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"To the solid ground
Of Nature trusts the mind which builds for aye."—WORDSWORTH.

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MYCOLOGY AND PLANT PATHOLOGY.

A Text-book of Mycology and Plant Pathology. By Prof. J. W. Harshberger. Pp. xiii+779. (London: J. and A. Churchill, 1918.) Price 15*s.* net.

THIS text-book cannot fail to give much valuable information to the rapidly increasing number of students of plant diseases. Part i. deals with mycology in a general sense, comprising classification, morphology, histology, physiology, bio-chemistry, ecology, and phylogeny. In part ii. general plant pathology is dealt with; the predisposing and determining factors of disease and the botanical phenomena accompanying pathologic plant growth are discussed in detail. A very useful chapter, well illustrated and full of practical details, is given on "Practical Tree Surgery." Part iii. is entitled "Special Plant Pathology," and comprises a list of the common diseases of economic plants in the United States and Canada, followed by a detailed account of about 100 parasitic and non-parasitic diseases, which have been selected either because of the economic importance of the disease over wide geographical areas, or because their study helps the student to connect up the practical and the systematic parts of the book. Some very interesting information from various bulletins of the United States agricultural experiment stations is given in this section. It would have been well if the author had made room for a full account of the wart-disease of the potato (*Synchytrium endobioticum*), in view of the fact that it is the most destructive disease of the potato known, and that while the United States are believed to be still free, an alarming outbreak occurred in Canada in 1912. An account of the methods employed against this disease by the agricultural authorities in this country for the past ten years would have formed an excellent object-lesson for the student of the disastrous results that follow from the neglect of scientific measures in dealing with the early outbreaks of a new fungous pest.

Part iv. consists of laboratory exercises in the cultural studies of fungi, and this part will endear the book to the practical working student of mycology, in the same way as Percival's "Agricultural Botany" has been welcomed by the student in agricultural botany. Information is also given on micrometry, microscopic drawing and photomicrography, staining, culture media, and methods of microtoming. The methods of staining the flagellæ of bacteria appear to have been omitted here, no doubt accidentally.

The book concludes with appendixes on methods of making fungicides and insecticides and their formulæ, together with a spray calendar. The new ammonium sulphide wash might have been mentioned, as this is useful where any discoloration of the part of the plant sprayed (*e.g.* fruit) is to be avoided. The other appendixes consist of dichotomous keys to the classification of the Myxogastrales, Mucor, Aspergillus, Penicillium, the Erysiphaceæ, and the Agaricaceæ.

In any future edition it would be well to satisfy the curiosity of the student by giving more information on the subject of Eriksson's "mycoplasm," since it has been advanced to account not only for sudden outbreaks of rusts, but also for the appearance in the spring of the American gooseberry-mildew. From the remark made by Prof. Harshberger on p. 308 it may be inferred that he belongs to the majority who hold that there is no satisfactory evidence of the existence in Nature of "mycoplasm." The treatment of the subject of specialisation of parasitism seems to us to be too meagre. The subject is not only of great interest physiologically, but also of considerable economic importance. It is a loss to find no account given of the thorough investigations carried out by Marshall Ward in the Uredineæ, or of the work of the various mycologists—including G. M. Reed—in the United States on the same problems in the Erysiphaceæ. The work recently published by H. Wormald shows that similar phenomena of specialisation occur in the species of Monilia which cause the "brown rot" diseases. Since Prof. Harshberger says that "to be a successful pathologist one must be a good morphologist, histologist, geneticist, and physiologist," some account should have been given the student of the work of Prof. R. H. Biffen, who first established the inheritance of disease-resistance on Mendelian lines.

The morphological description of the Erysiphaceæ on p. 155 is incorrect, since that family includes one genus with an endophytic mycelium. The common rose-mildew of the United States is not, as stated on p. 461, *Sphaerotheca pannosa,* but *S. humuli.* The danger of generalising as to what is the dominant factor in outbreaks of disease under field conditions is shown by Prof. Harshberger's statement on p. 324 that "early sowing of winter wheat has been found beneficial in the reduction of the amount of stinking smut, for wheat sown early in October showed no sign of infection, while plants sown at the end of October were much attacked (about 60 per cent.) by the smut." In the case of a field of "bunted" wheat which came under the present writer's notice during the past season, the percentage of bunted grains, on an actual count, was found to be considerably higher in that portion of the field which had been sown a few weeks earlier! Since "bunt" and "smut" diseases of cereals appear to be on the increase in this country, we may note here the statement, to which Prof. Harshberger gives credence, that "in the summer of 1914 300 threshing machines were blown up or burned by smut explosions"; the ignition of the oily and dry masses of smut spores is attributed to static electricity in the cylinder of the threshing machine.

It would be difficult to accept—if this were necessary—all the terms used in this book. While we may have to accept "æciospore," "uredinio-

spore," and "teliospore," it does appear unnecessary to replace the convenient word "conidium" by "conidiospore." Also, "epiphytotisms," in the place of "epidemics," is rather dreadful. And a firm protest must be made against the attempt to label the "wart-disease of the potato" "chytridiose," or we shall be required ultimately to tell the farmer to call "potato-blight" "phytophthorose"!

Not the least valuable part of this book, which is indispensable to all mycologists, is the excellent bibliography (dealing chiefly with American and German authors) which is given in all the sections.

E. S. S.

DYNAMICAL AND POPULAR ASTRONOMY.

(1) *An Introductory Treatise on Dynamical Astronomy.* By Prof. H. C. Plummer. Pp. xx+344. (Cambridge: At the University Press, 1918.) Price 18*s.* net.

(2) *The Destinies of the Stars.* By Prof. Svante Arrhenius. Authorised translation from the Swedish by J. E. Fries. Illustrated. Pp. xviii+256. (New York and London: G. P. Putnam's Sons, The Knickerbocker Press, 1918.) Price 7*s.* 6*d.* net.

(1) THERE has long been a need for a general book on celestial mechanics on a smaller scale and at a more accessible price than the standard work of Tisserand, and Prof. Plummer's recent publication is a very successful effort to satisfy that need. It is so concisely written that a most remarkable amount of material is made available within a limited space, with only occasional loss of clearness. Halphen's theorem, that if the acceleration of a particle is a function of its position alone, and all the trajectories are plane curves, then the acceleration is always directed towards a fixed point, forms the commencement of the problem of two bodies. This constitutes a most welcome innovation, as Kepler's second law now becomes a consequence of the first, and its truth a confirmation of it. The methods of determining from observation the orbits of planets, comets, and visual and spectroscopic binaries are treated in detail, and then the author passes on to the treatment of perturbations, which is dealt with much as usual; but it is pleasant to see that chap. xvi., on secular perturbations, includes a table of numerical results. Very useful features are the account of recent work on methods of numerical interpolation and integration, and the description of Cowell and Crommelin's method of computing special perturbations. The lunar theory and the theories of precession, nutation, and lunar libration are also discussed in some detail. Misprints are few and the index is good. The present writer would like to suggest, however, that in a future edition tables of the best available values of the elements of the solar system, in astronomical and metrical units, should be included; for these are the fundamental data of dynamical astronomy, and are not usually presented in any convenient form.

(2) Prof. Arrhenius's work is a popular account of three very different astronomical subjects. The first chapter deals with the influence of the heavenly bodies on primitive human thought, describing how the moon's phases came to be used as a basis of chronology, on account of their easily recognisable variability, and how with the advance of culture the importance attributed to the year and the sun increased. The early knowledge of the major planets is also discussed, especially with regard to its religious bearing. The interesting fact that the Mexican priests discovered the very accurate coincidence between five synodic periods of Venus and eight solar years is mentioned incidentally.

The second chapter is devoted to the nature and origin of the Milky Way. Prof. Arrhenius inclines to the view that it is a spiral nebula, and suggests that it may have been formed by the collision of two gaseous nebulæ of immense size. Recent investigations on stellar motions and their relation to spectral type, and on the rotations of nebulæ, are discussed at considerable length. It is highly creditable to the author and the publishers that work published so recently as 1917 is referred to, though the absence of all mention of the ellipsoidal theory is regrettable.

The surface features, and especially the climatic conditions, of the planets are next discussed at great length and in a very interesting manner. The history of the earth's atmosphere, regarded as largely derived originally from volcanic gases, leads to an account of the leakage of gases from planetary atmospheres and the ability of the inner planets to support life. Mars is declared uninhabitable, as its mean temperature must be about $-37°$ C., and even at noon on the equator it can scarcely rise much above freezing-point; the available water supply is also exceedingly low. The canals are considered to be fissures corresponding with the dislocation fissures on the earth.

Mercury and the moon are totally uninhabitable on account of the absence of atmosphere. Venus, on the other hand, has a dense, warm atmosphere of high humidity, and "everything on it is dripping wet." Life may therefore exist; that near the equator would be of a low order on account of the uniform climate and lack of need for specialisation; that in higher latitudes may, however, be more highly differentiated.

A few blemishes somewhat mar a very instructive book. Such are the title, which is unfortunate for a work the scope of which, except for one chapter of forty-three pages, is confined to the solar system; the opening sentence, "Astronomy occupies a rather unique position among the natural sciences"; the illucid account of W. S. Adams's work on p. 50; such remarks as "the original matter of the stars stands still in space" (p. 55); "what force . . . causes the motion of the stars?" (p. 56); "Mercury lies five times nearer the sun than the earth does" (p. 230); the mention of "hydrate of chlorine" (p. 165); and the reference (p. 245) to "the title-page illustration," which does not exist.

H. J.

ELECTRICAL INSTRUMENTS.

Industrial Electrical Measuring Instruments. By Kenelm Edgcumbe. Second edition, revised and enlarged. Pp. xvi+414. (London: Constable and Co., Ltd., 1918.) Price 16*s.* net.

IN the student days of their career the majority of electrical engineers are strongly attracted towards the design and manufacture of large machines. To design a 10,000-h.p. dynamo is found to be easier and far more exciting than to invent some small improvement in a measuring instrument. This is one of the reasons which make it far more difficult to get—for instance—a manager for a telephone factory than for a large machine shop. The former would probably be offered a salary four times as large as the latter, although the latter probably did much better during his college course. It is advisable, therefore, for students to remember that there are certain drawbacks to following what is for the moment the fashionable branch of engineering to the neglect of much more profitable branches.

Mr. Edgcumbe's wide experience in the manufacturing and testing of instruments admirably qualifies him for his task. Although there have been no great changes introduced in the types of instruments used since the first edition was published, yet the continuous developments that have taken place have made it necessary to rewrite the whole book. Mathematical reasoning is avoided so far as possible. One consequence is that the mathematician who studies the work carefully will be tempted to explore for himself numerous practical and interesting problems. On p. 25, for instance, there is a diagram of a volt-ammeter with an ohm scale. Few mathematicians will be able to resist the temptation of finding the equation to, and the properties of, the curves which give the ohm scale. Dials marked in this way are used in the Board of Trade panel on the switchboard of a central station. There is a great demand in America for the analogous instruments which give the volts, amperes, and watts on the same dial face. They are useful in electric motor-cars.

The introductory chapters on "Errors and Accuracy" are most helpful. A diagram (p. 9) is given of a scale where the unavoidable error of observation produces the same percentage inaccuracy at all points of the scale. We take it that if R is the reading and x the distance of the pointer from the unit mark on the scale, then $R=a^x$ gives the law according to which the scale is divided, a being a constant. The divisions on this scale, ordinarily called a logarithmic scale, are obviously much further apart at low readings than at high readings. We were surprised to learn that the definition of the percentage error e "usually adopted in this country" is given by

$$\text{True value} = \text{Reading}\ (1+e/100).$$

We should have thought that the academic definition

$$\text{Reading} = \text{True value}\ (1-e/100)$$

was more widely used.

Amongst the instruments described are all types of ammeters, voltmeters, wattmeters, frequency tellers, synchronising devices, recording instruments, speed indicators, oscillographs, pyrometers, relays, rail-bond testers, etc. Descriptions are also given of meggers, ohmers, ducters, graphers, etc. These names are not schoolboy slang, but are in everyday use by engineers. In the old days anyone who could talk about an "earth" or a "short-circuit" might rank as an electrician; now he must be able to define the meaning of quaint phrases like "milking booster."

On p. 384, when describing instruments for testing lightning conductors, the author says that the earth should on no account exceed 10 ohms. Is there any reason why the number 10 should be chosen rather than, say, 1 or 100? The present writer once measured the earth resistance of a lightning conductor on a chimney-stack and found it to be 70 ohms. He had the end dug up, and found that the electrician had put a brick instead of the usual copper plate at the end of the conductor. This had been done twenty years previously, but although the stack had been repeatedly struck by lightning, no damage had been done. It would probably have fulfilled its functions equally successfully for another twenty years if the brick had been left undisturbed.

In conclusion, we congratulate the author on the clearness of his descriptions and on the skill with which he exposes the weak points in the design of several well-known instruments. The diagrams are worthy of the highest commendation, and the printing is good. There are a few misprints. The only serious one is on p. 183, where there are two errors in the formula for the electrostatic attraction between two plates. On p. 404 also lines 4 and 5 from the bottom of the page should be interchanged.

A. RUSSELL.

OUR BOOKSHELF.

Modern Engineering Measuring Tools: A Handbook on Measuring and Precision Tools as used in the Modern Tool-room and Engineering Workshop. By Ernest Pull. Pp. viii+115. (London: Crosby Lockwood and Son, 1918.) Price 4*s.* 6*d.* net.

PRIOR to the outbreak of the war there were still a large number of engineering firms in this country which had not adopted systems of precision in the manufacture of component parts. War conditions have altered this so far that there must be very few firms now which have had no experience in precision methods. It is to be hoped that there will be no retrogression in this important matter now that the war is practically over.

This book is intended to help workmen to acquire a practical acquaintance with the construction and use of the commoner types of measuring appliances as employed in tool-rooms and engineering workshops. It includes sections dealing with the use of micrometers, verniers, various special appliances such as depth-gauges, screw-thread micrometers, etc., gauges and gauge systems, and

types of measuring machines. The sections dealing with micrometers and verniers are arranged in a specially helpful manner, and contain many diagrams showing the instruments set to various readings, including those cases which present difficulties to beginners. There is also a good description of the Johansson system of standard gauges and the methods of using these gauges, and there is sufficient matter included on the subjects of limits, tolerance, and limit-gauges.

Omissions are inevitable in a small book of this kind, and there are many special appliances developed during the war which do not find a place. The success which the author has attained in this and his companion book for munition workers should encourage him to undertake a more comprehensive volume in which laboratory as well as workshop methods might find a place.

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.*]

Fuel Economisers.

DR. AITKEN'S letter in NATURE of December 12 calls to my mind some unpublished experiments which I made at the National Physical Laboratory in connection with some work on radiation from surfaces, which entirely bear out his statement that the colour of a hot surface at relatively low temperature has very little influence on the amount of radiation leaving it. This is a conclusion which, *a priori*, one would not consider very probable, yet is actually found.

In a series of experiments the sides of a thin cubical metal canister were painted in panels of varying colour, the interior of the cube being filled with rapidly stirred oil electrically heated. The amount of pure radiation leaving each kind of surface at a series of steady temperatures up to about 200° C. was compared with that coming at the same temperature from a "black body" constituted by a re-entrant tube with appropriate diaphragms. The exterior of the tube was washed by the hot oil. For temperature differences in the region of 100° C. it was found that:—

(1) A bright surface of ordinary tin-plate only gave off an amount of radiation equal to 5–10 per cent. of that from a "black body." The quality of the optical perfection of the surface was of little importance so long as it was bright. A metal surface treated with galvanit of various kinds showed effects of the same order as tin-plate. Burnished copper well cleaned with metal polish gave a lower intrinsic radiation than tin.

(2) A coat of almost any paint, regardless of colour, brings the true radiation up to from 80–90 per cent. of that of a "black body," and a quite thin layer of paper varnish or of celluloid varnish, so thin and transparent as to be almost imperceptible to the eye, applied over the bright metal, has almost the same effect.

(3) A layer of tissue-paper or wallpaper pasted over the bright surface, or a coating of whitening or lime-wash, shows the same kind of effect in restoring practically the full radiation so long as the coating is thin.

(4) If the surface of the cube be metallised with aluminium paint, the pure radiation is reduced to from 45–55 per cent. of that of a "black body." Much depended, however, on the kind of vehicle used for the aluminium, and different samples of aluminium paint, though giving results similar in appearance to the eye, differ considerably in the effects produced. Bronzing and such-like processes produce intermediate effects.

In some later experiments, with which Mr. Ezer Griffiths was associated, a study was made of the total heat-leaving surfaces, with the view of obtaining some data as to the relative effects of conduction, convection, and radiation in ordinary still air. From these experiments it would appear that in the case of low-pressure steam radiators in the region of 100° C., almost exactly half the heat leaving the vertical surfaces, if these are of an ordinary character or painted in the usual manner, consists of pure radiation, the remainder being the combined effect of conduction and convection. Therefore, if, as is a very common practice, the radiators be metallised by painting with aluminium paint, the amount of heat reaching the middle of a room warmed by such radiators would be lowered to half, or double the amount of heating surface would be required to produce the same radiation effect as if the surface were black or of bare metallic iron. These results certainly have an important bearing upon the practical problems of heat transfer.

In the course of a recent perusal of Leslie's "On Heat" I have been much struck with the fact that many of these things were by no means new to him a hundred years ago. His very suggestive and interesting researches do not appear to be anything like so well known as they certainly deserve.

J. A. HARKER.

Munitions Inventions Department,
Princes Street, Westminster, S.W.1.
December 17.

MY attention has been directed to the note in NATURE of November 28 (p. 249) referring to Prof. C. V. Boys's fuel economisers, and also the letter by Dr. John Aitken in the issue of December 12; and as I devoted some consideration to this question about twenty years ago, a description of the apparatus I then devised for a similar purpose, and the results obtained with it, may be of interest.

In order to heat this house, which is a cold one, and finding that the open fireplace in the hall consumed much fuel with little heating effect, I fixed an open fire-stove in front of the existing fireplace. I then fitted a wrought-iron closed box, 3 ft. high, 2 ft. broad, and 9 in. deep, at the back of the stove in the recess in which the fireplace previously existed.

The chimney of the stove was connected to the box near the top at one side, and an outlet connected to the box on the other side, which was led up the chimney. As this outlet-pipe is much smaller than the existing chimney, an iron plate was fixed across the intervening space so as to block it against the entry of air except through the stove.

This box was divided vertically into two equal compartments by a plate extending from the top to within 6 in. from the bottom, so as to ensure that the hot gases flowed past the internal surfaces of the box and imparted their heat to them. At one side of the box near the bottom was fixed a door in case it should be necessary to remove any soot that may have accumulated in it.

The stove is lighted in the usual manner with a little coal, and a coke-fire is maintained thereafter. The iron box soon becomes heated by the gases issuing from the stove, which without the addition of the box would have passed direct into the chimney, and the air of the room circulating around its external surfaces becomes heated, and that of the hall warmed.

The saving of fuel by the adoption of this contrivance is very marked, as is proved by the fact that the temperature of the products of combustion when they leave the box is considerably lower than when they enter it.

The apparatus, which is not unsightly, as it is practically concealed by the ornamental stove in front of it, has been in operation for the past twenty years without causing any trouble or requiring any repairs.

Now fuel is scarce, economisers such as the one described might be adopted with advantage.

R. C. PARSONS.

48 Princes Gardens, South Kensington, S.W.7, December 16.

The Perception of Sound.

I WOULD beg permission to add a brief correction to my remarks relative to the quotation from Helmholtz given by Sir Thomas Wrightson, since I may have been guilty of some misunderstanding. Sir Joseph Larmor has been kind enough to explain to me how the relation between the wave-length of the vibrations set up in a closed volume of liquid by a vibrating body immersed in it and the dimensions of this body is of importance in the case of the cochlea.

The time taken by the compression to travel from the oval window to the round window is so short in comparison with the wave-length that there can be only a very minute difference of pressure between the two sides of the basilar membrane due to this cause. The movement of the fluid as a whole will be the means by which the membrane is set into backward and forward movement. If different parts of the membrane, however, have their own rates of vibration, these parts would be set into resonant vibration by the appropriate rates of alternation of current, on account of the differences of pressure on the two sides of the membrane implied by the flow of liquid. The quotation from Helmholtz seems to suggest that he had come to look upon these movements of the liquid as the actual exciting cause of the local resonance. If so, it may be that the most satisfactory solution of the many difficulties of the case is in a combination of part of Sir Thomas Wrightson's view with the resonance theory of Helmholtz.

W. M. BAYLISS.

The Meteoric Shower of December.

THE weather proved very unfavourable for observation during the first half of December this year, and I watched for a return of these meteors on three nights only, viz. the 6th, 8th, and 9th. The temperature was unusually high for the period, the mean being 49·5°, and about 9° in excess of the average. Few Geminids were recorded on December 6, but on December 8 and 9, between 13h. and 15h., they were more numerous, and the place of the radiant admitted of accurate determination. There seems no question that the position moves to the eastward, with the time, similarly to the Lyrid and Perseid radiants. From observations obtained at Bristol in recent years the Geminid centre came out as follows:—

		R.A.	Dec.
		°	°
1916 December	3	102	+32
1912	6	104½	+33
1914	8	105	+31
1918	8	107	+32
1918	9	108	+33
1914	12	109	+33
1915	12	110	+33
1917	12	112	+33
1914	15	114	+33

W. F. DENNING.

Bristol, December 18.

Lady Roberts's Field Glass Fund.

MAY I, through the hospitality of your columns, ask all officers and others who have received glasses or telescopes on loan through my Fund to send them back to me now for return to their owners? All instruments lent through my Fund bear the letters N.S.L. (National Service League), followed by a letter and a number. I should be glad if officers and others returning glasses would enclose in the case a note of acknowledgment for the owner.

I wish to record my gratitude, not only to the public for the munificent loan of 30,000 glasses, but also to the Press for the valued help which it has given this undertaking.

The address for glasses and correspondence is the Manager, Lady Roberts's Field Glass Fund, 64 Victoria Street, S.W.1.

ROBERTS.

INTER-ALLIED CONFERENCE ON INTERNATIONAL ORGANISATIONS IN SCIENCE.

THIS important conference was held in Paris on November 26–29. Primarily, it was a conference of the Committee of Inquiry (*Commission d'Etudes*) which was constituted at a meeting of representatives of academies of the Allied countries and the United States of America held in London, on the invitation of the Royal Society, early in October last.

The Committee of Inquiry was to "prepare a general scheme of international organisations to meet the requirements of the various branches of scientific and industrial research, including those relating to national defence." At the London conference certain resolutions had been passed and proposals submitted, and the duty of the Paris conference was to weld these into a workable whole and generally to establish on a sound basis an international council or federation of national councils which would be representative in each country of academies and other scientific societies.

The names of the delegates, who met in Paris to the number of forty-seven, are given in the following list:—*Belgium*—MM. Lecointe, Massart, de la Vallée Poussin; *Brazil*—M. de Carvalho; *France*—MM. Painlevé, Guignard, E. Picard, A. Lacroix, Lippmann, E. Perrier, Roux, Haller, Bigourdan, Baillaud, Lallemand, Moureu, Flahault; *Italy*—Sen. V. Volterra, Profs. Reina, Nasini, Ricco, Fantoli; *Japan*—Profs. Tanakadate and Sakurai; *Poland*—M. L. Mickiewicz; *Rumania*—MM. Soutzo, Hurmuzeco, Mrazee, Marinesco; *Serbia*—MM. Zujovic, Petrovitch, Jopovitch; *United Kingdom*—Prof. Schuster, Mr. J. H. Jeans, Sir Frank Dyson, Sir E. Sharpey Schafer, Profs. Frankland, Sherrington, and Starling, Col. Lyons, Dr. Knott; *United States of America*—Prof. Bumstead, Col. Carty, Drs. Durand, Flexner, Hale, Noyes. Although the Academy of Athens had not been able to send representatives, Greece must also be included in the list of countries invited to form national research councils.

On the morning of Tuesday, November 26, the representatives met in the Academy of Sciences, and were welcomed in a short address by M. Painlevé. It was then proposed that Prof.

Schuster should act as president of the conference, and M. Lallemand as secretary.

Having unanimously agreed that all present arrangements must be regarded as provisional, the committee, acting along the line of the resolutions passed at the London conference, assumed temporarily the title of the International Research Council, and proceeded to embody its findings in a series of resolutions, the leading features of which need only be referred to.

An Executive Committee of five was elected, consisting of MM. Picard (chairman), Volterra, Lecointe, Hale, and Schuster, the seat of the bureau to be in London. The powers of this committee were formulated on a wide basis so as to enable it to carry out effectively the objects aimed at in the resolutions of both the London and the Paris conferences. So soon as this committee considered that things were sufficiently matured, the International Research Council would be convened so as to take the necessary steps towards assuming its final form as a Federation of National Councils. Meanwhile, the Executive Committee was to examine proposals for the formation of new international scientific associations submitted to it by any academy represented at the conference, or any group of delegates of such an academy or of a National Research Council. For the thorough examination of these proposals the Executive Committee would appoint special committees, the members of which need not be members of the International Research Council. In all cases the endeavour would be to get the most suitable persons to serve on these special committees.

In thus laying the foundation for the establishment of effective organisations of an international character, the International Research Council emphatically declared that there was no intention of interfering with individual enterprise. On the contrary, since all great advances in science are initiated by individual efforts, the International Research Council regarded it as one of its important functions to give every possible encouragement to those capable of conducting scientific research of a high order. It was also clearly recognised that with respect to the initiation of new international associations or to the revival of old ones no decision could be arrived at without consulting bodies or persons specially interested.

Definite progress was made in the institution of three associations: (1) Astronomy, (2) Geophysics, (3) Union of Chemical Societies. These might be taken as typical examples of the many other associations to be formed hereafter. It will suffice to direct attention to one of these, say the second named above.

It is proposed to form, among the States which have been at war with Germany, an association, to be called the International Geophysical Union, having for its aim the development, in their respective territories, of all useful work in connection with the physics of the globe. Geophysics is understood to include geodesy, meteorology, terrestrial magnetism, and seismology. This union (or each of its sections) is to be controlled by an international committee composed of delegates from national councils, which will consist of representatives from scientific societies specially interested, and of delegates appointed by the respective Governments. The number of delegates from each State serving on the International Committee will be determined by the population of the State, according to this scheme:—Fewer than 5,000,000 inhabitants, one delegate; between 5,000,000 and 10,000,000, two delegates; and so on up to five delegates for a population exceeding 20,000,000. Each State will contribute towards the expenses of the International Committee definite sums regulated according to the number of inhabitants of the State. Each union or association will have its own bureau, with president, vice-president, and secretary; and meetings will be held at least once every three years. The union once constituted, any nation which has been at war with Germany may formally enter the union on agreeing to the conditions laid down. Any neutral nation desirous of ultimately entering the association can be admitted only by a three-fourths vote of the countries represented on the International Council. The present agreement may be revised on the request of half the members of the International Council, any proposed modification requiring a two-thirds vote in its favour.

In addition to the resolutions which were debated and passed, certain proposals were laid before the International Research Council bearing upon such questions as international exchanges of publications, internationalisation of great laboratories, comparison of university programmes of study, the publication of authoritative abstracts of scientific papers. and the whole bibliography pertaining thereto. Undoubtedly extremely useful work could be effected along these lines, but much spade work must needs be done by well-chosen enthusiasts.

At present the main consideration is the practical success of the movement which has been inaugurated. The Executive Committee has ample powers to get into touch with all kinds of scientific academies and societies, inaugurate special committees which have power to add to their numbers, and encourage the formation of national councils the federation of which will form the International Council. This Executive Committee, it must be remembered, is a temporary body, which will naturally dissolve when the International Council is finally constituted. Its five members are known to be keenly interested in the whole question of international scientific work, and the task of establishing effective international organisations could not be in better hands. Their efforts must, however, be supplemented by all scientific academies, societies, and unions entering heartily into the movement, and aiming at the formation of international associations in all branches of science, physical and biological, in the widest

sense of these terms. The first great step has been taken. In carrying the project out to a successful finish, men of science must see to it that the new organisations are not hampered by conditions which in certain instances marred the efficiency of former international organisations of a similar kind. C. G. K.

OUR ROADS.

IN view of the generally accepted reconstruction programme of rehousing our working population and providing small holdings for a large number of the men from our fighting forces when they are released from service, the question of our roads and their extension to give access to the proposed new factories, workers' houses and gardens, small farms and allotments is of great interest, and has attracted much attention, several papers dealing with this matter having been recently read and discussed by the Institution of Civil Engineers.

It is evident that the transport facilities for collecting and distributing goods into these transformed rural districts must be such that the country resident is as nearly as possible on an equality with the townsman. It is equally evident that this distribution of goods cannot be given by extending our railway system, whether by branch lines of standard gauge or by narrow-gauge feeders, as has been the case in France and Belgium; for, however much we extend a railway system by light railways or tramways, these can only collect and distribute produce up to the point reached by the rails themselves, and thus a railway system *per se* can serve but a very small part of the land area. In fact, a well-extended road system which connects every door by road wagon is in a sense comparable with the sea, which connects every port in the world by our ships.

The future extension and improvement of means of transport by road are, therefore, of first importance. It is interesting at this stage to review the work already carried out in road-surface improvement by the local authorities themselves or in cases where these authorities have been aided by the Road Board. A great deal was done in the improvement of road surfaces during the ten years immediately preceding the war. Many new methods of waterproofing the surfaces, first by using coal-tar and pitch, and later on by bitumen, were tried on a large scale. Although we hear through the Press that our roads have suffered terribly from the war, and that the shortage of labour and restrictions on the use of road materials, combined with the motor traffic, have resulted in the breaking-up of the road surfaces to such an extent that vast sums will be required to put them into a fit state to carry the increased traffic which is expected during the reconstruction period, this is not true as regards the improved roads. As a matter of fact, the improved road surfaces which had been developed previous to August, 1914, have stood the severe strain of carrying the increased war traffic remarkably well. For instance, if we take the main road from London to Folkestone as an example of one which has been daily traversed by heavily laden trains of motor-wagons carrying war material, this road has practically had no money spent on it, its surface is as good as it was at the commencement of the war, and, what is interesting from a sanitary point of view, it has been self-cleansing, the rainfall doing all the scavenging that was necessary. Fortunately, we have before us many similar examples of the substantial correctness of the methods which were developed just previous to the outbreak of war. The damage on which so much stress has been laid by the Press has been almost entirely confined to the old, unimproved water-bound roads, which must now be taken in hand.

The newer roads, however, differ from the older roads in one feature, *i.e.* that the use of pitch and bituminous materials for binding the road stone together has given an entirely new aspect to the process of repairing and maintaining our roads. The old water-bound roads wore out by the material being ground away by the traffic, when it was wetted by the rainfall, so that the stones could move on one another, and instead of remaining angular they lost their corners and tended towards the spherical shape we see in water-washed shingle. The pitch or bituminous binding introduced reduced this wear to a great extent, but in place of it introduced a new trouble: it was often the case in the experimental work when pitch was used as a binder that the roads were found to become corrugated by the traffic; harmonic waves were formed on their surfaces, and these waves could be levelled only by breaking up the surface and relaying it—an expensive process.

Road engineers are by no means unanimous as to the causes of this wave formation. Some of them blame the particular process employed for preparing the material and finishing the surface by rolling, but all have noticed the bad effect of the synchronising or harmonic action of vehicles passing over them, especially when the majority of these are exactly of the same class, which is the case when a line of motor-omnibuses begins to work on a road previously traversed by heterogeneous traffic. It is unnecessary to dwell on this point, nor is it important, for it is certain that corrugation or wave formation *always* results from the rolling action of wheels on any surface, even of hard steel wheels on steel rails, as is shown by the corrugation of railway and tramway rails.

The study of the harmonic effects of wheels rolling over surfaces of varying degrees of rigidity and elasticity is a large and very interesting question which cannot be discussed within the limits of this article. It is more important to know what can be done to limit its effect on road surfaces. During the years of the war the question has

been much studied, and some excellent results have been obtained in Scotland by Mr. Robert Drummond, the engineer of the Paisley roads, who has devised methods by which the stones forming a road surface can be wedged into position by simple and inexpensive methods, and then waterproofed by pouring a very small quantity of pitch over the wedged surface. Roads so made have stood the heaviest traffic with a minimum of deformation. It is practically certain that Mr. Drummond's method, hitherto worked by hand, can be carried out still more efficiently by machinery. This will undoubtedly be done and will greatly reduce the cost not only of resurfacing the vast mileage of roads which must now be taken in hand, but also of the great extension which must be undertaken, as foreshadowed in the early part of this article, to enable country districts to be opened up. In conclusion, if, twenty years ago, anyone had stated that the extension of roads was even more important than the extension of railways, he would have been looked upon as a visionary; but this is now actually the case.

Since the above was written, the announcement has been made that the Government, acting on the recommendation of the Road Board, has allocated 10,000,000*l.* to our roads and bridges. We are not informed whether Ireland is to share in the grant, but it is stated that the greater part is to be spent on roads, as the bridge improvements can be carried out by the local authorities, borrowing for this purpose on long-term loans. Ten million pounds is a large sum, but it will be found sufficient only to resurface about one-quarter of the main roads of England, Wales, and Scotland so as to bring them to an equality with the improved roads we have mentioned, even if the most economical methods now known are faithfully followed.

This grant is sufficient for a commencement. It will give employment to many demobilised men as they return from overseas, but it is to be hoped that the Government or the Road Board will see to it that really scientific training is given to the executive staff which is to carry out the work. The special local knowledge of climatic conditions, local road stones, and so forth, which used to form so large a part of the qualifications of our local road surveyors, will no longer suffice. As we have shown, the road engineer has now to deal with scientific questions which ought to be determined for him by the central authority, which is at present the Road Board; it is to be hoped, therefore, that the instructive experimental work commenced by it previous to the war will be at once renewed, so that the methods of resurfacing the roads of the kingdom may be to some extent standardised.

Road problems are already so specialised that our universities might with advantage follow the example of some of the American universities by instituting special courses of lectures on highway engineering.

THE AMERICAN CHEMIST IN WARFARE.

UNDER the above title Dr. Charles L. Parsons, chairman of the U.S. Committee on War Service for Chemists, communicated to the American Chemical Society, at a recent meeting at Cleveland, a paper which is reproduced in our contemporary *Science*. As the paper bears directly upon matters of national importance, and is of interest as showing the promptitude and thoroughness with which our Ally dealt with a great and critical emergency, it may be desirable to give a short summary of its contents.

Some months before the United States entered the war Dr. Parsons was sent by the Ordnance Department to study in England, France, Italy, Norway, and Sweden certain chemical processes, particularly those relating to the fixation of nitrogen. When he arrived in England he was strongly impressed with the dangerous position in which this nation stood owing to the policy of the War Office in drafting practically every available man, irrespective of his qualifications and potential value, into the combatant ranks. Perhaps at the time no other course was possible. It was absolutely necessary to stem the rush of the enemy, and men were required to do it. Meanwhile, the Government was halting between two opinions—shilly-shallying with the question of conscription, and "letting *I dare not* wait upon *I would.*" The consequence was that owing to the lack of technical men, chiefly chemists, the supply of munitions was greatly retarded. This was no less true of France. Everywhere the same statement was made that the greatest mistake of the Entente countries was in giving too little attention to brain power and too much to physical prowess. Germany, on the other hand, had carefully conserved her chemical strength in order to develop the new and terrible methods of warfare which her policy of "frightfulness" forced upon the world. We were ultimately reluctantly driven to fight her with her own weapons, and to better her example, if we could.

The war, in fact, entered upon a new and utterly unexpected phase for which this nation was very inadequately prepared, and with which the War Office, as then constituted, was quite unable to cope. Practically the whole chemical force of the Empire was called upon to grapple with the position. How our difficulties were at length surmounted, and how our chief enemy was eventually compelled to regret that he had ever embarked upon such a mode of warfare, will perhaps some day be made fully known. It is a chapter in the history of the war not only of present interest, but also of future value. There is no question that before this consummation was reached we were for a time in great jeopardy. Indeed, it was necessary for all the Allies to seek for chemists and chemical engineers wherever they could be found. France secured the services of Norwegians; England drew upon her colonies and her oversea possessions. Dr. Parsons, indeed, says that "the chemist who perhaps more than any

other in England is responsible for the success of England's munitions programme is an American."

This lesson was not lost upon the authorities of the United States when it was recognised that they would be forced to take their part in crushing the great conspiracy against the freedom of the world. How they took it to heart is the purpose of Dr. Parsons's paper to show.

In the first place they at once instituted a census of American chemists. It was started in February, 1917, and was kept up without interruption. By July, 1917, some 15,000 chemists had sent in particulars of their address, age, place of birth, lineage, citizenship, dependents, places of instruction, chemical experience at home or abroad, military training, publications, research work, etc. The data obtained were indexed and cross-indexed by the American Chemical Society working in conjunction with the Bureau of Mines. When America entered the war every chemist was directed to keep the society informed as to his military status and duties. The president of the American Chemical Society had already offered without reservation the services of its members to President Wilson in any emergency that might arise. The society recommended the use, in their respective fields, of all trained chemists, and urged that those of special ability should be held to the work they could best perform. Influential committees of representative men were formed to consider how the war service of chemists could best be made, and a plan for the "Impressment of Chemists and for the Preservation of the Supply of Chemists" was drawn up, and the aid of the technical Press was enlisted in making known the procedure. A large number of the chemists engaged on war work were obtained by means of the classified list. Practically all the chemists who early entered the Ordnance Department with commissions were obtained through the American Chemical Society or its officers. The list was equally useful to the Bureau of Mines when it entered upon the subject of gas-warfare. All the bureaux and departments in Washington consulted it from time to time as the necessity arose.

From the first (says Dr. Parsons) the chemical *personnel* of the Army and Navy and the civilian bureaux was partly civilian and partly military. As the war progressed the proportion of chemists in uniform naturally increased as the men were taken from the Army and assigned to chemical duty. The question is still a disputed one—to be settled probably only when the war is over—as to whether a chemist can serve best in a civilian or a military capacity. Certainly in both capacities the demand for chemists has been unprecedented, and the development of chemistry in modern warfare to those in touch with the advancement made seems almost a fairy-tale.

Considerations of space forbid the attempt to follow in detail Dr. Parsons's account of the various organisations for co-operative research which were instituted in practically every university and polytechnic throughout the States, nor can we deal fully with the story of how the various sections and sub-sections of the chemical warfare service were eventually organised and co-ordinated. This service was ultimately established as a unit of the national Army, being, Dr. Parsons claims, "the first recognition of chemistry as a separate branch of the military service in any country or any war."

Dr. Parsons pays a well-merited tribute to the zeal and sense of duty with which practically the whole of the chemical profession in America entered upon this work. "The organisation was rapidly built up and contained the names of the most prominent chemists in the country, as well as those of hundreds of young chemists who will later become prominent."

In reading this interesting story it is impossible to avoid being struck with the evident ease with which the civilian element was promptly merged into and made to co-operate with the bureaucracy when the necessity arose. It may be that in a democracy like America public departments are more in actual touch with the public than with us. There is seemingly less of that aloofness and jealousy of outside interference and advice which are apt to characterise our public offices. The Civil Service of America is not less highly organised than our own, and as regards its knowledge and appreciation of modern necessities and conditions it is, perhaps, in some respects, better equipped. That our Government offices have something to learn in this respect is evident from the considerable importation of "business men" into the Government service that it has been necessary to make during the last four years. It cannot truthfully be said that all our public departments have invariably risen to the emergencies with which they have had to deal, and certain of those most directly concerned with the conduct of the war, and with the conditions which have arisen out of it, have been most faulty in this respect. It may be, to adopt the Prime Minister's phrase, they have too many "vested prejudices" to contend with.

We have now had the story of the American chemist in warfare from one who is well qualified to tell it. May we not hope that before very long someone equally well qualified to deal with the experiences of his English *confrère* may give us a similar account? The record may not be quite so satisfactory in all respects, as our cousins had our mistakes to warn them and our experiences to guide them, as Dr. Parsons admits. But in spite of mistakes, and of a certain tardiness on the part of those entrusted with the conduct of the war to realise the importance of chemistry in modern warfare, and to welcome the skilled assistance which was offered them, the story is highly creditable to us, and will bear comparison with that of which a short account has been given. As already stated, it constitutes a chapter in our section of the history of the war, and should be made known for the satisfaction of those who have lived through the anxieties of the past and for the instruction and benefit of those who come after us.

T. E. THORPE.

NOTES.

THE announcement of the appointment by the Department of Scientific and Industrial Research and the Medical Research Committee of a Research Board to investigate the conditions of industrial fatigue comes as a welcome reminder that the importance of fatigue in industrial processes, long insisted on by those engaged in its investigation, can no longer be neglected. Fatigue, indeed, forms the dominating factor in limiting output, and its investigation during the war established facts of fundamental importance. It is right that these researches should now be co-ordinated and extended to other industrial processes where, up to now, fatigue has not been adequately investigated. The Board consists of:—Prof. C. S. Sherrington (chairman), Mr. E. L. Collis, Sir Walter Fletcher, Mr. W. L. Hichens, Dr. Edward Hopkinson, Mr. Kenneth Lee, Dr. T. M. Legge, Col. C. S. Myers, Mr. R. R. Bannatyne, and Mr. D. W. Wilson (secretary). The duty of the Board will be to initiate, organise, and promote, by research, grants, or otherwise, investigations in different industries with the view of finding the most favourable hours of labour, spells of work, rest pauses, and other conditions applicable to the various processes, according to the nature of the work and its demands on the worker. The Board will be glad to receive suggestions as to any problems of the kind described. All communications should be addressed to the Secretary, Industrial Fatigue Research Board, 15 Great George Street, Westminster, S.W.1. It is a hopeful sign that, in industrial research, employers are convinced of the need for progress, and, should undue delay occur, they will be prepared to take into their own hands the prosecution of investigations and the application of results.

TEN years ago Wilbur Wright gave at Le Mans, western France, a demonstration of the practicability of aerial navigation with machines heavier than air. On Sunday, December 22, we learn from the *Times*, this notable achievement was celebrated by the laying of the foundation-stone of a monument to Wilbur Wright, erected by the people of Le Mans, in the Place des Jacobins, at the foot of the rising ground on which the cathedral stands, the presentation of a commemorative tablet to Le Mans by the Aero Club of America, and a memorial tablet and bronze wreath from the citizens of Dayton, Ohio, Wilbur Wright's birthplace.

THE President's gold medal of the Society of Engineers has been awarded to Mr. T. Roland Wollaston, of Manchester, for his paper on "A Survey of the Power By-product Problem."

THE *British Medical Journal* announces the resignation of Prof. E. Roux of the directorship of the Pasteur Institute, Paris, and the appointment of Dr. A. Calmette as his successor.

IN an article on reconstruction, in the *Scientific American* for November 23, the Hon. W. C. Redfield, Secretary of Commerce to the United States, gives a short account of what is being done in the States to restore industry to a peace basis and to improve it in the future. Mr. Redfield points out that the industrial success of Germany arose out of two causes—first, the appreciation of the science which underlay each industry, its study and its application in the industry; and secondly, the training of the mind as well as the hand of the worker, so that he should understand both *how* to do a thing properly and *why* that was the proper way. Neither in Great Britain nor in America has scientific research or vocational training been conspicuous, or even visible, in industry. Both are now being introduced in America as quickly as possible. Experimental cotton and woollen mills, a paper mill, and a rolling mill have already been established, and other industrial laboratories are to follow, so that any problem which affects a whole industry can be at once worked out on a practical scale. The Federal Board for Vocational Education is distributing large and increasing sums to each State of the Union to ensure to every worker a knowledge of the *why* of his work.

AT the meeting of the Illuminating Engineering Society on December 19 some particulars were given, by permission of the Ministry of Munitions, of researches which have been undertaken by two committees on the illuminating value of flares, parachute lights, etc., and on the brightness of self-luminous radio-active material. Mr. A. P. Trotter, who dealt with the former problem, showed several forms of photometers specially designed to deal with the fluctuating and very powerful light of these service flares, which in certain instances attained 130,000 c.p. The work had to be done exclusively on moonless nights, and, as experiments were conducted in the open, precautions had to be taken against the disturbing effects of wind, mist, and smoke. Several interesting results of these experiments are mentioned. It appears that nests of parallel flares give substantially a candle-power equal to the sum of the values of the constituent flares; also that the light is of the same value at different angles below the horizontal; in other words, such flares act as flames, and not in a manner resembling the crater of an electric arc. As a rule, sample flares were mounted on high poles, but they were also attached to the carrier of a military kite with the object of ascertaining the illumination that would be produced in practice when such flares are dropped from aeroplanes. The second series of experiments, described by Mr. W. C. Clinton, related to the decay in brightness of compositions containing zinc sulphide with a small admixture of radium bromide in course of time. Experiments extending over a year showed that specimens containing from 0·1 to 0·8 mg. of radium bromide per gram of composition all eventually possessed a brightness of the order of 0·01 foot-candle, though originally the compositions with the higher radium content were much the brighter. Experiments were made to determine the desirable depth of material by which the brightness and life are also affected. In view of the costliness of radium, such experiments are most useful in determining the minimum amount which can be usefully employed in practice. Both series of experiments afford an instructive instance of the useful work undertaken by many scientific societies during the war.

THE Registrar-General's return for the week ending December 14 shows a continued decline in the influenza epidemic. The deaths in the ninety-six great towns of England and Wales were 1885, which is only a little more than one-half of the deaths in the preceding week, and is lower than in any week since that ending October 12, about the first week of the epidemic. In London the deaths were 322, which is less than one-half of those in the preceding week, and also fewer in any week since that ending October 12, which was the first week in which the number of deaths in London exceeded twenty. The *Times* of December 18 gives the following as the "influenza world-toll," from its medical correspondent:—"Though estimates of deaths over the whole world from any single epidemic are very difficult to form, there seem to be reasonable grounds for believing that some 6,000,000 persons have perished of influenza and pneumonia during the past twelve weeks. . . . Never since the Black Death has

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such a plague swept over the face of the world; never, perhaps, has a plague been more stoically accepted. In India alone more than 3,000,000 deaths occurred. Bombay had 15,000 of these; Delhi, with a population of only 200,000, had 800 deaths a day; the Punjab lost 250,000 persons. South Africa suffered no less severely."

THE death is announced, at eighty-three years of age, of Dr. Artemas Martin, of the U.S. Coast and Geodetic Survey. From an obituary notice in *Science* we learn that early in life Dr. Martin began contributing problems and solutions to various magazines. In 1877, while engaged in market-gardening for a livelihood, he began the editing and publishing of the *Mathematical Visitor*, and in 1882 he followed this up with the *Mathematical Magazine*. He also contributed numerous papers to other mathematical journals in America and abroad. He was an authority on early mathematical text-books, and collaborated with Dr. Greenwood in the "Notes on the History of American Text-books on Arithmetic." In 1885 Dr. Martin was appointed librarian of the U.S. Coast and Geodetic Survey, where his wide knowledge of mathematics made him of great service. In 1898 he was made computer in the Division of Tides, which place he held until his death. Honorary degrees were conferred upon him by several American universities, and he was a member of numerous learned societies. Dr. Martin's memory is to be perpetuated in the Artemas Martin Library of the American University at Washington, D.C., and at the same university there is to be an Artemas Martin lectureship in mathematics and physics, endowed by Dr. Martin.

WE regret to record the death of Col. William Vincent Legge, who was born in Tasmania in 1840, and died there on March 25, 1918. Educated in England, France, and Germany, Col. Legge entered the military academy at Woolwich, and received a commission in the Royal Artillery in 1862. He early evinced his partiality for ornithology, and finally became a notable authority on that science. Of his thirty-five scientific papers, the first is to be found in the *Zoologist*, to which journal, in 1865, he communicated a paper on birds found nesting in Essex. From 1868 to 1877 he was stationed in Ceylon, and it was during this period that he laid the foundations of what was to be his *magnum opus*, namely, "The Birds of Ceylon," a large quarto volume of 1238 pages, with thirty-four hand-coloured plates depicting the endemic species, and a map showing the faunal areas. This valuable work was issued in parts between 1878 and 1880, and was largely based upon specimens which its author had collected. In 1883 Col. Legge returned to the family estate in Tasmania, and published a series of papers, chiefly on Australian birds. In 1884 he was president of the Australian Association, and delivered a suggestive address on the zoogeographical relations of the Ornis of the Australian sub-regions. He was one of the founders, and the first president, of the Royal Australasian Ornithologists' Union, a member of the Royal Society of Tasmania, and a Colonial member of the British Ornithologists' Union.

DR. WILLIAM G. SMITH, Combe lecturer in general and experimental psychology in the University of Edinburgh, died on November 22, one of the many victims of the influenza epidemic. Dr. Smith was born on August 25, 1866, the youngest son of the Rev. Walter Smith, Half Morton, Dumfriesshire. Entering the University of Edinburgh in 1883, he graduated with first-class honours in philosophy in 1889, and afterwards acted for two years as assistant to the professor of moral philosophy. The foundations of a broader study of psychology in this country had just been laid by Prof. Ward's treatise in the "Encyclopædia Britannica" and William James's "Principles of Psychology," and the experimental methods of approach developed in Germany were also attracting the younger men. Dr. Smith spent fully two years in Germany studying experimental psychology, chiefly in Wundt's laboratory at Leipzig. He graduated Ph.D. in 1894 with a thesis on "Mediate Association," the substance of which appeared in an article in *Mind* in the same year. This was followed by another in 1895 on "The Relation of Attention to Memory," based partly on his Leipzig studies and partly on further investigations carried out in the physiological laboratory, Oxford, under Burdon Sanderson. In 1895 Dr. Smith went to America, and, after working some time with Münsterberg in the Harvard psychological laboratory, was appointed professor in Smith's College, Northampton, Mass. He held this position for some years, but eventually preferred to return to this country, where he became, successively, lecturer on psycho-physics in King's College, London, and assistant lecturer in physiology in the University of Liverpool. During these years Dr. Smith contributed a number of papers, based on experimental investigations, to the *Psychological Review*, the *Archives of Neurology*, *Mind*, and the *British Journal of Psychology*, in several of which he continued and extended his researches on memory. When an independent lectureship in psychology was established in the University of Edinburgh in 1906, he was chosen to be its first occupant, and his main energies since that time have been devoted to the equipment and organisation of the department. This he had carried through with marked success, and under his guidance the subject has taken an important place in the university curriculum.

THE Journal of the Academy of Natural Sciences of Philadelphia (second series, vol. xvi., part 4, 1918) contains a finely illustrated monograph by Mr. Clarence B. Moore entitled "The North-Western Florida Coast Revisited." The aborigines of Florida were in the habit of "killing" the vessels interred with the dead by breaking a hole in the base, thus freeing their souls to accompany those of their owners to the life beyond. Doubtless the more thrifty mourners regretted this destruction of serviceable pottery, and hence arose a refinement of the custom, the manufacture of mortuary vessels of inferior ware, and provided with a basal perforation made before the firing of the clay. A large collection of these interesting vessels made by Mr. Moore is illustrated and described in this interesting monograph.

IN *Folk-lore* (vol. xxix., No. 3, September, 1918) Dr. W. Crooke discusses the tales of the prentice pillars and the architect and his pupil. We have in this country instances of such pillars at Roslin Abbey and Melrose, and windows in Rouen Cathedral, where the story is current that the master, through envy, is said to have killed his pupil who constructed the work. In a second form of the tale the builder or architect is said to have fallen a victim to the jealousy of his employer, who feared that he might lose his reputation if the workman transferred his services to another master. Of this type of story numerous instances are quoted from India and other parts of the East. It has been suggested by Mr. H. A. Rose that the legend is based on the idea of a foundation sacrifice, the most appropriate victim being the person responsible for the work. But this does not easily explain some forms of the story, and further examples must be collected before the problem can be finally solved.

DR. A. PIJPER has described certain diffraction phenomena observed with cultures of micro-organisms by means of which the size of the organisms may be ascertained without direct measurement (*Med. Journal of S. Africa*, vol. xiv., 1918, p. 211). It was noticed that certain colonies of a bacterial plate culture viewed with ordinary daylight were colourless, but when the plate was held in the beam of an electric arc at a certain distance from, and at a certain angle to, the source of light, the colonies exhibited a blue colour. From theoretical considerations and control experiments the conclusion was arrived at that the coloration was due to a diffraction effect, the thin layer of micro-organisms acting like a grating. For the better observation of the effect the following arrangement was devised: The beam from an electric arc was parallelised by means of a condensing lens and passed through a hole in the proximal side of a closed box. In the box the bacterial plate culture was suspended, the glass of the dish being painted over with black paint except at one spot placed opposite the beam. Immediately opposite the transparent spot a second lens collected the rays, bringing them to a focus on a transparent screen forming the distal side of the box. On viewing the screen the spot in the axis of the beam is colourless, but around this a series of coloured rings spreads over the screen. Knowing the focal length of the collecting lens, and measuring the distance of any coloured ring from the axis, the size of the slits can be calculated, and, for spherical micro-organisms, the size of the slits is found to be just equal to the diameter of the organisms. This was verified by observations on various micro-organisms, the size found by the diffraction method and by micrometric measurement being practically identical.

THE last two reports of Bergens Museum, dealing with the years 1916–18, bear witness to a restriction of growth and activity caused by the war. In spite of this, much valuable work has been accomplished, and the educational influence of the museum has not lessened. Among recent accessions are several representatives of the anthropoid apes, notably a mounted group of male and female gorilla with young, and a fine skeleton of the male; a good mounted specimen of the wart-hog (Phacochærus); the Scandinavian herbarium of the lately deceased J. R. Landmark, who had continued to the end his donations of plants collected by himself in remote districts; numerous prehistoric remains from recent excavations, particularly a set of miniature greenstone axes, arrow-heads, knives, scrapers, and flakes from Vaagsø, Søndmør. Dr. A. Brinkmann, head of the zoological department, has started a collection of skeletons of the various races of Norwegian domestic animals, especially pedigree individuals, for which he hopes to obtain the co-operation and pecuniary help of the agricultural department. Such a collection, as was recognised by Sir Ray Lankester when director of our own Natural History Museum, is not merely of popular interest and practical importance, but has a value for the study of morphology and heredity. During the period covered by the reports the seismographic station connected with the museum has continued its work, and we think it well to conclude by quoting a sentence that appears in each report: "The Government has, on request, appropriated 4000 kroner to the acquisition and installation of a new seismograph, which will be purchased as soon as it is possible to obtain it from Germany." British instrument-makers should note this remark.

THE little-known grain called quinoa (*Chenopodium quinoa*) is the subject of an illustrated article in the July issue of the Bulletin of the Pan-American Union (vol. xlvii., No. 1), a journal devoted to all aspects of Latin America. It seems to be indigenous to the highlands of South America, where it has been cultivated since early times in Peru, Bolivia, Ecuador, and Chile. It is very hardy, and thrives well at altitudes of 11,000 ft., though in warmer climates it cannot compete with maize. The natives who grow quinoa use it in making a sort of bread, and it may also be treated like oatmeal or rice. Quinoa is still cultivated in a very primitive manner, and no attempts have been made to improve the grain by seed selection. The United States Department of Agriculture, however, is now experimenting with the grain in the hope of finding suitable areas where conditions of soil and climate will make it a profitable crop.

ENORMOUS quantities of timber have been used during the great war. In the first few months all available seasoned supplies were absorbed; for the remainder of the period green, unseasoned timber had to be employed, with the resultant inevitable high percentage of wastage through cracking and shakes. Large quantities of timber will be required for reconstruction purposes and restarting industries. The timber trade will therefore be in much the same position for some time to come. It will not be possible to await the period required for the natural seasoning of the material. There are several methods in operation for artificially drying timber by means of hot air. Mr. Herbert Stone in the *Quarterly Journal of Forestry* for October last discusses a method based on the use of cold air. The method is worthy of consideration. The plant required is a closed, double-roofed shed dimly lighted from the north. At the end farthest from the door a small refrigerating apparatus, such as is used in cold storage, though of smaller dimensions, is placed. By means of this a cold atmosphere is created sufficient to cause the air moisture in the shed to condense in hoar-frost, thus keeping the atmosphere continually dry. The moisture coming from the pores of the timber is thus constantly condensed in hoar-frost and got rid of, the wood drying without the risk of cracks and shakes, so often the accompaniment of hot-air drying. Mr. Stone is scarcely correct in his assertion that in the future most of our timber must be drawn from hot countries, where he recommends the method for trial. For one thing, our chief timber demands are for soft coniferous timber from the temperate regions; and, for another, the method, for various causes which will be readily appreciated by those having acquaintance with forestry conditions in the tropics, would be far more difficult of application.

THE American Geographical Society has published an index to the first sixty-four years of the Bulletin and Journal of the society. The periodical publications started in 1852, and for some years appeared intermittently, but apparently no annual index was published until 1895. The present volume will be welcomed by geographers as facilitating reference to a most valuable set of periodicals. There are references to both subjects and authors.

IN a most interesting paper in the October issue of the *Geographical Review* (vol. vi., No. 4) Mr. Edmund Heller descusses the geographical barriers to the distribution of big-game animals in East Africa. The paper is accompanied by a map showing the life-zones in the region. Mr Heller finds that climate is the chief controlling factor, and that it operates mainly in limiting certain vegetable growths which afford food and cover to animals. Large rivers, such as the Nile and the Tana, are important barriers to big-game mammals, but seem to have little influence on smaller

mammals and reptiles. Crocodiles may assist in making a river a barrier to certain animals, though bushbucks, waterbucks, hippopotami, and elephants are not influenced by them. Antelopes and other ungulates seem to have a dread of water infested by crocodiles. The paper also considers the geographical aspects of the distribution of native tribes in East Africa.

M. MOUSSU, who made an investigational journey into north-east Morocco in 1917, has discovered a certain number of outcrops which point to the existence of petroleum deposits, especially as gypsum and gypsum-clays occur frequently in the neighbourhood. The three principal outcrops are at the Arab villages of Ouled-Slama, Kohlott, and Khaïrett. The principal of these outcrops was found at the first-named place, which is a short distance from the military station of the Tleta des Cheragas. The oils are probably of a heavy or bituminous nature. They ooze out of the ground in wet weather in the form of emulsion, and there is an absence of vegetation where they occur. From the main outcrop the writer was able to collect a few litres of the product. According to the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale* for September–October, 1918, this product is a heavy brown (nearly black) oil, which rises in the form of emulsion in the salt-water of the watercourse. This sample was distilled at temperatures ranging from 90° to 225° C., and gave about 96 per cent. of distillates of a density of from 800 to 830, the result being a very pure kerosene. The quantity of ether and petrol is very small indeed. It is probable that these constituents evaporate owing to the heat at the surface of the outcrops. On the other hand, the yield of lamp-oil is very high and the residue very low. Since the outcrops discovered by the author extend over several kilometres, it is reasonable to assume the existence of others.

IN the *Zeitschrift des Vereines deutscher Ingenieure* for October 5 last Dr. G. Rohn discusses the question of Germany's textile requirements in the light of the feared economic boycott of that country by the Entente Powers, and briefly reviews what has already been accomplished in the way of finding substitutes. A certain amount of success has been attained in nettle cultivation. Although the yield of fibres from nettles is only 6 to 7 per cent. of the weight of the plant, the fibre has valuable properties, being very fine and smooth and strong. Since the war broke out some fifty processes for utilising nettle-fibres have been patented. It is thought that 1,000,000 hectares of low-lands could be planted with nettles, producing some 80,000 tons of fibres annually. The author also shows the progress made with wood-fibres, especially from the conifers. Experiments have been going on for some time with the view of extracting the fibres by chemical treatment, and success has rewarded the efforts of investigators in some directions. Developments have taken place, too, in the production of yarns from paper-stock, a number of companies having obtained licences to work the Türck Co.'s patents. The method of obtaining yarn from paper itself is outlined, and it is said that this method of treating wood is expected to render valuable service to Germany in future.

SINCE 1914 France has made great strides in the production of acetate of cellulose for use as an aeroplane dope, for kinematograph films, and for non-inflammable celluloids for various general purposes. The *Bulletin de la Société d'Encouragement pour l'Industrie Nationale* for September–October last gives particulars of what has been accomplished in the manufacture both of the acetate of cellulose itself and of the acetic acid, solvents, etc. Various processes are employed, and the manufacture is carried on at a number of chemical factories which had had no experience in its production until the necessities of war made it imperative for them to take it up.

IN the Journal of the Washington Academy of Sciences for October 19 Mr. L. W. Austin describes a new method of using contact detectors in radio-telegraphic measurements. The sensitive vacuum and tellurium platinum thermo-elements have resistances which vary with the current, and are either slow in action or difficult to make and transport. They have therefore been replaced in the Naval Radio Laboratory of the United States by contact detectors in series with high-resistance galvanometers shunted by paper condensers of a microfarad capacity. The detector and galvanometer are shunted by a resistance of a few ohms. The sensitivity of the arrangement is greater than that of the best vacuum thermo-elements of the same equivalent resistance, and the deflections are proportional to the square of the radio current, except in the case of the galena detector, which shows a slight deviation from the law.

WHEN a canal connects two rivers situated at different levels, and the ordinary chamber lock is used to pass traffic from the higher to the lower level, the water taken from the higher-level stream is often considerable. A German firm has now patented a system of "dry" lock (*Zeitschrift des Vereines deutscher Ingenieure*, October 19 and 26, 1918), in which the ordinary lock-chamber is replaced by a concrete basin permanently filled to a definite level with water. In this are immersed powerful floats, also made of concrete, running on runners on the side of the basin. Connected by suitable means to the float is a trough, which carries the vessel to be transported from the high to the low level, or *vice versa*. The floats are capable of supporting the carriage, the trough, and the vessel transported. Now supposing it is desired to ship a vessel from the higher to the lower level, all that has to be done when the vessel is shipped into the conveying trough (by suitable gear) is to overcome the buoyancy of the floats by a suitable prime mover, *i.e.* the floats are immersed until the trough is on a level with the lower sluice-head. The reverse operation is followed when shipping from low to high level. An installation of this kind is now working on the Neckar-Danube Canal, and is said to offer considerable advantages over the ordinary system of lock or the various types of ferrying gear hitherto used.

THE Cambridge University Press has in preparation, for appearance in its Cambridge Technical Series, "Architectural Building Construction," W. R. Jaggard and F. E. Drury, vols. ii. and iii.; "Electrical Engineering," Dr. T. C. Baillie, vol. ii.; "Automobile Engineering," A Graham Clarke; "Electro-technical Measurements," A. E. Moore and F. Shaw; "Paper: Its Uses and Testing," S. Leicester; "Mining Geology," Prof. G. Knox and S. Ratcliffe-Ellis; "Textile Calculations—Materials, Yarns, and Fabrics," A. M. Bell; "Laboratory Note-book for Applied Mechanics and Heat Engines," F. Boulden; "Elements of Applied Optics," W. R. Bower; "Electric Installations," C. W. Hill; "Accounting," J. B. Wardhaugh; "Chemistry for Textile Students," B. North and N. Bland; "Dyeing and Cleaning," F. W. Walker; and "Experimental Building Science," J. L. Manson, vol. ii.

OUR ASTRONOMICAL COLUMN.

THE PLANET MERCURY.—This planet will be favourably visible as a morning star at the end of the present year and the first week of January. On December 31 it will rise at 6h. 18m. a.m., or 1h. 50m. before the sun, and this interval will undergo little change on the few following mornings. The greatest elongation will occur on the morning of January 8 (23° 13′ W.). The planet will be situated in Ophiuchus, and at the period from December 26 to 29 will be placed about 4½° south of the star η Ophiuchi (mag. 2½). With a clear sky in the region of the S.E. horizon it will be possible to observe Mercury with the naked eye on the mornings from about Christmas Day to January 10. The planet's stellar magnitude on January 1 will be +0·2, and on January 6 ±0·0, according to the Nautical Almanac.

THE JANUARY METEORS.—This display will probably furnish a rather striking event on January 3, when there will be no moonlight to interfere with observation. Last year the meteors were unusually abundant, and presented a curious feature, the centre of radiation being about 7° north of the position determined in previous years. Formerly this was at 231°+52°, but on January 3, 1918, the point was at 234°+59½°, which nearly corresponds with the place of the star ι Draconis. The meteors move rather slowly, and they often traverse long flights, the radiant being low in altitude, and only 14° above the horizon in due north at 8.40 p.m. if the point is in N. decl. 52°. The shower will probably be presented to the best effect in the morning hours of January 3, but observations should also be conducted in the early evening hours of January 2. It will be important to determine the place of radiation as accurately as possible.

OPPOSITION OF VESTA.—Vesta will be in opposition on January 16, magnitude 6·9. The following ephemeris is from the Berlin Rechen-Institut:—

		R.A.			N. Decl.		Log r	Log Δ
		h.	m.	s.	°	′		
January	5	8	4	6	22	14	0·400	
	13	7	55	48	23	3		0·183
	21	7	47	0	23	49		0·182
	29	7	38	36	24	31		0·186
February	6	7	31	6	25	6		0·195
	14	7	25	12	25	33	0·395	

DISTRIBUTION OF LUMINOSITY IN STAR CLUSTERS.—An interesting summary of some recent work by Prof. E. Hertzsprung on the distribution of luminosity in globular clusters is given in the *Observatory* for December. In view of the immense distances of these objects, it is probable that a multitude of faint stars belonging to them leave no impression on the photographs, although they must contribute appreciably to the general luminosity of the cluster. In the case of M3, by giving a long exposure with the stars somewhat out of focus, Prof. Hertzsprung obtained an image with a continuous distribution of photographic density, which permitted measurements of the total amount of light given by different parts of the cluster. The luminosity due to the stars which appear in the ordinary photographs was then subtracted, and the remainder represented the light of the faint stars. The distribution of these faint stars was thus found to follow closely that of the bright ones. The total photographic light of the cluster was equivalent to mag. 7·17, and half of this was from the space within a radius of 50″. If the distance of the cluster be 10,000 parsecs, half the stars lie within a radius of 2½ parsecs, indicating a remarkable concentration towards the centre. The light-intensity in unit volume would, in fact, be 10^5 times higher than that in the neighbourhood of the sun.

PRIZE AWARDS OF THE PARIS ACADEMY OF SCIENCES FOR 1918.

Mathematics.—Grand prize of the mathematical sciences to Gaston Julia, Samuel Lattès receives a very honourable mention; the Poncelet prize to Sir Joseph Larmor, for the whole of his mathematical work; the Francœur prize to Paul Montel.

Mechanics.—The Montyon prize to Ch. Boileau, for his studies on petrol motors; the Boileau prize to MM. C. Camichel, D. Eydoux, and M. Gariel, for their experiments and calculations on hammering in water-mains; Henri de Parville prize to Emile Belot, for his scientific and industrial work. No memoir was received on the subject proposed for the Fourneyron prize.

Astronomy.—The Lalande prize to Aristarch Bèlopolsky, for his work on spectrum analysis applied to astronomy; the Valz prize to Frédéric Sy, for his astronomical work as a whole; the Janssen prize to P. Stanislas Chevalier, for his astronomical work in China. The Damoiseau and Pierre Guzman prizes are not awarded.

Geography.—The Tchihatchef prize to Filippo de Filippi, for his contributions to the geography of the Kara-Korum range and of Central Asia. The Delalande-Guérineau, Gay, and Binoux prizes are not awarded.

Navigation.—The prize of 6000 francs between Ernest Berger and Emile Guilbert (3000 francs) and Georges Walser and André Broca (3000 francs), for work which cannot at present be disclosed; the Plumey prize divided equally between Maurice de Broglie and C. J. Tossizza, for work bearing on the national defence.

Physics.—The L. La Caze prize to Aimé Cotton, for his researches in magneto-optics; the Hébert prize to P. Boucherot, for his work in electricity; the Hughes prize to Anatole Leduc, for the whole of his work; the Danton foundation to Louis Dunoyer, for his works on radiant phenomena; the Clément Félix prize to Paul Langevin, for his work on electrical resonance.

Chemistry.—A Montyon prize (unhealthy trades) to Henri Guillemard and André Labat (2500 francs), for their work relating to collective protection against asphyxiating gases; an honourable mention (1500 francs) to Félix Leprince-Ringuet, for his researches on the inflammability of methane, and to Louis Nomblot (1000 francs), for a method of preparation of a dangerous product utilised by artillery; the Jecker prize to Robert Lespieau, for his work as a whole; L. La Caze prize to Paul Lebeau, for his chemical researches, mainly in inorganic chemistry; the Cahours foundation divided between Mme. Pauline Ramart-Lucas (2000 francs) and Etienne Boismenu (1000 francs); the Houzeau prize to Marcel Guichard, for his researches on iodine and molybdenum compounds.

Mineralogy and Geology.—The Cuvier prize to Arthur Smith Woodward, for his work on fossil vertebrates.

Botany.—The Desmazières prize to Camille Sauvageau, for his researches on the biology of the Algæ; the Montagne prize to Joseph Capus, for his researches in plant pathology, with an honourable mention to Amédée Laronde for his contributions to cryptogamic geography; the de Coincy prize to Jules Laurent, for his work on the flora and botanical geography of the neighbourhood of Reims.

Anatomy and Zoology.—The Thore prize to Pierre Chrétien, for his researches on the Lepidoptera. The da Gama Machado and Savigny prizes are not awarded.

Medicine and Surgery.—Montyon prizes to Félix Lagrange (2500 francs), L. Ombredanne and R. Ledoux-Lebard (2500 francs), A. Mignon, Henry Billet, and Henri Martin (2500 francs); mentions to André and Joseph Chalier (1500 francs), Alfred Khoury (1500 francs), and E. Velter (1500 francs); a citation to Henri Velu; the Barbier prize to L. Bruntz and Marcel Jaloux, for their memoir on medicinal plants; the Bréant prize (arrears of interest) between Jean Pignot (2000 francs), Maurice Lœper (1500 francs), and Julien Dumas (1000 francs). The Bellion prize is not awarded, but encouragements (500 francs each) are accorded to Josefa Ioteyko, for her researches on fatigue and muscular work; to R. Legendre, for his contributions to the treatment of carbon monoxide poisoning, artificial respiration, and studies on bread manufacture; and to B. Roussy, for his book on the domestic education of women. The Baron Larrey prize is not awarded, but A. Rochaix receives a recompense (500 francs) for his studies on the rapid detection of sewage contamination in drinking-water. No awards were made of the Mège and Godard prizes.

Physiology.—The Montyon prize to Stéphen Chauvet, for his memoir on infantilism; the Lallemand prize to Henry Cardot and Henri Laugier, for their work on the electrical stimulation of nerves; the L. La Caze prize to Raphaël Dubois, for the whole of his work in physiology; the Pourat prize, no memoir on the subject proposed has been received; the Martin-Damourette prize to Gérard de Parrel, for his work entitled "Précis d'anacousie vocale et de labiologie"; the Philipeaux prize to Hugues Clément, for his studies on the application of the centrifuge in producing alterations in the development of the egg and embryo in several animals; the Fanny Emden prize is not awarded, but the arrears are attributed to Mme. Albert Dastre.

Statistics.—The Montyon prize is not awarded.

History and Philosophy of the Sciences.—The Binoux prize to Maurice Delacre, for his memoir on the history of chemistry.

Medals.—Berthelot medals are awarded to André Labat and to Marcel Guichard.

General Prizes.—The Bordin prize, no memoirs received dealing with the subject proposed; the Estrade Delcros, Le Conte, Parkin, and Wilde prizes are not awarded; the Houllevigue prize to the late Camille Tissot, for the whole of his work; the Saintour prize to René Kœhler, for his work in zoology; the Henri de Parville prize between R. Devillers (1500 francs), for his book on the dynamics of the aeroplane, and Hector Pécheux (1000 francs), for his book on metallurgy; the Lonchampt prize to Emile Guyénot, for his studies on the growth of organisms under aseptic conditions; the Caméré prize to Paul Séjourné, for his engineering work; the Victor Raulin prize to Jules Rouch, for his work in meteorology, atmospheric electricity, and physical oceanography; the Gustave Roux prize to the late Georges Boyer, for his geological work; the Thorlet prize to Adolphe Richard.

Special Foundations.—The Lannelongue foundation to Mmes. Cusco and Ruck; the Laplace prize to Jean Vignal; the L. E. Rivot prize to Jean Vignal (750 francs), Paul Reufflet (500 francs), Henri Scaillierez (750 francs), and Camille André Antoine (500 francs).

Foundations for Scientific Research.—The Trémont foundation (1000 francs) to Charles Frémont, for his researches relating to the working of metals; the Gegner foundation between F. Pisani (2000 francs), for his work in mineralogical chemistry, and the late Samuel Lattès, for his work on mathematical analysis; the Jérôme Ponti foundation between Paul Barbarin (2000 francs), for his work on non-Euclidean geometry, and Louis Fabry (1500 francs), for his work on the smaller planets; the Henri Becquerel foundation between Camille Gutton (2000 francs), for his work in physics, especially that having reference to the national defence; Pierre Fatou, 2000 francs.

The Bonaparte Foundation.—Twenty-one requests for grants have been considered, and the following six are recommended:—2000 francs to E. de Boury, to allow him to continue his studies of the gasteropod molluscs; 3000 francs to Auguste Chevalier, for his studies on the forest flora of Indo-China, and for his researches on the woods of that region capable of being utilised; 2000 francs to Paul Garrigou-Lagrange, for the continuation of his meteorological studies and attempts at the kinematography of the atmospheric movements; 2000 francs to Louis Germain, for the publication of his works on the malacological fauna of Africa and Asia, and for the continuation of his study of the molluscs of the Loire basin and the French coast of the Atlantic Ocean; 2500 francs to C. Le Morvain for completing the publication of the "Carte photographique et systématique de la lune"; 5000 francs to H. Perrier de la Bathie, for the continuation of the geological and botanical researches which he has pursued with success at Madagascar for many years. The balance of the fund in hand, after paying the above grants, amounts to 72,500 francs.

The Loutreuil Foundation.—4000 francs to R. Anthony, for printing the osteological catalogue of the collections of the National Museum of Natural History; 5000 francs to Charles Moureu, for completing the equipment and collections of the laboratory of the Collège de France; 5500 francs to the Lyons National Veterinary School, for the installation of a kinematograph for teaching purposes; 3000 francs to the Toulouse National Veterinary School, to complete the radiological installation for the diagnosis of diseases of animals; 4000 francs to Edouard Sauvage, for the construction of an apparatus designed to study the forces of inertia in the parts of a machine; 1000 francs to E. Ariès, for the purchase of a calculating machine for use in his researches on the equation of state of fluids; 2000 francs to Henry Bourget, for assisting the publication of the *Journal des Observateurs*; 2000 francs to Maurice Cossmann, for his various publications on palæontology; 2000 francs to A. Ménégaux, for the French ornithological review; 6000 francs to Aloys Verschaffel, for the calculation and publication of the ephemerides of the minor planets, according to a plan approved by the Bureau des Longitudes; 5000 francs to Col. Roche, for the equipment of the laboratory of the Ecole Supérieure d'Aéronautique.

Charles Bouchard Foundation.—2000 francs to Jean Nageotte and Louis Sencert, for researches on grafting with dead tissues; 1500 francs to Paul Brodin and François Saint-Girons, for their work on bleeding; 1500 francs to Pierre Duval and Adrien Grigaut, for their researches on traumatic shock.

A NEW THEORY OF THE ICE AGE.

TWO recent papers in the Quarterly Journal of the Royal Meteorological Society by Mr. C. E. P. Brooks have emphasised the point of view that there is no necessity to appeal to astronomy or to make any arbitrary assumptions, such as that of a specially cold region in space, in order to account for an Ice age. The subject of the papers is "Continentality and Temperature" (Quart. Journ. Roy. Met. Soc., vol. xliii., pp. 159–73, and vol. xliv., pp. 253–70), and

the author's endeavour is to correlate mean temperature at certain stations with the distribution of land and water in the neighbourhood of the stations, first for a definite region, including the Baltic and most of northern Europe, without much range of latitude, and next for the world in general, with special reference to latitude.

It is clear that very definite results are unlikely, having regard to the very irregular distribution of land and its topographical peculiarities; and not less clear that a great deal of labour must have been involved in obtaining any result whatever. The temperature of a place is affected by the size, distance, and direction of land and water masses in relation to the prevailing winds, and also by the relief of the land and the temperature of the neighbouring sea. The correction for height above sea-level is apparently straightforward and simple, but in regard to the others it was only convenient to take as a first approximation the percentage of land included in circles of 5°, 10°, and 20° radius, centred at the station in question, and the resulting correlations are by no means easy of interpretation.

Certain stations introduce special difficulties, *e.g.* Haparanda, where the continentality is not the same throughout the year owing to the freezing of the sea in winter. There are, however, some general conclusions worth quoting:—(1) In winter the effect of land to the west is to lower temperature. (2) In winter the effect of land to the east is almost negligible, so that even in continental areas the lowest temperatures are found near the eastern coasts. (3) The general effect of land in the summer either east or west is to raise temperature, but not to anything like the same extent as the opposite effect in winter.

Special interest attaches to the extension of the investigation with regard to long intervals of time. In the Litorina (early Neolithic) period the climate of the Baltic regions was rather different, as also were the distribution of land and the freedom of access from the Atlantic. In the first paper, which deals specially with this region, the author claims that the alterations of continentality suffice to account for all the historic variations of local temperature. A more important generalisation follows in the second paper, in which the author considers the period immediately preceding the last or Quaternary glacial period. An outline is given of the distribution of land at that period, and an explanation of the formation of ice-sheets by reason of fall of temperature and increase of snowfall, the argument being almost entirely meteorological. The next step, however, is of a different kind, and the theory of isostasy is summoned to account for the gradual upsetting of an apparently permanent glaciation. The weight of the masses of ice causes the subsidence by slow degrees of the ground below equilibrium being gradually restored by the fluid interior. The sinking of the ice-surface causes an increase of temperature with consequent melting. The isostatic action is, however, so slow that the surface continues to sink, causing a higher temperature in higher latitudes (inter-glacial period). After a time the equilibrium, which is clearly disturbed in the opposite direction, induces isostatic action again, raising the land-surface and causing another glaciation. The author considers that this "ebb and flow" has taken place four times in succession, the amplitude diminishing each time, as is to be expected.

The course of these age-long changes is not quite so simple as its general outline, for many irregularities are necessarily introduced by the disposal of the melting ice, which will depend on the geographical features thus uncovered, and, again, by the locking up of so much moisture into glaciers; but the explanation of such well-known phenomena as the warm period of the Tertiary by this geographical method appears more straightforward than any depending on assumptions as to the effect of changes in the obliquity of the ecliptic—an effect which we are almost powerless to forecast.

The purely meteorological part of the subject is not without difficulties of its own, some very anomalous figures for sea temperature in high latitudes resulting from the attempt to deal with the earth as a whole, and to allow for the vagaries of land distribution and of ocean currents. The effect of insolation in different latitudes and on different land and water surfaces is a very difficult problem, and so also is the question of precipitation, but Mr. Brooks is not afraid to tackle these difficulties, and must have brought an enormous amount of research to bear, in addition to the very laborious and complicated analysis of the data obtained. It is to be hoped that this subject will not escape the notice of the British Association Geophysical Committee. W. W. B.

REPORT OF THE DEVELOPMENT COMMISSIONERS.

THE report of the Development Commissioners for the year ended March 31, 1918, has been published as a Parliamentary Paper (118, price 3*d.* net), extracts from which are subjoined. Except so far as the special circumstances of the war have called for extended expenditure or new schemes in respect of food supply and natural products, or for the preliminary outlay in the preparation of schemes which may employ labour after the war, the Commissioners have continued the policy which they have adopted since the commencement of the war of confining their advances in the main to ensure the continuity of schemes which were already in working in 1914, and cannot properly be discontinued. In one instance, that of flax-growing, the expansion owing to war needs has led to an increase of the undertaking to a scale on which it is no longer of an experimental or educational nature, such as is appropriate for assistance from the Development Fund, and the undertaking has accordingly been taken over by the Board of Agriculture.

In the introduction to last year's report mention was made of an advance of 50,000*l.* for improving the fish food supply by installing motors in fishing-boats. But the problems of this supply are not solved by the mere catching of fish; there remain the problems of its rapid delivery or preservation. In connection with these latter points the Commissioners have recommended an advance of 6750*l.* in aid of landing and entraining facilities at Valentia, and in January, 1918, they promised to recommend an advance (later fixed at 10,000*l.*) for the establishment of an experimental fish-canning factory on scientific lines.

Reference was also made last year to the extra expenditure on a largely increased supply of plants for afforestation, and this has continued in the year now under review. Thus an advance of 6905*l.* to the Commissioners of Woods for this purpose has been recommended; while in Scotland, in addition to ordinary expenditure, grants of 2000*l.* for each of the financial years, 1917–18 and 1918–19, were recommended to meet expenditure on the establishment of forest nurseries, and 930*l.* for an additional Forest Officer on the staff of the Board of Agriculture. A sum of 1000*l.* was also made available for preliminary arrangements for the afforestation of privately owned lands and a flying survey.

In earlier reports the Commissioners have explained in some detail the important scheme financed from the Development Fund for the development of agricultural research at universities, colleges, etc., and the extension of advisory and local investigation work. The scheme includes provision for the encouragement of individual workers in agricultural science outside the field covered by the research institutes, and the Commissioners have annually recommended a grant not exceeding 3000*l.* for this kind of work in England and Wales, and small grants for work in Scotland. The Commissioners originally contemplated a maximum grant of 5000*l.* for the whole United Kingdom, to be allocated on the advice of a Committee representing Scotland and Ireland, as well as England and Wales, and suggested that the English Board's Advisory Committee on agricultural science might be enlarged for this purpose by the addition of representatives nominated by the Agricultural Departments for Scotland and Ireland. An agreement has now been reached under which the three Agricultural Departments will co-operate for this purpose. The English Board's Advisory Committee has been dissolved and the Commissioners have set up a Committee of their own, including representatives of the three Departments, to report to them on applications for "Special Research" grants, and on such other subjects as the Commissioners may refer to them. The Commissioners are prepared to consider, and, if they are satisfied with the applications supported by the new Committee, to recommend, an annual grant, not exceeding 5000*l.*, for the assistance of special research schemes in the United Kingdom. The Advisory Committee is constituted as follows:—Sir Daniel Hall, K.C.B., F.R.S. (chairman), Mr. W. Bateson, F.R.S., Prof. Biffen, F.R.S., Mr. J. R. Campbell, Dr. R. B. Greig, Mr. W. B. Hardy, F.R.S., Sir T. H. Middleton, K.B.E., C.B., Prof. Noel Paton, F.R.S., Sir David Prain, F.R.S., Dr. G. H. Pethybridge, Dr. E. J. Russell, F.R.S., and Dr. David Wilson.

The grants recommended for research purposes are as follows:—

Agriculture and Rural Industries.

	Grants £
Aberdeen University and North of Scotland College of Agriculture—Joint Committee of:	
Schemes of agricultural research ...	813
Board of Agriculture and Fisheries:	
Agricultural research, advisory work, etc.	31,200
Research in plant pathology at Kew, maintenance grant	1,411
Maintenance of Board's veterinary research laboratory	2,000
Agricultural and dairy education ...	13,350
Migratory and co-operative cheese schools	3,000
Scheme for augmenting the production of eggs and poultry	1,700
Board of Agriculture for Scotland:	
Schemes of special research in agricultural science	395
Extension work at the Scottish agricultural colleges	5,000
Chester Corporation:	
Investigation into the practicability of using the water-power of the River Dee, above Chester, to generate electricity for agricultural purposes	200
Department of Agriculture and Technical Instruction for Ireland:	
Special laboratory for the manufacture of anti-swine fever serum	2,500 [1]
Technical and advisory work in agriculture	4,000
Maintenance of property acquired for a veterinary research laboratory ...	196
Imperial College of Science and Technology:	
Investigation into the effect of electrical discharge on the growth of crops	595

Forestry.

	Grants £
Board of Agriculture and Fisheries:	
Forestry research, advisory work, etc.	5,000

Fisheries.

	Grants £
Board of Agriculture and Fisheries:	
Grants to various institutions for fishery research	410

SUMMARY OF RECOMMENDATIONS MADE DURING THE YEAR 1917–18.

	Grants £	Loans £
Agriculture and rural industries	153,665	5,125
Forestry	21,652	—
Reclamation and drainage of land	750	—
Harbours	8,093	350
Fisheries	2,162	—
	186,322	5,475
Total ...	191,797	

SUM TOTAL OF ADVANCES RECOMMENDED TO THE TREASURY UP TO MARCH 31, 1918.

	Grants £	Loans £
Agriculture and rural industries	1,645,837	133,625
Forestry	123,485	153,411
Reclamation and drainage of land	7,315	4,000
Rural transport ...	—	80,000
Harbours	222,632	171,760
Inland navigations ...	—	109,500
Fisheries	111,459	30,250
Sea defence works ...	—	800
	2,110,728	683,346
Total ...	2,794,074	

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

LONDON.—The Senate on December 18 adopted a resolution approving the appointment of Prof. H. G. Atkins as assistant principal of King's College for five years as from January 1, 1919.

The annual report of the University Extension Board shows that, although four years of war have considerably reduced the number of students, there were still between five and six thousand in attendance at the courses last year, the number of those who qualified for certificates being as high as in the previous twelve months. The study of foreign nationalities and of problems of reconstruction were

[1] Part of sum of 8000*l.* sanctioned in December, 1914, for capital cost of a Veterinary Research Laboratory.

notable features of the year's activities. Important pioneer work was done, both in England and overseas, through the Y.M.C.A. Universities' Committee, and in conjunction with the Victoria League lectures were also organised at military hospitals. Amongst the fresh developments during the session were the institution of a diploma for civic workers under the scheme for diplomas in the humanities, and the inauguration of lectures in offices of the Ministry of Munitions, this being probably the first occasion on which the University has been invited to carry on educational work in a Government office.

The Senate is taking steps to provide that students from overseas universities of the Empire who have served in his Majesty's Forces may be admitted to certain Intermediate and Final Examinations, and that reports may be furnished with the view of enabling the universities at which the students have begun their respective courses to recognise these examinations of the University of London in lieu of their own. By this arrangement it is hoped that a number of students may continue a university career while they are waiting until they can return to their own countries.

The Senate has conferred on Dr. H. Stanley Allen, of King's College, the title of reader in physics in the University.

DR. OTTO TUNMANN, of Berne, has been appointed professor of pharmacognosy in the University of Vienna in succession to Prof. Moeller.

MR. W. W. MYDDLETON has been appointed lecturer and demonstrator in chemistry at the Municipal Technical Institute, Belfast, in succession to Mr. C. W. Addy, who has left to take up work in chemistry in connection with the British Cellulose and Chemical Manufacturing Co., Ltd.

THE movement for adopting Latin as the universal language of the future—or, rather, of restoring it to the position which it once occupied as the language of the learned world—forms the subject of a note by Prof. Carlo Pascal in the *Rendiconti del R. Istituto Lombardo* (2) l., 14–15. It is suggested that action should be initiated by the institution in question. In support of this argument it is pointed out that the growth of scientific literature published in a multiplicity of small languages is of recent origin, and that the attempts to invent artificial languages have increased, rather than removed, the confusion. Prof. Pascal refutes the idea that Latin is a dead language, seeing that it is taught in all schools and colleges, and further points out that modern scientific terminology is largely Latinised in form. The main objection which can be raised against the proposal in its unmodified form is the grammatical difficulty. It might be quite easy for a classical scholar to write to a business manager in ancient Latin, but it would be unfortunate if the latter in his reply was so puzzled as to whether to use the dative or the accusative case of a noun that he forgot what he was writing about. A few years ago there was formed an Academia pro Interlingua, which proposed to retain the Latin vocabulary with a simplified grammar, and Prof. G. Peano, of Turin, took a leading part in this movement.

IN the presence of a brilliant company assembled at the Sorbonne, the degree of doctor, *honoris causa*, was conferred upon President Wilson by the University of Paris on December 21. In the course of his acknowledgment of the honour, the *Times* reports President Wilson to have said:—"I have always thought that the chief object of education was to awaken the spirit, and that, inasmuch as literature, whenever it touched its great and higher notes, was an expression of the spirit of mankind, the best induction into education was to feel the pulses of humanity which had beaten from age to age through the utterances of men who had penetrated to the secrets of the human spirit. And I agree with the intimation which has been conveyed to-day, that the terrible war through which we have just passed has not been only a war between nations, but that it has been also a war between systems of culture; the one system the aggressive system, using science without conscience, stripping learning of its moral restraints, and using every faculty of the human mind to do wrong to the whole race; the other system reminiscent of the high traditions of men, reminiscent of all those struggles, some of them obscure, but others clearly revealed to the historian, of men of indomitable spirit everywhere struggling towards the right, and seeking, above all things else, to be free. . . . I feel that this war is intimately related with the university spirit. The university spirit is intolerant of all the things that put the human mind under restraint. It is intolerant of everything that seeks to retard the advancement of ideals, the acceptance of the truth, the purification of life; and every university man can ally himself with the forces of the present time with the feeling that now at last the spirit of truth, the spirit to which universities have devoted themselves, has prevailed and is triumphant."

WE have received from the Asiatic Society of Bengal a Catalogue of the Scientific Serial Publications in the Principal Libraries of Calcutta. In this catalogue there are several interesting features to be noted. Full information is given, in regard to the twenty-four libraries indexed, as to where they are to be found and the hours when they are open. In the case of libraries that are not open to the public the reader is told how to get permission to consult the books. The arrangement of the catalogue is geographical, the world being divided into twenty-four countries subdivided into towns placed in alphabetical sequence. Publications issued by an institution are indexed under the name of the town in which the institution is established. Independent serials are indexed under the town in which they are published. In each case there is indication of the library or libraries in which the publication may be found. It may happen that, although the title of a journal is well known, a reader may be unable to recollect the name of the town in which it is published. To meet this difficulty an alphabetical index of names of journals with references to their position in the catalogue is provided. We are glad to see that volumes or parts missing from the sets are recorded. The catalogue has been compiled by Mr. Stanley Kemp with the assistance of the librarians of the institutions concerned. Dr. W. A. K. Christie, of the Geological Survey of India, honorary secretary of the Asiatic Society of Bengal, has given Mr. Kemp continuous advice and help. The result does great credit to all who have taken part in a catalogue remarkable both for its completeness and for the care with which the material has been arranged.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, December 12.—Sir J. J. Thomson, president, in the chair.—L. **Hill** and H. **Ash**: The cooling and evaporative powers of the atmosphere, as determined by the kata-thermometer. A further investigation has been made of the cooling power of air at known temperature and velocity of movement in the large wind-tunnels at the East London College, with the aid of Mr. N. A. V. Piercey, the lecturer on

aeronautical engineering, timing the rate of cooling of the kata-thermometer, a large-bulbed spirit thermometer graduated between 100° and 95° F., and the factor of which was determined whereby the cooling power on a surface at body temperature is expressed in millicalories per sq. cm. per sec. The formula was deduced $H=(0{\cdot}27+0{\cdot}49\sqrt{v})\theta$, where θ = the difference between the temperature of the air and 36·5° C. Using this formula, the authors found the velocity of the wind determined by the kata-thermometer at Kew Observatory agreed closely with the velocity determined by the Cup and Dines anemometers. Using this formula to determine velocity, the cooling of the wet kata-thermometer was reinvestigated in a tube 3 in. in diameter, through which air was drawn from a chamber, the temperature and humidity of which could be varied. The effect on evaporative power of varying the temperature of the evaporating surface was determined, and the use of the kata-thermometer as a measure of evaporative power of drying processes pointed out. The effect of barometric pressure on cooling power was worked out in a chamber in which the atmospheric pressure was varied from +15 lb. to 340 mm. Hg. The formula determined expresses influence of barometric pressure on convection cooling power. At ordinary temperatures cooling power exerted on dry kata-thermometer is half due to radiation, half to convection.—H. C. **Bazett**: Observations on changes in the blood-pressure and blood-volume following operations in man.—Dr. Marie C. **Stopes**: The four visible ingredients in banded bituminous coal. The coal discussed is the ordinary streaky bituminous coal of the British Coal Measures widely used in house and factory. Disregarding for the time the ultimate morphological nature of the plant organs contributing to them, four differing substances or constituents are described as composing such coal. These can be recognised by differences in their general character. (*a*) Differences in their macroscopic appearance and texture (*i.e.* with the naked eye in hand specimens). (*b*) By their different behaviour when treated with various chemicals. (*c*) By the differences in the *débris* of each which result from their treatment with various chemicals. (*d*) By the differences in microscopic sections of untreated samples of each. These differences are further followed up by analyses and distillations to be considered in a later paper. Diagrams are given to show the characteristic distribution of these constituents in section, and to indicate, if not a parallel to, at least a possibly useful comparison with, petrological work on rocks. The four ingredients thus determined are fusain (the already widely discussed "mineral charcoal"), and durain, clarain, and vitrain, the three latter names being given now for the first time.—Sir W. **Crookes**: The arc spectrum of scandium.

Royal Meteorological Society, December 18.—Sir Napier Shaw, president, in the chair.—Capt. C. J. P. **Cave**: A cloud phenomenon. On April 15, 1915, a cloud with an approximately straight front was seen approaching South Farnborough from the north-west. The sky had been clear in the morning. The cloud came overhead at 9.33 a.m., after which the sky was overcast; the sunshine record ended abruptly. At all stations in the eastern and south-eastern counties the sunshine record was similar, though the times of cessation differed considerably. By comparing the records it was possible to draw lines on a map showing the times when the cloud-front was approximately overhead. The 9 a.m. line ran through the Isle of Wight to Southampton, through Hampshire, Berkshire, and Middlesex, north-west of London, along the western borders of Suffolk and Essex, through Norfolk to Cromer. At 10 a.m. the cloud-front ran over the east end of the Isle of Wight, along the eastern border of Hampshire, through Surrey, south-east of London, through Essex, Suffolk, and Norfolk to the sea some miles north of Yarmouth. At 2 p.m. the cloud-front ran from between Pevensey and Bexhill to Westgate. A map shows the travel of the cloud-front from 7 a.m. to 3 p.m., and indicates that the cloud travelled across the country at about twelve miles per hour.—C. E. P. **Brooks**: Notes on a meteorological journal at Wei-hai-wei kept by Commander A. E. House, 1910 to 1916. Wei-hai-wei is a small British concession in the north of China, and is important as being in a sense the sanatorium of British stations in the North Pacific. It has a cool summer with a moderate rainfall, and a dry, bracing winter. Meteorological observations were taken by Commander House four times daily, and include pressure, temperature, humidity, rainfall, wind, and weather. These have been summarised and discussed, with notes on the relation of the various elements to wind direction and on the general climatology and possibilities of Wei-hai-wei.—Capt. E. H. **Chapman**: The annual symmetrical variation of certain elements, with a note on the choice of seasons. The average lengths of the astronomical day for the calendar months are more symmetrical for the calendar year January to December than for a year (1) December to November or (2) February to January. The mean monthly temperatures, Midland Counties, are most symmetrical for a year February to January. The mean monthly values of various meteorological elements are symmetrical for the calendar year January to December. Mean weekly temperatures, Midland Counties, are symmetrical for a year commencing with the fifth week of one year and ending with the fourth week of the following year. The method used for showing annual symmetry is to draw the first half of the curve forwards and the second half of the curve backwards along the ordinates of the first half, the nearness of the two portions of the curve showing the degree of symmetry. Annual symmetrical variation makes the division of the year into seasons a difficult matter. There is evidence in favour of making March a winter month. The usual meteorological three-monthly seasons are too early in the year, while the astronomical seasons are too late. An alternative suggestion of the three-monthly seasons, middle of December to middle of March, etc., is put forward.

SHEFFIELD.

Society of Glass Technology, December 18.—Mr. W. F. J. Wood, president, in the chair.—S. **English**: An apparatus for the accurate calibration of burette tubes. The method employed for the burette is based on that for the pipette, since it involves the use of a standardised pipette of precisely known volume and time of drainage. Mercury, however, is used instead of water to fill the burette and the standard pipette into which it drains in order to calibrate it; under the same conditions of ordinary use water is placed above the mercury level in the burette. This meniscus is viewed through a telescope attached to a cathetometer, and by an ingenious arrangement a needle is made to produce a mark on the burette precisely at the level of the meniscus. The author stated that a burette could be calibrated in five minutes, and the accuracy was far greater than was usually observed in calibrating these instruments.—Dr **Turner**: Bottle-glass and glass-bottle manufacture. The author's remarks were confined largely to two points—quality and quantity—in glass-bottle production. In regard to quality he pointed out that it was useless to produce a

bottle if the glass of which it was made was unsuitable for contact with the material it was intended to hold. Medical bottles in particular should be subjected to tests in order to ascertain that they conformed to a certain standard. One test was suggested in which solutions of the alkaloids and mercury solutions were kept in contact with the bottle for twenty-four hours and the absence or production of a sediment noted. The results of heating a number of different types of bottle in contact with water and steam under pressure were also described and tabulated, and emphasis was laid on the necessity for avoiding excessive use of soda-ash in melts. In the case of bottles made from sand, soda-ash, and lime spar, it was pointed out that lime spar should not fall below 7 to 8 per cent. of the batch mixture, otherwise the glass was acted on by water to a marked extent. The author also dealt with the problem of workability, whether from the point of view of hand-working or machine-working. The effect of different constituents present in bottle-glass, such as silica, soda-ash, lime, magnesia, and alumina, was described, and the importance of arranging a batch so that the resulting glass should set quickly was emphasised, if production at a rapid rate was desired. The limits of workability for glasses containing sand and soda, with lime, magnesia, or alumina, were set out.

DUBLIN.

Royal Dublin Society, November 19.—Dr. G. H. Pethybridge in the chair.—Dr. G. H. **Pethybridge** and H. A. **Lafferty**: A disease of tomato and other plants caused by a new species of Phytophthora. The disease is one in which the root system and base of the stem of young plants become involved in a rot leading to the death of the plants. It is caused by a species of Phytophthora hitherto undescribed, having sexual organs (with amphigynal antheridia) similar to those first described for *P. erythroseptica*. The disease is contracted from the soil, and also occurs naturally in Petunias. The fungus was proved to be parasitic also towards Aster, Gilia, Cheiranthus, *Solanum tuberosum*, Fagus, etc., and it is extremely probable that it occurs naturally and causes disease in some of these plants. Owing to the facility with which the tomato produces adventitious roots, affected plants can not infrequently be "cured" by amputating the diseased parts and treating the still healthy portions as cuttings. The disease causes serious losses in nurseries, but can be avoided by raising seedlings in steam-sterilised compost.—E. J. **Sheehy**: Part i., An economical method of determining the average percentage of fat in a cow's milk for a lactation period. An account of two experiments conducted at the Albert Agricultural College. The author explains the liability to error in determining the average percentage of fat in a cow's milk by the method of averaging two or three random samples taken during the lactation period, because of the great variability in fat yields for successive days. A test is suggested over four consecutive days as suitable and convenient, and this single test is applied to the fifth month of the lactation period as a means of determining the average percentage for the whole period. Part ii., The comparative variation in the different constituents of cow's milk. In this part an analysis is made of the variability of milk, and it is shown by graphical representation that the solids not fat and water in the milk of successive days vary approximately as the milk, while fat varies in a fashion peculiar to itself, suggesting that the secretion of fat is governed by factors not identical with those governing the secretion of the other constituents.

BOOKS RECEIVED.

Catalogue of the Scientific Serial Publications in the Principal Libraries of Calcutta. Compiled for the Asiatic Society of Bengal by S. Kemp. Pp. xii+292. (Calcutta: Asiatic Society of Bengal.)

The Cambridge University Calendar for the Year 1918–19. Pp. xxvi+1074. (Cambridge: At the University Press.) 10*s.* 6*d.* net.

Who Giveth Us the Victory. By A. Mee. Pp. 191. (London: George Allen and Unwin, Ltd.) 5*s.* net.

Echo Personalities. By F. Watts. Pp. 111. (London: George Allen and Unwin, Ltd.) 4*s.* 6*d.* net.

Ambulance de "l'Océan," La Panne. Tome ii. Fasc. i. Pp. 376. (Paris: Masson et Cie.) 18 francs net.

Everyman's Chemistry. By E. Hendrick. Pp. x+319. (London: University of London Press, Ltd.) 8*s.* 6*d.* net.

Coniferous Trees for Profit and Ornament. By A. D. Webster. Pp. xx+298. (London: Constable and Co., Ltd.) 21*s.* net.

The Scientist's Reference Book and Diary, 1919. (Manchester: J. Woolley, Sons, and Co., Ltd.)

The Production and Treatment of Vegetable Oils. By T. W. Chalmers. Pp. x+152+9 folding plates. (London: Constable and Co., Ltd.) 21*s.* net.

Agricultural Bacteriology. By Prof. H. W. Conn. Third edition, revised by H. J. Conn. Pp. x+357. (Philadelphia: P. Blakiston's Son and Co.) 2 dollars net.

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