section 1902–15, and of the Saturn section 1898–1911. This is not the place to describe Mr. Seabroke's public work for the town of Rugby during the last forty-five years, but it may be mentioned that he was an active commander of the volunteer corps and was given the rank of Hon. Lt.-Col. of the 2nd Warwickshire Volunteer Battalion. He also took a leading part in the co-ordination of fire brigades, which led to the establishment of the National Union of Fire Brigades, of which he was one of the founders. Elected to the old Rugby Board of Health in 1875, he soon took in hand the task of supplying Rugby with a plentiful supply of pure water, to the maintenance of which he paid constant attention. A few weeks before his death he was made deputy-lieutenant of the county of Warwick.

THE death is announced of Mr. Robert Winthrop Blackwell, one of the best-known pioneers of electric traction, whose name has been equally familiar in this country and in the United States during the last thirty-five years. Mr. Blackwell was born in 1858, and educated at Princeton University, where he was a contemporary of President Wilson. He afterwards practised at the American Bar, and was attracted into electrical work in 1883, when he founded the Bentley Knight Electric Railway Co., which installed an electrically operated tramway system in Cleveland, Ohio; this line, opened in 1884, was the first commercial line operated electrically. Mr. Blackwell took up his residence in this country in 1890, and founded the firm of Robert W. Blackwell and Co. in 1894. This firm secured the contract for the Bristol electric tramways in 1895, and the great success of this undertaking paved the way for many others. His name will be remembered on account of the excellent quality of the work carried out under his direction, and for the kindly assistance and advice which he was always ready to offer. He was a member of many clubs, and was in charge of most of the arrangements for looking after the American Military Mission during its visit to this country.

WE regret to note that *Engineering* for April 12 records the death of Mr. John Shanks Brodie, who since 1900 had been the borough engineer and surveyor of Blackpool. Mr. Brodie was born in 1850, and acted as engineering assistant from 1877 to 1884 to the Corporation of Liverpool. During the following sixteen years he occupied the positions of borough, harbour, and waterworks engineer at Whitehaven. Among many other improvements carried out at Blackpool under his direction are the sea-walls, designed by Mr. Brodie and executed under his direct supervision. It would be difficult to find around our coast sea-defence works carried out in a more thorough manner. Mr. Brodie was elected a member of the Institution of Civil Engineers in 1906.

ACCORDING to an announcement in the *Times* of April 6, the Royal Agricultural Society is entering upon an important development of its activities in the prosecution of agricultural experimental investigation. For several decades the society has carried on valuable work on its experimental farm at Woburn, but it is realised that many important practical problems cannot be adequately dealt with at a single centre. Members of the society are being invited, therefore, to co-operate with the view of carrying out experiments under the widely differing conditions prevailing in various parts of the country. Among the subjects for investigation referred to in the preliminary announcement are the continuous growing of corn, green manuring, unexhausted manurial value, the use of lime, the treatment of pasture, and calf-rearing. These subjects afford abundant scope for the practical investigator, but the value of the work accomplished under the scheme will depend largely upon the detailed arrangements for the planning and supervision of the work, further information concerning which will be awaited with interest.

THE report of the council of the Institution of Mining and Metallurgy for the year ended December 31 last, presented at the annual meeting held on April 11, records the increasing inclination of Government departments to turn to scientific and technical organisations for advice and assistance. The council is preparing to deal with problems of reconstruction after the war. Co-operation between the leading scientific and engineering societies has increased, the report points out, and augurs well for future developments. Substantial progress was made during 1917 in the tin and tungsten research inaugurated by the institution with the co-operation of the Royal Cornwall Polytechnic Society, and carried out under the direction of the committee of which Sir Thomas Rose is chairman. In connection with the organisation of the mineral resources of the Empire the council has done useful work in urging the establishment of a Department of Minerals and Metals. The Imperial War Conference which met in London during the spring of 1917 decided that it was desirable to establish in London an Imperial Mineral Resources Bureau, upon which should be represented Great Britain, the Dominions, India, and other parts of the Empire. The bureau should be charged with the duties of collection of information from the appropriate departments of the Governments concerned and other sources regarding the mineral resources and the metal requirements of the Empire, and of advising from time to time what action, if any, may appear desirable to enable such resources to be developed and made available to meet the metal requirements of the Empire. The committees appointed by the various Government Committees have recognised the necessity for such a central organisation, and the council awaits the final decision of the Government.

IN the issue of *Man* for April Dr. A. C. Haddon discusses the outrigger canoe of East Africa. Canoes with outriggers are confined to the Indo-Pacific area, and are absent, and so far as we can tell always have been, from the American continent and Europe. Canoes with single outriggers are unknown in Africa, while canoes with double outriggers are confined to the east coast, from Lamu to Dar-es-Salaam, to the Comoro Islands, and to the north-west coast of Madagascar. Their occurrence in this region is certainly due to a cultural drift from Indonesia, which also brought in its train a peculiar form of fish-trap. Mr. C. W. Hobley, through Mr. H. R. Montgomery, District Commissioner, East Africa, has supplied Dr. Haddon with an interesting account, furnished with numerous illustrations, of the East African type of canoe. Further information, both from East Africa and Indonesia, is required before the question of the origin of this type of canoe can be regarded as definitely settled.

AT a meeting of the Zoological Society on March 5 Mr. Tate Regan exhibited photographs of a fish with markings on the tail simulating old Arabic characters, on one side "Laillaha Illalah"—"There is no God but Allah"—and on the other "Shani Allah"—"A warning sent from Allah." The fish was sold in the market at Zanzibar for a penny; the man who bought it was going to eat it and cut off the tail, throwing it on the ground; another man picked up the tail and saw the writing; great excitement ensued, and the fish changed hands at increasing prices, until 5000 rupees was offered. Major H. R. Cartwright, Commandant of Police, had the fish preserved and sent photographs of it to the Natural History Museum, where it was identified as *Holacanthus semicirculatus*, Cuv. et Val., a widely distributed Indo-Pacific species of Chætodontidæ. Mr. Regan considered the markings as falling within the limits of normal variation of the species.

UNDER the title "Our Ill-fed Foes" the *Illustrated London News* of March 23 devotes a page to illustrations, drawn by Mr. W. B. Robinson, of some of the food substitutes used in Germany. The more thoughtful reader who will carefully examine his drawings may, however, learn many lessons which he will find distinctly beneficial in these days of rations and dear foods. We have before us also a paper written a year ago by Dr. F. A. Bather (of the Natural History Museum) in the *Putney News Letter*, advocating the use as vegetables of several of our common weeds, notably the dandelion and stinging-nettle, and sprouts of hops. The present writer can speak from experience as to the excellence of the young nettle-tops when served like spinach, and the attempt to weed the garden of dandelions is greatly stimulated by the reward of daily after-dinner coffee made from ground and well-roasted roots. Dr. Bather also recommends nettle soup, and dandelions stewed, while the latter are often eaten in salad by travellers abroad. Of the other "vegetables" depicted in the *Illustrated London News* we regard sorrel as a great delicacy; "Good King Henry" and watercress are too well known to require comment, but meadow-cress, herb Barbarea, and scurvy grass seem well worth trying, and without following the German practice of roasting the roots of "Lords and Ladies" (which are poisonous when raw), it would be very interesting to try using them for starching our shirts and collars. The German coffee substitutes shown in the diagram referred to include asparagus seeds and ground acorns; of these we are informed that the latter are often used in Switzerland; but quite a long list of other German substitutes, both for coffee and for tea, is given. Apparently hops and beech leaves form the staple substitutes for tobacco in

Germany. But in the matter of health, as well as of economy, advantages are to be gained by substituting dried coltsfoot leaves (either smoked in a pipe or made into cigars) for the more insidious narcotic. Mr. Robinson's diagrams do not include fungi, but judging from the British species, these would fill many pages of the *Illustrated London News*. Instead of pitying our "ill-fed foes," we might learn a good many interesting lessons from their dietary.

THE Board of Agriculture has issued a leaflet (Food Production Leaflet, No. 34) on the canning of fruit and vegetables which should be very useful to the large number of growers and others who are desirous of preserving the largest possible quantity of fruit and vegetable food for winter use. The leaflet deals specially with the use of small canning plants suitable for domestic use by amateurs or small fruit-growers. The instructions given for every stage of the process are sufficiently detailed to ensure a reasonable prospect of success for the veriest tyro. Demonstrations are given daily at 11.30 a.m. in the Canning Kitchen, Food Production Department, 72 Victoria Street, S.W.1, and, in addition, periodical demonstrations are arranged in provincial centres. The necessary outfit of steriliser and cans can be obtained from the Department on terms which are explained in the leaflet.

A SOMEWHAT original method of reinforcing metals is described in the *Engineer* for April 12. The process has been devised by Mr. C. W. Denny, and lends itself to the manufacture of tubes and plates. It consists in reinforcing with perforated steel, of suitable thickness, weaker metals such as copper and lead. In making reinforced copper sheets, the perforated steel plate is prepared by any well-known method for electro-deposition, and, finally, copper-plated to any required thickness, the deposition of copper going right through the holes and forming a sheet of copper with the steel core inside. It is claimed that a plate so formed will stand bending and pressing without the copper leaving the steel. In some cases the copper can be rolled on hot. In producing reinforced lead plates it has been found practicable to roll or press the lead into the perforations.

MESSRS. HENRY FROWDE AND HODDER AND STOUGHTON have in the press "The Medical and Surgical Aspects of Aviation," by H. Graeme Anderson.

MESSRS. WITHERBY AND CO. announce an important book which should be of interest to ornithologists, viz. "A Monograph of the Pheasants," by W. Beebe. The work, which is being published under the auspices of the New York Zoological Society, embodies the author's own observations and information from other sources, and will contain many coloured plates and maps; also photographs showing the pheasants of the world, their haunts, changes of plumage, nests, and eggs. There will be four volumes, the first of which is to be issued next month.

A USEFUL catalogue (New Series, No. 82) of books of science has just been issued by Messrs. J. Wheldon and Co., 38 Great Queen Street, Kingsway, containing 1328 titles of works relating to astronomy, chemistry, electricity, engineering, mathematics, meteorology, and physics, and, in addition, particulars of sets of many scientific journals. The catalogue will be sent to any applicant for the sum of twopence.

MESSRS NEWTON AND CO., 72 Wigmore Street, W.1, are offering for sale the collection of microscope slides (some 650 in all) formed by the late Mr. Lewis Wright. A classified list, with the prices asked, will be sent by Messrs. Newton upon application.

OUR ASTRONOMICAL COLUMN.

THE APRIL METEOR SHOWER.—There is reason to believe that this display may be more abundant than usual at the ensuing return on about April 21. Of late years it has been very disappointing, and very few true Lyrids appear to have been seen since 1901. The radiant point is like that of the August Perseids, for it exhibits a diurnal shift of 1° to the eastward, the positions on successive nights being:—

		° °			° °
April	17 ...	265+33	April	23 ...	274+33
	18 ...	267+33		24 ...	275+33
	19 ...	268+33		25 ...	276+33
	20 ...	270+33		26 ...	278+33
	21 ...	271+33		27 ...	279+33
	22 ...	272+33		28 ...	280+33

The stream has been observed with certainty between April 16 and 26, but it has very probably a longer duration than that.

This meteoric shower has a cometary connection, for the first comet of 1861 shows a suggestive similarity of orbit, but the periodic time of revolution, either of the comet or meteoric shower, is not exactly known. There were rich displays of Lyrids in 1803, 1851, 1863, and 1884. This year moonlight will interfere somewhat with the phenomenon, as, at the time of the maximum, our satellite will be a little past the first quarter, and above the horizon until between 2h. and 3h. in the morning.

TEMPEL'S COMET.—The following ephemerides of Tempel's first periodic comet have been constructed by Dr. A. C. D. Crommelin on three assumptions of the date of perihelion passage in 1918: (A) May 9·37; (B) May 17·37; (C) May 25·37. The ephemerides are for 9 p.m.

	A		B		C	
Date	R.A.	S. Dec.	R.A.	S. Dec.	R.A.	S. Dec.
	h. m. s.	° ′	h. m. s.	° ′	h. m. s.	° ′
April 17	16 51 18	16 30	16 32 4	14 48	16 12 36	12 55
25	16 52 6	17 9	16 31 44	15 25	16 11 4	13 26
May 3	16 50 54	17 55	16 29 20	16 3	16 7 39	14 2
11	16 47 52	18 43	16 25 5	16 48	16 2 33	14 40
19	16 43 26	19 34	16 19 41	17 36	15 56 28	15 25

Search should be made along a line through positions A, B, C, or this line produced. The values of $\log \Delta$ on hypothesis B are 0·0959, 0·0749, 0·0574, 0·0440, 0·0357 for the five dates. This comet has not been seen since 1879, so there is considerable uncertainty as to its position.

ABSORPTION AND RADIATION OF THE SOLAR ATMOSPHERE.—A paper by Prof. Shin Hirayama appears under this title in the Proceedings of the Tokyo Mathematico-Physical Society, second series, vol. ix., p. 236. Utilising observations of the radiation from different parts of the solar disc which have been made by Abbot, Prof. Hirayama computes the transmission and radiation of the solar atmosphere, on Schuster's supposition that a great part of the solar radiation comes from an absorbing and radiating layer above the photosphere. It is shown that the observations are better represented in this way than by the previous calculations of Biscoe, in which the radiation of the atmosphere was not considered. The coefficient of transmission increases gradually with the wave-length, and the radiation due to the atmosphere ranges from one-third of the whole radiation for the shorter wave-lengths to nearly one-half as the wave-length increases. Assuming the effective temperature of the sun to be 6000° Abs., it is calculated that the temperature of the photosphere is about 7040°, while that of the absorbing layer is 5210°.

THE POSITION OF NATURAL SCIENCE IN EDUCATION.

THE report (Cd. 9011, price 9*d.* net) of Sir J. J. Thomson's Committee appointed in 1916 to inquire into the position of natural science in the educational system of Great Britain has now been published, and we propose to deal with its main points in a later issue. It is a valuable survey of the position of science in schools and in relation to professional and university education. The case for increased attention to science in order to expand the mental outlook as well as equip the nation with the elements of industrial progress is so strong that it has already convinced all who have considered it. What remains to be done now is to act upon the principles set forth in the report, and if the stress of war has not shown the necessity for such action by our political rulers national disaster will do so when too late. It is pointed out that there has been no general and sufficient recognition of science as an essential part of the curriculum for all boys in the public schools, and that in grant-aided secondary schools the customary course of science work is too narrow, to the neglect of great scientific principles with their human interests and everyday applications. More trained scientific workers are needed, and to secure them there must be a generous extension of the system of scholarships and greatly increased contributions from the State for university and technical education. "If," says the report, "the universities are to discharge their responsibilities towards the science students who are coming, and to maintain their position as homes of scientific learning and research, they must receive a measure of financial support much more considerable than they have received hitherto." The report concludes with a summary of principal conclusions under eighty-three heads, a selection from which is reprinted below.

General.—Natural science should be included in the general course of education of all up to the age of about sixteen. Real progress in education depends on a revolution in the public attitude towards the salaries of teachers and the importance of their training. A large increase in the number of scholarships at all stages of education is necessary.

Secondary Schools.—Steps should be taken to secure for all pupils in State-aided secondary schools a school life beginning not later than twelve and extending at least up to sixteen. Science should be included in the general course of education for all pupils in public and other secondary schools up to the age of about sixteen, and this general course should be followed by more specialised study, whether in science or in other subjects. In all secondary schools for boys the time given to science should be not fewer than four periods in the first year of the course from twelve to sixteen, and not fewer than six periods in the three succeeding years. Increased attention should be given to the teaching of science in girls' schools. In girls' schools with a twenty-four-hour school week not fewer than three hours per week should be devoted to science in the period twelve to sixteen. A larger number of State-aided schools should be encouraged to provide advanced instruction in science, and those which undertake advanced work should be staffed on a more generous scale. The elements of natural science should be a necessary subject in the entrance examination of public schools, and due weight should be given to this subject in the entrance scholarship examinations to public schools.

Science Course Twelve to Sixteen.—The science work for pupils under sixteen should be planned as a self-contained course, and should include, besides physics and chemistry, some study of plant and animal life. More attention should be directed to those aspects of the sciences which bear directly on the objects and experience of everyday life. There should be as close correlation as possible between the teaching of mathematics and science at all stages in school work. The present chaos of English weights and measures causes waste of time and confusion of thought, and there are strong educational reasons for the adoption of the metric system. All through the science course stress should be laid on the accurate use of the English language.

Science Course Sixteen to Eighteen.—The amount of time devoted from sixteen to eighteen to the subject or subjects in which a pupil is specialising should be not less than one-half or more than two-thirds of the school week. Pupils specialising in science should continue some literary study, and those specialising in literary subjects should give some time to science work of an appropriate kind. Pupils who do advanced work in science should be enabled to acquire a reading knowledge of French and German. Eighteen should be the normal age of entry from secondary schools to the universities, and the age limit for entrance scholarships at Oxford and Cambridge should be reduced to eighteen.

Examinations.—In the First School Examination all candidates should be required to satisfy the examiners both in mathematics and in natural science. In this examination there should be co-operation between the teachers and examiners, and weight should be attached to the pupil's school record.

Teachers in Secondary Schools.—It is essential that the salaries and prospects of teachers in secondary schools should be substantially improved and a national pension scheme provided. A full year's training shared between school and university is necessary for all teachers in secondary schools.

Laboratories.—The teachers in State-aided schools should be given freedom and responsibility in the selection and purchase of laboratory appliances up to a fixed annual amount.

Elementary Schools.—Increased attention should be given to the provision of suitable instruction in science in the upper standards of elementary schools. A larger number of students in training colleges should be encouraged to take advanced courses in science. There should be in every elementary school a room in addition to the ordinary classroom accommodation available for work in science and other practical subjects.

Technical Education.—Greater efforts should be made to develop and increase the provision of instruction in pure and in applied science in technical schools and institutions of all grades. Many more scholarships are needed to enable technical students to pass on to the universities, and also to enable boys from junior technical schools (or their equivalent) and from evening schools to enter senior technical schools. The position of junior technical schools in the educational system should be reconsidered. It is essential that the salaries and prospects of teachers in technical schools should be substantially improved, and a national pension scheme provided for whole-time teachers. In the proposed continuation classes provision should be made for instruction in science both in its general aspects and in its bearing on industry.

Medicine.—The First School Examination should be recognised by the General Medical Council as qualifying for entrance into the medical profession. Students should be allowed to take the First Professional Examination in (*a*) chemistry and physics, and (*b*) biology

before entering the university or medical school. More scholarships should be provided for candidates of both sexes tenable throughout the medical course.

Engineering.—A thorough and practical training in mathematics and science is essential to the school education of engineers; it cannot be replaced and need not be supplemented at school by practice in an engineering workshop.

Agriculture.—Specific instruction in agriculture or agricultural science should not be given in elementary or secondary schools, though in favourable circumstances a rural bias may be given to the work of a secondary school. All county education authorities acting either singly or in co-operation should provide well-equipped farm institutes for their areas.

Army.—Science should be an obligatory subject in the examination for entrance into the Royal Military College, Sandhurst, and be included in the course of instruction in the college. Steps should be taken to improve the efficiency of the instruction in science at the Royal Military Academy, Woolwich. More encouragement should be given to officers at later stages of their career to improve their scientific qualifications.

Home and India Civil Service.—An inquiry should be made as to the best methods of securing the services of scientific men for the purposes of the State in permanent posts and otherwise. Many permanent posts can best be filled by men selected, not by the ordinary competitive examination, but at a riper age on the ground of high scientific qualifications and professional experience. All candidates for the competitive examination for these services should supply evidence of a continuous course of training in science extending over several years. To ensure sufficient catholicity in questions propounded in the *viva-voce* examination, these examiners should include some representative of science.

University Education.—The universities should adopt the First School Examination as the normal examination for admission, and should abolish special matriculation examinations for candidates from schools. Greek should not be retained as a necessary subject in Responsions at Oxford or the Previous Examination at Cambridge. The universities should make special arrangements to test the fitness for entrance of candidates who are above twenty-three years of age.

Degree Courses in Science at the Universities.—The Universities of Oxford and Cambridge should arrange to provide more suitable courses in science for candidates who do not aim at an honours degree. Candidates for the university intermediate examinations should be allowed to take the examinations from school. The universities should recognise the Second School Examination as alternative to the whole or part of their intermediate examinations. It is desirable that a year spent mainly on research should form part of the work of university students preparing for careers concerned with science and its applications; but this should follow the course for a first degree in science. Scholarships are needed to enable a young graduate to spend a year or more in research, at his own or at another university.

State Aid to the Universities.—Large expenditure of public money is necessary to equip the universities for their work in pure and in applied science. Grants from public funds to the universities should be increased to allow the universities to make a substantial reduction in their fees.

University Teachers.—The duties of junior demonstrators should be limited so that they can spend a considerable amount of time on research. There should be posts of substantial value in university departments for senior men whose best work lies in teaching. The heads of technological departments should be allowed to undertake private professional practice.

Scottish Universities.—Steps should be taken to remove the limitations which confine a large proportion of the old-established bursaries to the faculty of arts.

Scholarships at Schools and Universities.—Scholarships should be considered as distinctions awarded in recognition of intellectual merit and promise. All scholarships should be of nominal value, to be supplemented according to need. Where necessary the whole cost of a scholar's education and maintenance should be defrayed. Scholarships at the universities should be tenable for at least three years with a possibility of extension. Scholarships awarded by local education authorities should not be restricted to particular universities. Scholarships at the universities should be awarded on a wider range of subjects than at present. The age limit for scholarships at Oxford and Cambridge should be eighteen rather than nineteen. Scholarships should not be awarded on work done in large pass examinations for schools. Scholarships to the universities for candidates from technical and evening schools should be awarded without an age limit, and for the present on a limited range of subjects. The number of scholarships at the women's colleges should be increased. Loan funds should be established to enable senior students to obtain professional training.

Supply of Trained Scientific Workers.—Concerted efforts should be made by employers, teachers, local education authorities, and the State to increase the flow of capable students to the universities and higher technical institutions with the view of securing the larger supply of trained scientific workers required for industrial and other purposes.

APPLICATIONS OF ELECTRICITY TO MEDICINE.

THE Institution of Electrical Engineers devoted an evening meeting last week to a visit to the Cancer Hospital, Fulham Road, S.W. The occasion was a joint meeting of the members of the institution and the members of the Electrotherapeutic Section of the Royal Society of Medicine. Two papers were read by medical men, and there was a large and representative exhibition of radiographic and electrical apparatus used in the diagnosis and treatment of disease.

The modern and thoroughly well equipped research institute of the hospital, under the direction of Dr. Alexander Paine, was thrown open to the visitors, who had an opportunity of seeing the inner working arrangements of several laboratories equipped for research work in physics, pathology, bacteriology, chemistry, and other subjects associated with the investigation of disease by modern methods.

The governing body of the Cancer Hospital has always exercised a wise judgment in the adoption of new methods for the investigation of the causation of disease, its diagnosis and treatment. This hospital was one of the first in this country to recognise the therapeutic use of X-rays and other electrical methods in the treatment of malignant disease. So far back as 1903 it inaugurated a very complete X-ray department, which was carried on for several years under the directorship of Dr. J. D. Pollock.

In 1911 the research institute was ready for work, and a year or two later the scheme for modernising the special branches of the hospital work was completed by the equipment of the new electrical and radiotherapeutic department, which is housed in a

separate pavilion, connected to the main building and wards by corridors. These two buildings complete a scheme for the investigation and treatment of disease which is one of the most complete in this or any other country.

In the radiotherapeutic department are to be found the latest forms of electrical apparatus. These allow a wide range of wave-length for the treatment of disease by radiations, commencing with the ultra-violet radiation to the very penetrating γ ray of radium. The hospital possesses a large quantity of radium, which is in constant use in the department. Originally inaugurated for the treatment of patients suffering from cancer and allied diseases, the department was, at the outbreak of war, offered to, and accepted by, the War Office for the treatment of wounded soldiers. Of these a large number have been treated by X-rays, radium, and electrical methods, this work being carried on in addition to the ordinary work of the department.

An interesting development in radium therapy has been inaugurated in this department, a number of soldiers having been treated by radium and X-rays for keloid scars of the face and neck. These result from gunshot wounds, and frequently require plastic operations to restore the parts destroyed by the injury. Radiation treatment greatly aids the surgeon in his operative efforts by softening the scar tissue. A number of cases have been successfully treated in this way.

The use of electricity in the treatment and diagnosis of disease is well shown by the various forms of apparatus seen in the radiographic and radiotherapeutic department. High-tension transformers and large coil outfits are used for the energising of the X-ray tubes, of which a number are in daily use. The Coolidge tube is used exclusively for treatment. Diathermy and other forms of high-frequency apparatus are used for the relief of pain and for the surgical treatment of disease. Continuous and interrupted currents are used for the treatment of diseases and injuries of muscles, bones, and joints.

The radiographic side of the work was demonstrated in the large radiographic room, where a Siemens single-impulse apparatus was shown at work in conjunction with a Coolidge tube. A new piece of apparatus, designed by Mr. C. A. Holland, was also shown. This is a stereoscopic plate-changing stand which allows of two plates being exposed in about half a second. It is worked by a large flywheel, which actuates a mechanism for changing the plates, shifting the tube, and automatically making the exposure. This will be found to be extremely useful when stereoscopic plates of the thorax or abdomen are required, where it is essential that no great interval should elapse between the two exposures.

Two papers were read and discussed at the joint meeting; these very appropriately dealt with recent applications of electricity to medicine. Diathermy—the use of the electrical current to raise the temperature of the body in the treatment of disease—was the subject of a paper by Dr. E. P. Cumberbatch. A very clear description of the action of the high-tension current, the method of its production, and the uses to which it can be put in practical work claimed the appreciative attention of the audience. Diathermy is one of the most recent of the many electrical methods used in the treatment of disease; when its value is more fully realised by the medical profession, and the technique of its application is more developed, it will undoubtedly become a routine and valuable method for the treatment of diseases which are at present uninfluenced by other forms of treatment. It is a valuable agent to use in combination with X-rays and radium.

The second paper was on "Single-impulse Radiography: its Limitations and Possibilities," by Dr. R. Knox, director of the electrical and radiotherapeutic department of the hospital. The limitations of the apparatus at present in use were demonstrated, and a plea was made for help in the designing and production of more powerful apparatus.

In addition to the permanent apparatus in the hospital a number of new forms of electrical apparatus were exhibited by several firms. These attracted a good deal of attention and amply demonstrated that the manufacturers of this country can produce high-class apparatus equal to the product of any other. Given closer co-operation between physicists, electrical engineers, medical men, and manufacturers, it should be possible in the future for British manufacturers more than to hold their own in open competition with other countries.

The meeting was well attended by a large number of the members of the Institution of Electrical Engineers and of the Electrotherapeutic Section of the Royal Society of Medicine. The council of the institution is to be warmly congratulated on the success of the meeting, and it is to be hoped that it may be the forerunner of many more of a similar character.

SILVANUS THOMPSON MEMORIAL LECTURE.

AT the meeting of the Röntgen Society held on April 9, with Capt. G. W. C. Kaye, president, in the chair, Sir Ernest Rutherford delivered the first Silvanus Thompson Memorial lecture. He dealt with the important advances in our knowledge of the constitution of matter, resulting from the discovery of X-rays in 1895. The following brief abstract indicates the scope of the address.

The discovery of the X-rays marks the commencement of a new epoch in physical science, for in the attempts which were immediately made to ascertain the nature of the unknown radiation attention was directed to the study of radiation in general, and new phenomena were soon encountered. A general investigation of the cathode rays and of the nature of the discharge of electricity through gases led to the discovery of the "electron" and to the putting forward of the "ionisation theory" by Sir J. J. Thomson. Prof. Townsend followed up the initial work by his theory of ionisation by collision, and Prof. O. W. Richardson investigated the emission of ions from incandescent solids. All this work was originally of academic interest solely, but within the last few years the practical applications have been shown to possess immense value. These include the production of detectors and amplifiers for wireless telegraphy, electrical rectifiers and oscillators by which radiotelephony across the Atlantic is now possible, and the Coolidge X-ray tube, which is destined to play an important part in radiology and in pure science.

From the outset X-rays and the phenomena of phosphorescence were generally thought to be connected, and Becquerel, while in search of "invisible" or X-radiations from certain phosphorescent salts, discovered the radio-activity of uranium compounds. The brilliant researches of the Curies, by which this discovery was followed, resulted in the isolation of the radio-active elements, polonium and radium. Numerous other radio-active elements were brought to light, and the chaotic condition which ensued was not reduced to order until the introduction of the transformation theory by the lecturer. Difficulties regarding the periodic classification were overcome by Prof. Soddy, who applied the term "isotope" to substances which occupy the same place in the periodic table,

but cannot be separated chemically, and the atomic weights of which may differ slightly.

With regard to the study of the X-rays themselves, no outstanding advances were made for some ten years after their discovery, when Barkla obtained evidence of the existence of "characteristic" radiations from experiments on secondary X-rays. The discovery led to the wave-theory of the X-rays, which was completely substantiated at later dates by the diffraction experiments of Laue, the Braggs, Moseley, and Darwin. Barkla's characteristic rays are thus shown to be of the same nature as the rays yielding bright-line spectra in the case of ordinary light. The diffraction experiments led to the employment of the X-rays for two classes of investigation, in the hands of Prof. Bragg and his son, problems of crystal structure have been successfully attacked, while in the other direction the late Mr. Moseley has shown these phenomena to be a most powerful method of investigating the constitution of the elements. He showed that the critical property of an element was its atomic *number*, while its atomic weight was relatively of secondary importance. The important relationship between the frequency of the K or L series of characteristic rays and the atomic number of the element should be known as Moseley's law.

At the conclusion of the meeting the president presented to Sir Ernest Rutherford the first of the medals which will be given annually in commemoration of the Silvanus Thompson Memorial lecture.

SCOTTISH METEOROLOGY.

THE Journal of the Scottish Meteorological Society for 1916 retains the interesting character it has held of recent years. There are four articles besides the report of the council, and the statistical information, with fifteen pages of letterpress, on the weather of 1916 in Scotland.

Capt. Douglas gives a very interesting account of his observations on clouds as seen from an aeroplane, but as this was the subject of an article in the issue of NATURE for April 4 it is unnecessary to say more about it here.

The second article is by Mr. M'Cullum Fairgrieve, and discusses a chart suggested by Dr. Griffiths Taylor, and called by him a climograph. The chart is formed by plotting the mean monthly wet-bulb temperature against the mean monthly humidity on squared paper, and joining in order the twelve points so formed. The idea originated with Prof. Huntingdon, who was investigating the effect of climate upon the mental and physical fitness of a race. Both Mr. Fairgrieve's and Dr. Taylor's papers should be read—it is impossible in a brief space to give extracts; they are both very interesting, but the criticism that occurs to one is that the magnitude and prosperity of a big city do not depend very largely on its climate, but rather on its geographical position. Thus, Edinburgh or Liverpool has probably just as good a climate as London or New York, but the preponderance of the latter cities depends chiefly on other considerations.

Dr. Crighton Mitchell, in the third article, discusses the time of the occurrence of the maximum and minimum temperatures at Eskdalemuir. He has taken the frequencies at each hour of the day, and so formed a frequency table for each month. The standard deviation of the time of maximum is much less in the summer than in the winter. For the summer the time of maximum is 2 p.m. and the standard deviation 2·55 hours. For the winter these values become 1 p.m. and 5·85 hours. As at other stations, the minimum mostly occurs about the time of sunrise.

In the fourth article Mr. Smillie and Mr. Watt discuss a curious case of ground-ice which caused much inconvenience by blocking the inlet of a public water supply. The trouble occurred at Lochrutton Lock, near Dumfries, and is the only similar case recorded there, although many more severe frosts have occurred since the construction of the waterworks. There was no surface ice on the lock at the time, the inlet became clear, and no further trouble was experienced as soon as the surface was frozen. The authors discuss the reason of the formation of ground-ice and show that it is probably due to radiation.

The rest of the journal contains notes, reviews of current literature, a list of fellows, and a statement of accounts, as well as an interesting description of the weather of each month by Mr. Watt.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE Foreign Secretary and the President of the Board of Education have invited representatives of universities to attend a conference to be held on May 9 to consider the possibility of establishing closer connection between British universities and those of the Allied countries. The proceedings will be private.

IN recognition of his services to the cause of science the sum of two lakhs of rupees was recently presented to Sir J. C. Bose, of the Presidency College, Calcutta, by some of the leading citizens of Bombay. In accepting the gift Sir J. C. Bose stated that it would be held in trust by a committee of three for the use of the Bose Institute.

THE Department of Agriculture and Technical Instruction for Ireland will next June award a limited number of trade scholarships. The object of the scholarships is to enable selected persons who have been engaged in certain industries in Ireland, for a period of at least two years, to obtain systematic instruction in the principles of science and art as applied to these industries. By this means it is hoped that the standard of workmanship will be raised and the industries, as well as the scholarship holders, thereby benefited. Candidates must be recommended by the managers of the industries in which they are employed, and must produce an undertaking from the managers to the effect that the latter will re-employ them after the termination of the scholarships. Scholars must also undertake to resume their employment on the termination of the scholarships. Scholarships will not be awarded to apprentices whose apprenticeships will normally terminate within the period of the training course. The scholarships will be tenable for one school session, and will be of the value of 1*l.* per week during the period of instruction, together with class-fees and travelling expenses. Candidates unable to produce evidence of a satisfactory general education will be required to pass a simple qualifying examination in English, arithmetic, and drawing, and the standard will be equivalent to that of the sixth standard of the Board of National Education. For the session 1918–19 the industries selected are typography, cabinet-making, loom tenting, motor engineering, plumbing, and woollen manufacture.

A PAPER on "Technical Education in India: its Past and Future," was written by Mr. E. F. Tipple, of the Thomason Civil Engineering College, Roorkee, U.P., for the Indian Industrial Conference held in Calcutta in December, 1917. Mr. Tipple urged that practical education in India has been much neglected, and that courses for the technical education required for the management of industries should be provided, and

also the lower industrial training suitable for the actual workers. These appear to be essential if any progress is to be made, but India has lagged behind in most industrial matters. The existing system of family industrial training from generation to generation, which finally merges into the "caste" system, might be worked upon as the groundwork of the lower industrial training; but the higher technical education has been entirely neglected, possibly because, as Mr. Tipple points out, higher or university education in India has largely fostered courses which provide persons mainly equipped for Government service as lawyers, clerks, etc., but not for practical pursuits. He also deplores the fact that education in Indian schools has been arranged to lead up to university education of a literary type. He suggests that an Indian secondary-school career, instead of ending with an examination which is intended as an "entrance" into the existing universities, should end with a "school final examination." In such a school final a varied preliminary training suitable for diverse careers, such as industrial, commercial, and trade pursuits, might be provided for. This reform has been strongly urged during at least the last twenty years, and is essential if India is to hold its own in industrial work. It is to be hoped that the Indian University Commission, which has been taking evidence in different parts of India for some months, will give a much-needed lead towards more practical forms of education in India in the future.

A COPY of the annual statement of the Rhodes Trust for 1916–17 has been received from the secretary of the trust. It is recorded that the war has interfered increasingly with the operation of the scholarship system. At the close of 1916 the American section of the scholarships was still barely affected; but on the entry of the United States into the war the difference between American and Colonial Rhodes scholars naturally ceased to exist. The trustees have decided to postpone for the present all further election to scholarships. This will not, however, interfere with the holding of the annual qualifying examination in the United States, or in Colonies where qualification is not obtained through affiliation of local universities with the University of Oxford. Altogether, there were in residence at Oxford for some part of the year eighty-five Rhodes scholars, of whom seventy-one were American and fourteen Colonial. Of the seventy-one Americans, the great majority are now serving in the United States Army. For 1917–18 there are at present eight Rhodes scholars in residence—six Colonial and two American. Of the six Colonials, five are medical students; and of these five, two have already seen service. Of the two Americans, one has returned from a year's ambulance work on the French front, and is temporarily engaged in Government work in the University chemical laboratory, while the other has been rejected, on medical grounds, for military service. In addition, one ex-scholar has returned after three years' military service in France, to complete his medical course. The scholarships set free under the Act of Parliament cancelling the German Rhodes scholarships have been allotted as follows:—One to the Transvaal; one to the Orange Free State; one to Alberta and Saskatchewan (which have hitherto had only one between them); and one to Kimberley and Port Elizabeth alternately (Kimberley to select in the first year). Fourteen scholars and ex-scholars have given their lives in the service of the Empire during the year, and others have won many military honours. Five scholars were admitted in the year to read for advanced degrees. The address of the trust is Seymour House, Waterloo Place, London, S.W.1.

SOCIETIES AND ACADEMIES.

LONDON.

Optical Society, April 11.—Prof. F. J. Cheshire, president, in the chair.—J. W. **French**: The balsam problem. For cementing optical parts together Canada balsam is almost invariably employed. Although starting or starring of the balsam layer, actual separation of the parts, or deformation of the optical surfaces frequently occurs, there is no appreciably better substance known. Optical parts may be combined with an air space between the surfaces, by optical contact with or without sealed edges, by optical welding, or by cementing. The disadvantages of the various methods were enumerated, the loss of light at transmission surfaces being particularly discussed. A considerable number of balsamed specimens of ages varying up to ten years had been opened and photomicrographs of the balsam layer were exhibited. In all cases there were fluid layers between the harder balsam and the glass surface, and the photographs demonstrated particularly the smallness of the adhesion to the glass. Specimens artificially produced were also exhibited. In many cases the age of the specimen was shown to be deducible from the configuration. So-called granulation of balsam was stated to be due to the action of moisture on the balsam surface. No trace of crystallisation of glass-quality balsam was found in any of the experiments, but a number of the photographed specimens showed definite right-angled fractures occasionally observed in torn gelatine films.

PARIS.

Academy of Sciences, March 25.—M. Paul Painlevé in the chair.—A. de **Gramont**: The spectrum test for boron. The bands obtained in the Bunsen flame, with or without the addition of hydrochloric or sulphuric acid, are diffuse and insensitive; the use of the oxy-acetylene flame gives additional bands, but still diffuse. The lines of boron given by the condensed spark are characteristic and more delicate, and the presence of three lines only in the ultra-violet shown by Sir William Crookes is confirmed. The line $\lambda=2497{\cdot}82$ will just detect 1 in 100,000 of boron. Applications to metallurgy and mineralogy are given.—C. **Depéret**: An attempt at the chronological co-ordination of quaternary times.—S. **Lattès**: The repetition of rational fractions.—M. de **Pulligny**: Some values of the approximate quadrature of the circle.—G. **Claude**: The industrial preparation of argon. A method of fractional condensation and distillation of air is described by means of which a mixture is obtained continuously containing argon 75 to 80 per cent., nitrogen 1 to 2 per cent., the remainder being oxygen. The oxygen is readily removed by burning with the correct proportion of hydrogen.—M. **Travers**: The estimation of tantalum in its alloys with iron. The impure tantalic acid obtained by the usual method is freed from iron by fusion with caustic potash, and after igniting and weighing the tantalic acid, the silica still remaining is determined by volatilising the tantalic acid in a current of hydrochloric acid at 900° C.—F. **Zambonini**: The identity of shattuckite and plancheite.—A **Guébhard**: The notion of "geosynclinal."—A. **Polack**: Inversion of the Purkinje phenomenon in congenital hemeralopy.—Ch. J. **Gravier**: A new copepod, *Flabellicola neapolitana*, parasite of a polychetal annelid, *Flabelligera diplochaitos*.—L. **Binet**: The cerebral pulse in emotional states.

April 2.—M. Paul Painlevé in the chair.—L. E. **Bertin**: Obituary notice on Lord Brassey.—P. **Appell**: The notion of fixed axes and of absolute movement.—P. **Termier**: Contributions to the knowledge of the

tectonic of the Asturias; the signification of the Arnao mylonites.—P. E. B. **Jourdain**: Demonstration of a theorem on ensembles.—L. **Schlussel**: The value of the accelerations and velocities of dynamical actions registered by the dynamometer.—A. C. **Vournasos**: A new metastable form of antimony tri-iodide. Pure glycerol at its boiling point dissolves 20 per cent. of antimony tri-iodide, and deposits it on cooling as an amorphous powder, a fourth metastable modification of this substance. At 172° C. it is completely transformed into the stable form of hexagonal crystals.—R. **Charpiat**: The glauconite sands of the Lower Lutetian, in the north-east of the department of the Marne.—A. **Lécaillon**: The manner in which *Psammophila hirsuta* captures and carries its prey, and the rational explanation of the instinct of this Hymenoptera. The sense of smell is suggested as the means by which the prey is detected.—A. **Durand**: Correlation between the phenomena of condensation and smell. The author gives reasons for the view that water vapour plays a part in the mechanism of smell.

BOOKS RECEIVED.

The Young Observer's Handbook. By W. P. Westell. Pp. 317. (London: McBride, Nast, and Co., Ltd.) 7*s*. 6*d*. net.

Carnegie Institution of Washington Year-Book, No. 16. Pp. xvi+358. (Washington: Carnegie Institution.)

Club Types of Nuclear Polynesia. By W. Churchill. Plates xvii+pp. 173. (Washington: Carnegie Institution.)

Forecasting the Yield and the Price of Cotton. By Prof. H. L. Moore. Pp. vi+173. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd.)

The Aviation Pocket-Book for 1918. By R. B. Matthews. Pp. xvi+362. (London: Crosby Lockwood and Son.) 6*s*. net.

Welfare and Housing. By J. E. Hutton. Pp. viii+192. (London: Longmans and Co.) 5*s*. net.

Carnegie Institution of Washington. Papers from the Department of Marine Biology. Vol. xii. Pp. v+258. (Washington: Carnegie Institution.)

The Interferometry of Reversed and Non-reversed Spectra. By Prof. C. Barus. Part ii. Pp. 146. (Washington: Carnegie Institution.)

European Treaties bearing on the History of the United States and its Dependencies to 1648. Edited by F. G. Davenport. Pp. vi+387. (Washington: Carnegie Institution.)

Applied Bacteriology. Edited by Dr. C. H. Browning. Pp. xvi+291. (Oxford Medical Publications.) (London: H. Frowde and Hodder and Stoughton.) 7*s*. 6*d*. net.

DIARY OF SOCIETIES.

THURSDAY, APRIL 18.

ROYAL INSTITUTION, at 3.—Present-day Applications of Experimental Psychology: Lt.-Col. C. S. Myers.
ROYAL SOCIETY OF ARTS, at 4.30.—Water Power in India: A. Dickinson.
INSTITUTION OF MINING AND METALLURGY, at 5.30.
LINNEAN SOCIETY, at 5.—Narrative of the Percy Sladen Expedition to Brazil in 1913, with Lantern-slides: Prof. J. P. Hill.
INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—Overseas Distribution of Engineering Appliances: L. Andrews.
CHEMICAL SOCIETY, at 8.—Hugo Müller Lecture: The Old and the New Mineralogy: Sir Henry Miers.
MATHEMATICAL SOCIETY, at 5.

FRIDAY, APRIL 19.

ROYAL INSTITUTION, at 5.30.—The Use of Soap Films in Engineering: Major G. I. Taylor.
INSTITUTION OF MECHANICAL ENGINEERS, at 6.

SATURDAY, APRIL 20.

ROYAL INSTITUTION, at 3.—Musical Instruments Scientifically Considered Prof. E. H. Barton.

MONDAY, APRIL 22.

ROYAL SOCIETY OF ARTS, at 4.30.—Military Explosives of To-day: J. Young.
ARISTOTELIAN SOCIETY, at 8.—Behaviour as a Psychological Concept Prof. A. Robinson.
ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—The Transkei: Miss M. H. Mason.

TUESDAY, APRIL 23.

ROYAL INSTITUTION, at 3.—Barrow-Explorers: Prof. A. Keith.
ROYAL STATISTICAL SOCIETY, at 5.15.—The Industrial Position of Italy: Prof. Commendatore Attolico and Capt. F. Giannini.
INSTITUTION OF CIVIL ENGINEERS, at 5.30.—Annual General Meeting.
ZOOLOGICAL SOCIETY, at 5.30.—Report on the Deaths in the Gardens during the Year 1917: Dr. J. A. Murray.—Exhibition of Specimens Illustrating the Effects of Rickets: Prof. Wood-Jones.

WEDNESDAY, APRIL 24.

ROYAL SOCIETY OF ARTS, at 4.30.—Mental Effects of the War and their Lessons in Social and Medical Reconstruction: Sir Robert Armstrong-Jones.

THURSDAY, APRIL 25.

ROYAL SOCIETY, at 4.30.—Bakerian Lecture: Experiments on the Production of Diamond: Sir Charles Parsons.
ROYAL INSTITUTION, at 3.—Rheims Cathedral: Sir Isambard Owen.
INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—Large Batteries for Power Purposes: E. C. McKinnon.

FRIDAY, APRIL 26.

ROYAL INSTITUTION, at 5.30.—Food Production and English Land: Sir A. Daniel Hall.
PHYSICAL SOCIETY, at 5.—Notes on the Pulfrich Refractometer: J. Guild.—The Accuracy attainable with Critical Angle Refractometers: F. Simeon.—Cohesion: Dr. H. Chatley.

SATURDAY, APRIL 27.

ROYAL INSTITUTION, at 3.—Modern Investigation of the Sun's Surface: Prof. H. F. Newall.

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