THURSDAY, MAY 16, 1918.

AERODYNAMICS.

Resistance of Air. By Lt.-Col. R. de Villamil. Pp. x+192. (London: E. and F. N. Spon, Ltd., 1917.) Price 7*s.* 6*d.* net.

THE phenomenon of the resistance of a fluid to a body moving through it is complicated by the fact that it must depend not only on the density and elasticity of the fluid, but also on its viscous properties and on the nature of the relative motion. Mathematical investigations cannot at present lead to results that can be usefully applied, say, in aeroplane construction. Recourse must be had to experiment. During the past century many results have been obtained bearing on gunnery and navigation, whilst the great progress in aeronautics has been possible only because of the experiments of pioneers like Lilienthal, Langley, and Eiffel, and the systematic wind-tunnel researches at the National Physical Laboratory and elsewhere.

One of the most generally accepted conclusions is that fluid resistance is approximately proportional to the density, the square of rate of displacement, and the square of linear dimension. It is realised that this represents only a rough presentation of the actual state of affairs, and to take account of this fact it has been usual to consider the constant of proportionality "K" as a variable constant, depending on the nature of the fluid, the shape of the body, and the circumstances of the motion.

Col. de Villamil discusses the question in the light of the available experimental evidence, and in order to prevent the intrusion of irrelevant factors he very wisely restricts himself to a consideration of "the *law* of the resistance [in air] and the coefficients to be used for *flat*, square, or circular plates—with one or two small exceptions." There are three main questions: (1) Can the elasticity of the air be neglected? (2) Is there a "dimension effect"—*i.e.* does K vary if the only variable factor is size? (3) How does viscosity affect the resistance?

The author's conclusions can be summed up symbolically in the formula

$$R = K\rho(vl)^2(v/vl + c + bv/V),$$

where ρ, ν are the density and kinematic viscosity, v, l are the relative speed and a dimension, V is the "velocity of flow of the fluid into a *vacuum* at the pressure of the fluid experimented with," b, c are constants, and K is a coefficient of shape. He thus differs from Lanchester, who declares that the elasticity of the air can be neglected, and, though only formally, from Eiffel, and from Bairstow and others at the National Physical Laboratory, who assert the existence of a dimension effect.

Col. de Villamil bases much of his argument on dynamical similarity, and therefore devotes considerable—perhaps too much—space to an elucidation of the fundamental units of mechanics. His manner is vigorous and unorthodox, and his trenchant criticism of the professional mathematician is sometimes deserved and always enjoyable. Yet if the author desires to be read by "young people" he should pay less attention to polemics and more to notation. Not only is it bad pedagogy to present the innocent beginner with long and detailed criticisms of the false views held by others; but it is also very confusing when, after emerging from this thicket, he is brought up against a peculiar symbolism that suffers unexpected and unexplained changes.

With reference to his explanation of dynamical similarity the author says (p. 5): "I suppose I shall stand to be shot at; and I, equally, suppose I shall deserve it, since I am doing my best to 'give the show away.'" His first sentence on the principle as applied to air resistance runs as follows: "We first ask ourselves, Does the resistance due to viscosity cause change of momentum or not? We know perfectly well that it does: hence it is a 'Force.' We may consequently equate $\mu^x L^y V^z \rho^n = \text{Force} = MLT^{-2}$." Why is this array of symbols used to represent the resistance? Not a word of explanation is given. Why does the author violate his own dictum that symbols of dimension must not be regarded as algebraic symbols? Col. de Villamil need stand in no fear of the consequences of having "given the show away." S. B.

MILITARY PSYCHOLOGY.

Il nostro Soldato. Saggi di Psicologia Militare. By Fr. Agostino Gemelli. Con prefazione del Padre Giovanni Semeria. Pp. xii+339. (Milano: Fratelli Treves, 1917.)

THIS work is a study of the psychology of the soldier, and embraces an analysis of the various psychological processes which come into play during the events of the war. The author, who has made the most of his opportunities during the periods of mobilisation, preparation for fighting, and actual warfare, has conducted a careful inquiry into the causes predisposing to cowardice as well as heroism. Every possible condition which influences the soldier's life has received attention at the writer's hands: the combatant's original bias of mind, his antecedent social life and habits, his training in camp and in the trenches, and all forms of discipline which teach him to consider himself one of a crowd united by spiritual bonds to each other for a common purpose.

There is a very interesting chapter on the psychic factors underlying courageous actions. Many soldiers, having passed safely through several dangers, at length develop the conviction that they have acquired an immunity to death. Some become persuaded that their vital parts will escape injury. Others are buoyed up by religious feelings and formulæ, while others again are sustained by superstition or the war-cries of their regiment. The feeling of danger when shared in common loses in gravity the greater the numbers engaged.

The author is interesting on the folk-lore of war and the signification of soldiers' songs. These he must admit are for the most part crude and childish, but possess the merit of dispelling sadness and relieving psychic tension, and tend to elevate the patriotic spirit. He quotes figures to prove that the infantry invariably bear the brunt of the battle and most truly are the representatives of their nation. When it comes to the final assault they are the principal factor in victory. Each nation has its own innate characteristics, and therefore each army its own methods of fighting, so that the slavish imitation of another nation's methods should be severely deprecated. The feats accomplished by the infantry are due to strict laws and to the correlation between the nation and the army; thus a people in possession of good infantry can achieve a durable success, and this can be established only on a love of national independence. Modern war, therefore, has accentuated and not diminished the importance of individuality in battle. The ultimate argument in war is not the cannon, but the man.

In the last few pages of the book the author gives a short though useful account of the effects of war upon the soldier's nervous system. His conclusion is that "war insanity" in the strict sense is either non-existent or extremely rare. War simply brings into evidence, in those individuals already predisposed, the classical symptoms of the various insanities with which we are familiar in civil life. This opinion is now universally accepted.

The author has devoted most study in this direction to the psychoneuroses caused by profound emotion—for example, "shell shock"—and emphasises their similarity with those found to occur after earthquakes and other disasters. Violent emotion tends to produce fear, which in a normal person may be unaccompanied by a morbid mental disturbance. In the predisposed, however, the violent emotion of fear determines symptoms of "shock," some elements of which are fixed for a longer or shorter time by auto-suggestion. The author does not accept the view that emotional and "shock" symptoms are separable.

The book is an extremely able study and well worthy of perusal. One cannot, however, avoid criticising the unusually close spacing. This, possibly, is due to measures of economy.

OZONE AS A HYGIENIC AGENT.

Ozone: Its Manufacture, Properties, and Uses. By Dr. A. Vosmaer. Pp. xii + 197. (London: Constable and Co., Ltd., 1916.) Price 10*s.* 6*d.* net.

IN comparatively recent years the production of ozone, or rather of air containing a small percentage of ozone, on an industrial scale has reached a considerable degree of development, chiefly on account of its application to the sterilisation of drinking water. In a less degree ozonised air has been applied to the deodorisation of the air of public buildings, underground railways, etc. These technical developments are associated mainly with the names of the Siemens and Halske, Abraham-Marmier, Otto, and General Electric Companies.

As regards European works employing ozonised air for the purification of drinking water, Dr. Vosmaer gives a list of forty-nine installations, treating *in summo* nearly eighty-five million gallons of water per day of twenty-four hours. Of these the largest are at Paris, Petrograd, Nice, Villefranche, Lunéville, Lorient, Florence, Chartres, Saint-Servan, Laval, Compiègne, Constanza, and Wiesbaden.

Parts i. and ii. of the present work deal with the chemistry of ozone, the electrical discharge in gases, the different types of technical ozonisers and their output and efficiency. Part iii. is concerned with the uses of ozone, and part iv. contains a list of American patents bearing on ozone and a bibliography of papers and books.

Although it is undeniable that the book contains a good deal of useful information, and is written by an author practically familiar with the subject, it must be admitted that its scientific *niveau* is not high. Even when we come to the more technical part, where the author is obviously more at home, there is very little of that thorough quantitative information which is requisite for the scientific designer of plant. A number of diagrams, photographs of plant, and curves are given, but the treatment of the subject is distinctly sketchy and superficial, and does not convey the impression that the author possesses a real scientific knowledge of the chemical, electrical, and engineering principles relating to his subject. Viewed, however, as a semi-technical, semi-popular account of the manufacture and uses of ozone (which is, perhaps, all that the author intended it to be), the book is certainly interesting, and will, no doubt, be of use to readers unacquainted with the subject.

F. G. DONNAN.

OUR BOOKSHELF.

Cellulose: An Outline of the Chemistry of the Structural Elements of Plants with Reference to their Natural History and Industrial Uses. By Cross and Bevan. New impression, with Supplement. Pp. xviii + 348. (London: Longmans, Green, and Co., 1918.) Price 14*s.* net.

THIS well-known monograph by authors actively engaged in original investigation on many matters connected with the cellulose group is written in a manner stimulating to all workers in this field. The new impression is chiefly remarkable for a supplementary chapter of twenty pages, the greater portion of which is composed of the authors' critical review of researches published by others during the last two or three years. In addition there is a very interesting *résumé* of the authors' views on the standard of purity for "pure cellulose" and of their attempts to define a "normal cellulose." Whilst they regard cotton cellulose as the prototype of the group, it is affirmed, in contradistinction to the descriptions

common in the older text-books of cellulose as a very stable substance, (1) that cellulose is constitutionally modified by any and every treatment with reagents, and (2) that profound changes affecting the reactivity of its individual groups are determined by treatments which are not marked by change of weight of the cellulose or by visible structural modifications.

It thus follows that surgical cotton-wool or chemical filter-papers, for example, which are often considered as "pure cellulose" and the criteria of purity adopted by various manufacturers, are selected on an empirical basis, and the authors, therefore, attempt to define the "normal standard." Their definition of this as cotton purified from its raw condition by such treatments as attack and remove its non-cellulosic components with the ascertained minimum of action upon the cellulose itself obviously raises difficulties in the verification of the so-called "standard" product. Their conclusions are most valuable as a stimulus to further research, and their statement that "every process of treating the vegetable fibres in the arts produces some constitutional change" shows how necessary is systematic research work organised on a co-operative basis for the continued well-being of all the textile and paper-making trades.

ROBERT H. PICKARD.

The Year-Book of the Scientific and Learned Societies of Great Britain and Ireland. Compiled from official sources. Pp. viii + 334. (London: Charles Griffin and Co., Ltd., 1917.) Price 9*s*.

THE thirty-fourth annual issue of this useful work of reference provides a convenient record of the work done in science, literature, and art during the year 1916–17. Not only are the activities of the scientific societies chronicled, but an account is provided also of the researches carried out by the Meteorological Office, the National Physical Laboratory, the Royal Observatory at Greenwich, the Geological Survey, Kew Gardens, Rothamsted Experimental Station, and similar organisations of a national character.

The volume is very comprehensive in scope, but in the science sections we miss references to the Society of Glass Technology and to the Illuminating Engineering Society, both of which are active and important.

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.*]

Cotton-growing Statistics.

THE article on the above subject in NATURE of April 11 was welcome to me as directing attention to very important economic possibilities which lie behind the making of precise reports and reasoned forecasts concerning the state of all crops, by means of the Plant-Development-Curve method which I devised during my service in Egypt. With your permission, however, I would like to point out that the writer of the article was under a misapprehension in thinking that the recent Egyptian data he mentioned were adverse to this new method.

Although it is true that the paper cited from the *Agricultural Journal of Egypt* (vol. vii.) states that "the object of (1) was to study the life-history of the various types of cotton in the different parts of the country and to ascertain whether it was possible to estimate the yield of the crop several weeks before the cotton was ready for picking," yet the absence of further comment is obviously due merely to a certain looseness of structure in the paper in question, whereby a summary of results obtained under the stated purpose of this section "(1)" is given somewhat irrelevantly as follows on p. 52:—"The above observations seem to point to the fact that watering experiments on the cotton crop are most necessary; for if the flowering curve could be maintained (*sic*) during the whole of July instead of dropping considerably in the middle of the month, there should be a considerable increase in the yield of the crop."

Any decision as to the real result of this section of the paper in its declared object must therefore be taken from the data themselves, which are published in the form of plant-development curves.

So far as the prediction of bolling from flowering is concerned, with a seven-week interval between, the satisfactory nature of the results may be seen at a glance by those who care to consult the paper in question (although each curve represents the behaviour of only a single observation row of only fifty plants, instead of being the mean of at least five such rows of one hundred plants). In thus comparing the flowering and bolling curves, the reader should discard the first weekly ordinate in every bolling curve as there published, since the counting of the bolls was not started soon enough, and this ordinate, therefore, includes earlier bolls from the second, and even the third, antecedent week, which naturally spoils the similarity. On placing the curves in superposition with a seven-week shift, these new data (*e.g.* Fig. 9 and Fig. 11) then illustrate most satisfactorily the points which I have discussed in detail in "Analyses of Agricultural Yield" (Phil. Trans. Roy. Soc., B. 327, 333, 352), and specially demonstrated by Fig. 17 in part iii. of the "Analyses," such as the incidence of hot days, waterings, and boll-worm in affecting the shedding.

As regards the forecasting of the flowering itself by the growth-curve, the data under discussion have no significance. The daily fluctuation of flowering of cotton in Egypt is not predicted by main-stem growth measurements made later than June 1 (see Fig. 10 in my "Development and Properties of Raw Cotton"), owing to the four weeks' duration of this predetermination period, and to other causes which I discussed on p. 182 *et ante* of part iii. of the "Analyses." Since the growth-curves in vol. vii. of the *Agricultural Journal of Egypt* only began on May 28, they are effectively not for this purpose growth-curves at all. In any case, the growth should be measured daily, and not merely once a fortnight.

W. LAWRENCE BALLS.

St. James's Square, Manchester, April 16.

DR. BALLS's comments on the short article on "Cotton-growing Statistics" in the issue of NATURE for April 11 opens up a wide and interesting feature in scientific research, viz. the value of observed data and their interpretation.

Vol. vii. of the *Agricultural Journal of Egypt* gives a series of plant-development curves plotted from observed data. This method is claimed by Dr. Balls as having been devised by himself, but surely botany has not had to wait so long for growth to be graphically represented. Flowering and fruiting of a considerable number of members of the vegetable kingdom can be almost definitely stated if the time of the appearance of the plant above ground be known. The question of watering and the consequent increase of the crop are points brought out by the report, but this is quite an elementary matter also. The reference to it on p. 52 is simply an enunciation of the obvious, and quite harmless.

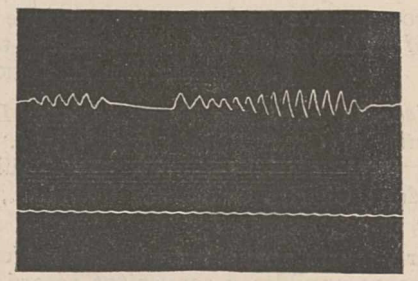
Dr. Balls's statement that "the satisfactory nature of the results may be seen at a glance by those who care to consult the paper in question" can only be interpreted as meaning that one row of fifty plants has produced data of considerable value and quite satisfactory as compared with the data obtained by himself from five rows of one hundred plants. From the important deductions arrived at by Dr. Balls in the analysis referred to in his letter, the data must be of an unusually complete nature, and the daily observations of this large number of plants throughout a season would be extremely useful for other minds to work upon. If these data are accessible, then the Egyptian Agricultural Department has wasted time, money, and energy in repeating on a much smaller scale research work that has already been so effectively done on a much larger scale by one of its own employees. Presumably the Department had the previous complete data before it, and yet we find it undertaking the research work *de novo*. Stranger still, no mention is made of the previous work so completely carried out on such a large scale by the Department—so complete, in fact, that it forms a far surer basis for deductions than the series of data now found in vol. vii. of the *Agricultural Journal of Egypt*.

Dr. Balls is quite correct in saying that "as regards the forecasting of the flowering itself by the growth-curve, the data under discussion have no significance." The writer of the article came to the same conclusion. It would appear that data on growth prior to May 28 are essential, and this feature is treated very inadequately in the report. It may be added, however, that observations are given commencing at various dates from April 27 to May 23. In the case of No. 17 Ashmoun, the growth records date from April 27, but these give no indications of any peculiarity between April 27 and early in June; the growth-curve is practically a straight line for a mean of forty-two plants (see p. 30 of *Journal*). If all the plants gave similar results, it may explain why further tests were not made. In any case, it is quite evident that height, *per se*, had little influence on the flowering either as to its beginning or as to the attainment of its maximum flowering period. If this earlier period of growth is such as to be so distinctive as to afford a forecast that would be of such enormous value to a great industry, why has the Department of Agriculture totally ignored it? Dr. Balls clearly indicates that the experiment on a very large scale has been made, and he has used the data for his own conclusions, so the Department must have had these important results in their possession.

As regards "the prediction of bolling from flowering" and the seven-week interval between them, the curves do not give anything approaching a satisfactory agreement when superimposed, not even when treated so unscientifically as suggested. It must be acknowledged that the whole series of data lacks the element of a real appreciation of the practical deductions that might have been made from them, and the draughtsmanship is bad, as well as the reproduction of the curves. This, however, does not prevent the redrawing of the curves from the data on a large scale. If this is done they yield nothing but generalities, of even less value than a schoolboy's observations on the growth of a pea or a daisy. If the Egyptian Agricultural Department would give us the much more complete and exhaustive data already obtained by its own experts in previous research work, the cotton industry of the country would be considerably benefited by having a basis on which to build up its own conclusions. THE WRITER OF THE ARTICLE.

The Duration of Resonance in the Internal Ear.

HELMHOLTZ's estimate, 9·5 free vibrations to reduce the intensity of a sound to one-tenth of its original value, was drawn from the effect of shakes or trills in music. It would have been better, instead of a reiteration of notes, to take the simple case of a single note ending staccato, as exemplified daily in speech. The reproduction here of a typical mouth-tracing, made with the kymograph, of the word *utter* in a phrase intoned rapidly at pitch 100, and timed by a 100 fork, shows that 9·5 vibrations would completely obliterate the mute or silence between the two utterances of voice. It would be impossible to distinguish *utter* from *udder*.



When speaking of the theory of resonance in the cochlea, Thomas Young had said (*Nat. Phil.*, 1807, i., p. 386):—"It is uncertain whether any fibres in the ear are thus sympathetically agitated in the process of hearing, but if there are any such vibrating fibres, their motions must necessarily be of short duration, otherwise there would be a perpetual ringing in our ears, and we should never be able to judge accurately of the termination of a sound." He returns to the subject on the next page. These remarks of Thomas Young appear to have been overlooked.

W. PERRETT.

University College, London, May 6.

Recovery of Speech through Excitement.

RECENTLY a soldier who had "lost" his speech through shell-shock was brought to me. I told him he was shamming, and that there would be trouble of an acute kind if he did not recover quickly. He was able to speak very well in a few days. I imagine that 99 per cent. of those who have lost their speech and then suddenly recovered it belong to the same category.

The case of the son of Crœsus quoted by Capt. Newton Friend in NATURE of May 9 is mythical. We learn to speak, and a man could no more speak at the first attempt than he could play the violin.

G. ARCHDALL REID.

Netherby, Victoria Road, S.,
Southsea, May 13.

A STUDY IN CONDITIONS OF HUMAN NURTURE.[1]

THE Carnegie United Kingdom Trust did the nation a good turn when it secured reports on the existing provision for promoting the physical welfare of mothers and young children in England and Wales, Scotland, and Ireland. The third volume, now before us, is by Dr. Leslie Mackenzie, and deals with Scotland. It is a very important human document, compiled with conspicuous scientific insight and unusual literary skill. It is not only well-planned, lucid, telling—it rises on appropriate occasions to a high level of art. We do not mean that there are purple passages, but something much subtler—that the author, in dealing with the intricacies of the human web of life and the often tragic clash of the human struggle for existence, has at strategic points attained to an impressive cadence and solemn dignity of diction which appeal to us as congruent with the urgency and seriousness of the problems discussed.

That artist and man of feeling should persist in a busy administrator is wonder enough, but our admiration grows as we realise the firm scientific grip and the fresh insight which the half-hundred chapters disclose. We should like to illustrate this by various examples.

(1) Dr. Mackenzie has shrewdly recognised the fundamental importance of the geographical factor. This note is struck in the two vivid maps—showing contours and distribution of population—which meet us at the threshold of the report, and it resounds through and through. The midland valley of Scotland contains one-fifth of the area, but about three-quarters of the population. A massive urbanisation, still very imperfectly integrated, has entailed a pressure of life which is hard on mothers and their children. The Highlands and islands, including more than half the area of Scotland, have only about one-tenth of the population, but the mitigation of the pressure of life is counterbalanced by the distances which often make the utilisation of medical and other welfare services difficult, and by such complications as the exceptional disproportion between local production of commodities and local demand, which explains the well-known seasonal exodus and other striking features.

(2) Following the Le Play method of regional survey, the author has obtained from numerous experts, as well as from his personal observations, a series of pictures of representative areas, such as a Highland parish, a mining village, an island in the Hebrides, an East Coast fishing village, a south-eastern agricultural area, a group of industrial villages, and so on. These special regional studies are of great value, and some of the general results, such as the apparent rarity of venereal diseases in the Highlands and islands, and fishing villages generally, have much biological as well as medical interest.

(3) The author's biological discipline has led him to attach much importance to intimate contact with his subject-matter—composed not of statistical units, but of flesh-and-blood, struggling organisms, his brothers and sisters, and children. This insight of sympathy, beyond scientific analysis and yet its needed complement, has led him to understand the people of Lewis and the like better than they understand themselves.

(4) In diagrammatic illustration of the author's mood and method we may refer to the so-called "black houses" of Lewis, still to be numbered in hundreds, if not in thousands (Figs. 1 and 2). They are without chimneys; the peat fire is kept burning day and night, and is, in spite of the smoke, the saviour of the household; the straw roof does not keep out the rain, and thus almost necessitates "box-beds"; there is often more than propinquity of the cows and their manure. The "black houses" are, of course, deplorable and deteriorative; but that is not their scientific description. The fact is that, in point after point, these "black houses" are like organisms built up under difficult conditions, meagrely perhaps, but with remarkable adaptiveness. The stones are from the moor; timber is from the sea; lime mortar is expensive; the roof must be moulted every year, and therefore the walls must be low; moreover, the gales are high. "At every point the house is adapted to its fundamental purposes," and what the doctrinaire student or the careless visitor dismisses as unworthy of savages, the product of laziness or perversity, turns out to be "a product of long labour and sacrifice," "a fundamental part of the only system of agriculture formerly found possible in this island of gneiss rock, clay, and peat moss." "It is part of the price that a people of

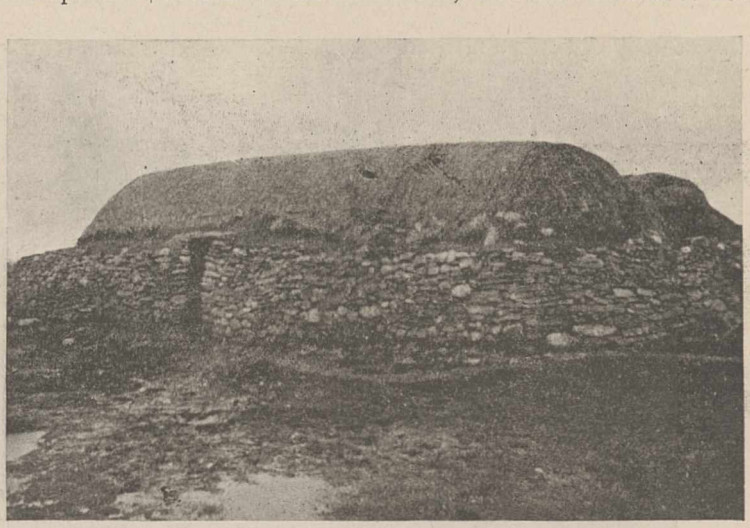


FIG. 1.—Hebrides. Typical "black house"—no chimney, no window.

[1] "Scottish Mothers and Children: Being a Report on the Physical Welfare of Mothers and Children." Vol. iii., "Scotland." By Dr. W. Leslie Mackenzie. Pp. xxviii+632; with 2 maps, 6 charts, and many illustrations. (East Port, Dunfermline: The Carnegie United Kingdom Trust, 1917.)

immense ability and high character have to pay for their civilisation."

The unsympathetic critic, who does not dwell with the people, as one must dwell with all sorts and conditions of living creatures if one is to understand them, does not discover that the peat smoke is tolerated and even encouraged day and night through all the winter in order that the straw may be saturated to form a manure which keeps the croft lands effective. The reasons for the so-called "cattle-housing" are similarly interpretable in terms of intelligible purpose. Not that the medical member of the Local Government Board for Scotland is advocating the encouragement of "black houses" and "cattle-housing." But he protests that we shall do well to pay to even the jetsam of the past the compliment of understanding it, or heaven help our future.

The geographer will be pleased by the author's appreciation of the basal importance of the map; the biologist will enjoy the recognition of the motor necessities and play necessities of the young child, and by the masterly way in which, amid an embarrassing multitude of details, the reader is never allowed to lose sight of the big underlying problem—the influence of nurture, environmental, nutritional, and functional, on the organism, whether adult and reproductive, or in process of early development. The author is neither optimist nor pessimist; he believes things can be bettered; he shows us what a multitude of salutary provisions are at present in operation; he indicates how development along the lines of education, research, and institutions may wipe away a reproach to our civilisation. Dr. Mackenzie has done great service to his day and generation in making his report, and he may take it as a sort of expression of his country's gratitude that the United Kingdom Trust should already have promised for Scotland, as well as for England, a national institute of maternal and child welfare.

FIG. 2.—Hebrides. South Uist, showing smoke issuing by doorway.

THE DEVELOPMENT OF TECHNICAL RESEARCH.

WITHIN the last year there has been an important movement in Germany having for its object the better application of scientific research to technical problems. It is well known that the same question has received earnest consideration in this country, and that a serious attempt has been made to attack it by the appointment in 1915 of the Committee of the Privy Council for Scientific and Industrial Research. The Committee consists, of course, of a number of important political personages, mainly distinguished for their lack of knowledge of both science and industry. It is, however, supplemented by a small Advisory Council, most of the members of which are eminent men of science. So far the Committee has done but little, though this fact is largely due to the difficulty of getting men to attend to anything other than the urgent national war work to which all our energies are being devoted for the moment. The Germans, on the other hand, have sought to attain their object by forming the "German Union of Technical Scientific Societies," which is a combination of some thirteen associations interested in various branches of technology. The object is stated to be the establishment of a balance between science and practice, seeing that most technical tasks require the collaboration of several distinct branches of science.

One of the first steps of this Union has been

the creation of a department to act as an intermediary between the scientific branches of the universities and technical colleges and the various industries, for carrying out scientific and technical researches that may be of value to the latter, and the Union has issued an appeal to industries to submit their problems and difficulties to it for the purpose of having these investigated by competent scientific authorities whom the above-named department is in a position to select. It is rather disquieting to find that the German method of attacking the question is an individualistic one to the extent that it is the industries themselves and the scientific and technical institutions which propose to find the necessary funds and to provide the means of solving their own difficulties, whilst we in this country, who have hitherto been proud of our individualistic principles, which have ever formed the basis of Britain's industrial greatness, are content to sink our individualism and to ask a Government Department to solve our industrial problems for us.

The German Iron and Steel Institute has taken a prominent part in the extension of the research movement. This institute joined the above-mentioned Union of Technical Scientific Societies at an early stage, and took an active share in its formation; it has furthermore founded a research institution of its own for the investigation of problems connected with iron and steel manufacture. Here, again, it is characteristic of the quite modern trend of German methods that the iron and steel industry proposes to provide practically the whole of the important funds required for such an institution, whilst the town in which this is to be built will have to provide a suitable building site and a contribution to the cost of erecting the buildings. Although we in this country have not been unmindful of the need for applying scientific research to the numerous problems that arise in iron and steel manufacture, we have attempted nothing on the scale of this projected German institution to be devoted entirely to this need. For example, the Alloys Research Committee of the Institution of Mechanical Engineers had an excellent piece of work to its credit. Thanks to the munificence of Mr. Andrew Carnegie, our own Iron and Steel Institute, too, has been enabled to assist and encourage research for the past seventeen years; but this has been done on quite different lines. The Carnegie Fund enables scholarships to be awarded, the holders conducting a specified research in the metallurgy of iron and steel at any suitable university, technical school, or works, the results being communicated to the Iron and Steel Institute, and in this way a great deal of useful and valuable work has been done. It is unquestionable that an institution equipped and maintained for such researches in any of our great metallurgical centres could do even better work than is possible to workers widely scattered, not provided with the best possible equipment, and each probably in ignorance of what the others are doing. It cannot be suggested that our iron and steel industry is less capable of providing the requisite funds, and, seeing that every single important invention in iron and steel manufacture has emanated from this country, it cannot be supposed that British metallurgists are less capable of conducting such researches or of applying their results; there is therefore no reason whatever why we cannot do here what the Germans are proposing to do, and do it at least as efficiently.

The other movement, too, for a more intimate union and a closer co-operation amongst the leading technical societies, is one that deserves equally to be imitated in this country. The first step ought to be joint action amongst our technical societies, above all between those connected with the mining, metallurgical, and allied industries, the key industries of our national prosperity; they ought to have a joint building in which they could all be housed, forming a common meeting place for all, with suitable laboratories, and, in particular, one common library in which the whole of the world's technological literature could be found readily accessible to every student or inquirer. Such a library alone would save as much time and money, merely by avoiding the vast duplication of efforts that is now going on, as would give an adequate return upon its cost, not to mention the new vistas of study that it would open up. A building of this kind already exists in New York, where some of the most important of the technical and engineering societies are housed under one roof, to their very great mutual advantage. If we had such a building in London it might very beneficially shelter also the new Imperial Bureau of Mineral Resources, which would become immensely more useful if it were thus in close and constant touch with the chief technical societies and through them with the industries themselves. The technical societies, on the other hand, would gain by being able to communicate directly with the Government Department with which they would be chiefly concerned, and could work with it whilst at the same time preserving their independence, thus gaining the advantage of Government support without the risk of being strangled by administrative red-tape. H. L.

CONFERENCE OF UNIVERSITIES.

AN important conference which met at the Imperial Institute on May 10 was attended by about seventy representatives of the universities of the United Kingdom and also by Mr. Joynt, representing New Zealand, Prof. Bragg, representing the universities of Australia, President Tory, representing the universities of Canada, and Prof. Gilbert Murray, Acting-Director for the Board of Education of Special Inquiries and Reports. Sir Donald Macalister was voted to the chair.

Matters arising out of a private and preliminary conference at the Foreign Office were considered. A committee was appointed to advise the Government with regard to representatives of British universities to take part in Mr. Balfour's Mission to the United States. The vice-chancellor or principal of each university, or a deputy appointed

by him, together with the executive committee of the Universities Bureau, were appointed to consider any matters of common interest arising out of the proceedings of the conference or submitted to it by the Government.

The title of the degree to be obtainable by students of the King's Dominions overseas or of foreign countries as the result of post-graduate work and research was discussed at considerable length, revealing a much higher degree of unanimity than seemed to be likely when the conference met a year ago.

It was recognised by the conference that the question of the title of a degree and the conditions under which it could be obtained were of far greater import than the influence which the degree might have in attracting graduate students to the United Kingdom. It involves the whole question of the function of universities in the modern world. In our own country the tradition still lingers that a university is a place of post-school education, whereas in the modern world there is greater need for the provision of highly trained men and women capable not merely of absorbing knowledge, but also of increasing the common stock. This position was well defined by Sir Ernest Rutherford, whose speech may be quoted as an epitome of the views of the conference:—

It should be made clear that the new degree which many universities propose is an entire innovation. It will involve a full period of post-graduate training, introducing into Britain a system practically identical with that which obtains in America, and to a large extent in Canada also. It is of great importance that it should be adopted by the English-speaking world. In Britain it is likely to be a degree of very high standard, because we have the opportunity of building it on an honours basis. It is generally considered that the course should last for not less than two years, and this, I consider, is as it should be for a student who has already taken an honours degree, say in the first class, before he starts post-graduate work and investigation. If he shows promise and ability he will be able to take the M.A. in a year. We must also consider those who come to us from a distance, who will already in many cases have done a certain amount of research. It will be a real and very great departure in English education—the greatest revolution, in my opinion, of modern times. It is true that some universities have already attempted post-graduate training in a somewhat spasmodic manner. To carry out the scheme in its entirety will involve a much larger and more highly specialised staff and much more money for equipment.

NOTES.

WE deeply regret to announce that Sir Alexander Pedler, F.R.S., died suddenly on Monday, May 13, at sixty-eight years of age, while attending a committee meeting at the Ministry of Munitions. Sir Alexander was formerly Vice-Chancellor of the University of Calcutta and Director of Public Instruction for Bengal. He retired in 1906, and since 1907 had been the honorary secretary of the British Science Guild, as well as an active member of many other public and scientific bodies.

WE learn with great pleasure that Oliver Heaviside has been elected an honorary fellow of the American Institute of Electrical Engineers. He is the fifth honorary fellow, the others being Marconi, Ferranti, Blondel, and C. E. L. Brown. Heaviside has often contributed to our columns on scientific theory and on educational matters. He holds very strong views about the mathematical teaching that used to be given in our schools, and has little patience with concentration upon its logic and philosophy. In his own books he does not spare the reader, but makes him master his own peculiar nomenclature and notation before he can learn those principles of electromagnetic theory which he has developed so successfully, and some of which are of great importance to practical engineers. His books would have a far wider vogue if he had conformed more to conventional methods, but the value of his work would probably have suffered, and he would have lost much of the pleasure which he obviously felt in writing them. Standardisation has its uses, but it has also serious limitations. Many of us are grateful to Lodge, Perry, and Searle for explaining many of the good things in his books which we might otherwise have passed over. From the practical point of view Heaviside's most important discovery was the "distortionless" circuit for speech transmission and his suggestion of the use of inductance coils at intervals in long telephonic lines. This suggestion was taken up and developed by Pupin and other American electricians, and has been largely and most successfully utilised in many submarine telephone lines all over the world. We rejoice that our American *confrères* have done Oliver Heaviside honour; we thank them and offer to him our warmest congratulations.

THE Pereira medal of the Pharmaceutical Society of Great Britain has been awarded to Miss H. C. M. Winch.

LORD ROTHSCHILD has been elected an honorary member of the Entomological Society of Spain, of which we recently noted the foundation.

THE Decimal Association informs us that the Federation of British Industries, by a unanimous resolution of the executive council, has now given its support to the Decimal Coinage Bill which is before the House of Lords.

MR. W. B. RANDALL, of Waltham Cross, has generously provided funds for the establishment of a new research post at the Rothamsted Experimental Station, and the committee has appointed Mrs. D. J. Matthews (formerly Miss Isgrove) to occupy it. Mrs. Matthews will devote herself to the study of some of the problems connected with soil sterilisation as it is now being carried out in certain types of nurseries.

THE annual congress of the South-Eastern Union of Scientific Societies will be held at Burlington House on May 29–June 1, and will follow the usual lines. The president will be Sir Daniel Morris, who will deliver his address on the evening of Wednesday, May 29, when his subject will be "A Chapter in the Geographical Distribution of Plants." On Thursday evening, May 30, at 8 p.m., Sir Ronald Ross will open a discussion on mosquitoes in England.

THE death is announced, on May 12, of Dr. R. G. Hebb, consulting physician and physician pathologist to Westminster Hospital, lecturer on pathology at Westminster Hospital Medical School, reader in morbid anatomy at the University of London, and editor of the Journal of the Royal Microscopical Society.

WE regret to record the death at Newcastle-upon-Tyne on May 7 of Sir William Haswell Stephenson, aged eighty-two years. Sir William joined the Tyne Improvement Commission in 1878, and from 1900

until his death was chairman. It was during his long *régime* that the building of large ships became possible. He was an honorary D.C.L. of Durham University, and the honour of knighthood was conferred upon him in 1900.

THE General Congress of Civil Engineering, which was held in Paris on April 18–23, proved an entire success. A total of 151 reports were printed and circulated to the members and discussed at the sessions of the congress. The sections of the congress were:—(1) Public Works and Civil Engineering, (2) Transport, (3) Mechanical Engineering, (4) Mining and Metallurgy, (5) Industrial Physics and Chemistry, (6) Industrial Electricity, (7) Rural Engineering and Agriculture, (8) Industrial Organisation, (9) Social Hygiene and Welfare, and (10) Industrial Legislation. In the economics section much attention was given to educational reform and to the future training of the worker and the engineer.

WE have received a pamphlet entitled "Building Jerusalem" (from a line of the poet, William Blake), being the annual report of the National Council of Public Morals. It is noted that action has been taken on the recommendation of the council's national birth-rate commission in scheduling as a poison certain forms of lead which have been extensively used as abortifacients. During the past year a commission of inquiry on the physical, educational, and moral influence of the kinematograph has completed its labours and published a useful report. Valuable propaganda work has also been done for furthering the establishment of a Ministry of Health, and pamphlets for the troops and for the civil population on venereal disease have been issued together with other publications.

A NUMBER of further cases of the disease resembling botulism (see NATURE, May 2, p. 170) have been reported in London and Birmingham. The epidemic has assumed sufficient proportions for the medical officer of the Local Government Board to issue a memorandum to health authorities describing the symptoms, etc., and the London County Council has decided to place at the disposal of medical practitioners in London the services of its medical staff for consultation. Considerable doubt exists as to the disease being botulism. So far we believe the *Bacillus botulinus* (the causative microbe of botulism) has not been isolated in connection with the present epidemic, which has also not been associated with any particular article of food. It is suggested that the disease may be a cerebral form of poliomyelitis, which in its spinal form occurs in epidemics and principally attacks children, causing infantile paralysis.

SIR ROBERT HADFIELD has been for some years a strong advocate of the scheme for erecting a joint home for technical associations connected with the metal industry, including the Institute of Mining and Metallurgy, the Iron and Steel Institute, the Institute of Metals, and the Institution of Mining Engineers, none of which has at present adequate accommodation. It is estimated that the cost of a suitable building would amount to 400,000*l*. Besides providing a common meeting-place for the bodies concerned with the metal industry, the scheme would render possible a joint library, an advantage which has been strongly emphasised in the experience of the United Engineering Societies Building in New York. The council of the Iron and Steel Institute has approved the scheme, and it is probable that the Sheffield City Council, and possibly the Cutlers' Company and the Chamber of Commerce, will be invited to consider it.

A REPORT has been issued summarising the work of the Industrial Reconstruction Council during the three months ending March 31. It will be recalled that the first public meeting of the council was held at the Guildhall on February 15, when representatives of a large number of trade unions and trade associations were present. Meetings have since been held in Bristol, Manchester, Edinburgh, and Nottingham, addresses being delivered by Lord Balfour of Burleigh, Mr. E. J. P. Benn, the Rt. Hon. Christopher Addison, the Rt. Hon. G. H. Roberts, Sir William McCormick, and others. Conferences have also been arranged with the officers of the Federation of British Industries, the Manufacturers' Section of the London Chamber of Commerce, and the Engineering Employers' Federation. The council emphasises the need for educational work amongst both employers and employees, and of increasing the number of lecturers and speakers who are willing to explain the principles of the Whitley report. It is hoped that branch organisations will shortly be established.

"FISHERIES NOTICE No. 9," just issued by the Board of Agriculture and Fisheries, is a practical description of methods of eel-capture. The pamphlet is well illustrated, showing the details of construction of traps and weirs, and it includes a list of makers of the fishing gear mentioned. Copies may be obtained, free of charge and postage, on application to the Secretary, Board of Agriculture and Fisheries, 43 Parliament Street, London, S.W.1. The Fresh-water Fish Committee (54A Parliament Street) also issues a notice relative to the distribution of elvers for stocking lakes, reservoirs, farm-ponds, marsh drains and pools, and the upper parts of suitable river systems. It is estimated that 1000 elvers per acre is an adequate supply where eels are scarce. About three to four years are required before the elvers grow to marketable-sized eels. Full directions are given in the notice to which reference is made. The cost of the elvers is from 3*s*. 6*d*. per 1000 to 2*l*. 5*s*. per 20,000. These notices are deserving of wide publicity, and should be obtained by all persons who have control of suitable waters for rearing purposes.

A GANG of riveters at the works of Messrs. Fraser and Fraser, Ltd., Bromley-by-Bow, celebrated *Lusitania* Day by creating a world's record in rivet-driving. The squad consisted of the riveter, Mr. R. Farrant, who used an Ingersoll-Rand "Little David" pneumatic riveter, weighing 28½ lb., a holder-up using a hand-tool weighing 16 lb., and five other men or boys. The rivets were ½ in. in diameter by 1⅛ in. long. The following particulars—extracted from the *Engineer* for May 10—are of interest in showing the rates for different periods of the day:—

Time	Rivets driven	Rate per hour
6.30 a.m.	nil	—
7.30	536	536
8.30	1032	494
Half-hour interval.		
9.30 a.m.	1304	544
10.30	1823	519
11.30	2257	434
1.0 p.m.	2920	442
One-hour interval.		
2.30 p.m.	3100	360
3.30	3550	450
4.30	4007	457
5.0	4276	538

The average for the day of nine hours is one rivet per 7·58 second. The American record of 2720 rivets in nine hours, held by Charles Schock, has been beaten

by 57 per cent., although it is only fair to say that full information is lacking regarding his performance, and hence strict comparison is not possible. A note in the *Times* of May 15 states that Farrant's record of 4276 rivets has been beaten by a workman in Messrs. Beardmore's yard at Dalmuir. Working the usual shift of nine hours on ship's plates, the man drove 4452 rivets, 176 more than Farrant's total.

THE first instalment of an interesting article on the Larderello natural steam power plant, by Ugo Funaioli, director of the electrical department of the Società Boracifera di Larderello, appears in *Engineering* for May 10. Reference has already been made in NATURE to the utilisation of volcanic heat in Tuscany, and the present article gives an account of the method employed in boring for steam. Heavy steel chisels are attached to a rigid system of iron rods, and the whole system is lifted by an electric winch and then released, the fall causing the chisel to penetrate the soil. Steam and water are found generally at a depth of 20 m., and the work from that point proceeds with increasing difficulty and requires specially trained workmen. Diameters of bore of 40 cm. have been attained, and experiments are being made to arrive at still larger diameters in order to augment the output of steam. The holes are lined with iron tubes so as to prevent crumbling of the sides, and the tubes are welded together with oxy-hydrogen flame; the oxygen and hydrogen required are produced locally by the electrolysis of water. When it is judged by signs known to the practised eye of the foreman that the hole has reached a sufficient depth, a curious operation termed locally "sfulminazione" (explosion) is sometimes performed, which clears the hole from all remaining *débris* and of the water which balances the pressure of the steam. A sort of rough piston is introduced into the hole, and is afterwards withdrawn as rapidly as possible by means of the electric winch. If all necessary conditions are fulfilled this provokes a small volcanic eruption, and the hole emits violently mud, stones, and boiling water. This eruption lasts for some minutes, and is followed by the steady emission of dry steam.

THE inaugural meeting of the Société de Chimie Industrielle was held recently at Paris under the presidency of M. Clémentel, Minister of Commerce, who was introduced by M. P. Kestner, president of the society. An important paper was read by M. Matignon on the problem of the production of synthetic ammonia before Haber. M. Matignon pointed out that the first steps in this direction were due to an English chemist, Perman, who showed in 1904 that the combination of nitrogen and hydrogen to form ammonia and its resolution into these elements form reversible reactions depending upon certain conditions of equilibrium. These conditions and the amount of ammonia producible thereunder were studied in the following year by Haber and one of his pupils, Van Ordt, and as a result of these studies a works for the annual production of 30,000 tons of ammonium sulphate was erected at Oppau, near Ludwigshafen. The first patent, however, bearing on this subject is dated so far back as July 11, 1865, being an English patent taken out by Dufresne in the name of Charles Tellier for the preparation of oxygen, in which he claims the utilisation of the nitrogen eliminated in his process by passing it over spongy iron heated to redness, and afterwards passing hydrogen over the combination of iron and nitrogen thus formed, when a large quantity of ammonia is at once generated. A French patent was taken out by Tessié du Motay in 1871 for similarly employing nitrides of titanium. In 1881 Charles Tellier took out further French and German patents for the production of ammonia from atmospheric nitrogen by means of iron and titaniferous iron. Further work in this direction was done by Ramsay and Young in 1884, and patents were taken out by Hlavati in Austria in 1895, and in France by the Christiania Minekompani in 1896, and again by M. Le Chatelier in 1901. Perman had, moreover, pointed out the effect of numerous metals as catalytic agents in the combination of nitrogen and hydrogen, also the advantage of employing high pressures. It would, therefore, appear probable that the monopoly of the rights in the production of synthetic ammonia, which the Badische Company lays claims to, is likely to be invalidated by the publication of the above list of patents.

IN an article entitled "Psychology in Relation to the War," in the *Psychological Review* for March last, Major R. M. Yerkes, of the United States Army, and president of the American Psychological Association, reports upon the organisation of American psychologists for military service during the year 1917. In April, 1917, twelve committees were appointed from the members of the American Psychological Association "to render the Government of the United States all possible assistance with psychological problems arising from the present military emergency." The subjects allotted to these various committees included the psychological examination of recruits, the selection of men for tasks requiring special aptitudes (*e.g.* artillery service, signalling, etc.), psychological problems of aviation, problems of "incapacity" (shell-shock, re-education, etc.), recreation in the Army and Navy, psychological and pedagogical problems of military training and discipline, and visual and acoustic problems in relation to military service. For obvious reasons a detailed report upon the later activities of some of these committees cannot be given, but the account of the work of the committee for the psychological examination of recruits well repays study. The purposes of the psychological tests applied were:—"(*a*) To aid in segregating the mentally incompetent; (*b*) to classify men according to their mental capacity; (*c*) to assist in selecting competent men for responsible positions." It is important to notice that of the number so tested, the lowest (10 per cent.) and the highest (5 per cent.) were subjected to a more searching individual examination, on the basis of which a report was made by the psychological examiner to the medical officer. As a result of an examination of 5000 officers and 80,000 men, the Medical Department recommended the extension of psychological examining to the entire Army. In December, 1917, this recommendation was approved by the General Staff, and the section of psychology in the Surgeon-General's Office is engaged in the preparation of a plan for this work. We are now informed that a division of psychologists has been organised, consisting of twenty-seven majors, fifty-two captains, and sixty-two lieutenants, with six hundred assistants.

Two forms of "Githathi," or magic stones, in use among the AKikuyu are described and figured by Mr. H. R. Tate in the Journal of the East Africa and Uganda Natural History Society, vol. vi., No. 12. The larger of these is circular, the smaller cylindrical, in shape, and both have been drilled through the centre. The use of such stones seems to have fallen into desuetude; but Mr. Tate has been able to show that they were used to invoke vengeance, or to obtain compensation for offences against tribal law. Mr. Hobley, some years ago, was fortunate enough to witness a trial by ordeal as practised among the Akamba of Kilima Njaro, in which one of these stones was actually used. In the same issue of this journal

Mr. C. M. Dobbs describes a small stone bowl found at the entrance to a cave in Sotik. None of the natives living in the neighbourhood had ever before seen such a bowl, and could offer no suggestions as to its probable use; hence it is evident that it is a relic of some extinct tribe, of which more may be discovered later. He also describes some remarkable circular holes found all through the district from the Nyando River to Sotik. Arranged in groups of from ten to twelve, each hole is provided with an entrance in the form of a long narrow passage. But there is nothing in the form either of the passage or of the pit itself to afford a clue as to the uses to which the excavations were put. By the present native population of the Lumbwa country they are said to have been made by a tribe called the Sirikwa, now, apparently, no longer in existence. The only other trace of this tribe now remaining exists in the form of fragments of red pottery of a type now unknown in the country. In placing these evidences of vanishing and vanished races on record, the society is doing some extremely valuable work.

IN the March issue of the *Journal of the Board of Agriculture* Messrs. E. S. Salmon and H. Wormald give an account of an experiment in the treatment of "covered smut" (*Ustilago hordei*) of barley. Seed from an affected crop was secured for the purpose, and separate portions of this were treated with copper sulphate (2½ per cent.), Bordeaux mixture, and formalin respectively, whilst a fourth portion was subjected to "sweating" in a malt kiln. Plots, each two acres in extent, were sown with the treated seed, whilst a fifth plot of one acre sown with untreated seed served as control. The results were assessed by counting the plants with smutted ears growing in the six outside rows along each side of each plot, the area thus covered by each separate count being, roughly, one-tenth of an acre. The formalin treatment proved completely successful, whilst the treatment with copper sulphate, though less effective, greatly reduced the extent of the attack. On the other hand, neither "sweating" nor the treatment with Bordeaux mixture afforded any measurable protection.

THE depressing effect of weeds upon the growth of accompanying crops has in the past been commonly regarded as either an effect of competition for the available soil nutrients or a shade effect, although in recent years increasing support has been given to the view that toxic excretions from the roots may play a very great part. This latter view receives little support, however, from the experiments carried out at Rothamsted during the last four years by Dr. Winifred E. Brenchley, the results of which are summarised in the March issue of the *Journal of the Board of Agriculture*. Pot- and water-culture experiments, in which poppy, spurrey, blackbent, and charlock have been grown separately and together with wheat and barley under varying degrees of competition, have shown that the association of any of the weeds with wheat had a great influence upon the growth of both, the results varying according to the species of weed introduced. The presence of extra wheat plants produced an effect similar to that of weed plants, the depreciation in individual growth being indeed, in some cases, much greater than was caused by the weeds. From a survey of the whole series of experiments it seems probable that the essential factor in the relation of crop with weed is that of competition for food, space, and light rather than that of toxic excreta from the roots. The mere competition of plant with plant, irrespective of species, has much to do with development, the chief factors involved being the time and duration of competitive check. The possibility of toxic action cannot be ruled out entirely, but it is evident that any such action is easily masked by the many other factors of competition, such as root interference, crowding of aerial parts, and deficiency of plant food.

THE late Prof. F. E. L. Beal attained a world-wide fame as the result of his minute studies on the food and feeding habits of wild birds, and in the recently issued Bulletin No. 619 of the U.S. Department of Agriculture, treating of the food habits of the native swallows, his reputation is fully maintained. The paper is characterised throughout by ripe experience, scrupulous detail, and a broad grasp of the subject. The stomach contents of the seven species dealt with have been carefully examined, 2030 specimens being utilised in determining the nature of the food, and, as was to be expected, they prove, in their relation to man, to be as harmless as any family in the bird kingdom. They are practically wholly insectivorous, the major portion of their insect food consisting of injurious species. In only a single species, the tree-swallow (*Iridoprocne bicolor*), was there any appreciable amount of vegetable matter; here it reached 19·5 per cent., and consisted chiefly of the fruit of the bayberry and a few weed seeds. Curiously, in this species Diptera form the largest item of the food, viz. 40·5 per cent.; these were taken throughout the year, the highest percentage (89·5) being reached in November. The relative proportions of the different elements of food of the seven species were as follows:—Weevils, 4·2; other beetles, 11·8; ants, 9; other Hymenoptera, 16·7; Hemiptera, 17·2; Diptera, 26·9; Lepidoptera, 2·7; Orthoptera, 0·4; other insects, 7·8; other animal food, 0·3; vegetable food, 3 per cent. On the whole, we may say that the bulk of the food consists of beetles, Hemiptera, Hymenoptera, and Diptera. Lepidoptera are only sparingly eaten, the larvæ not being readily taken on the wing. From time immemorial these birds have been of the greatest economic importance to man; indeed, it is questionable if there is any other family of birds so wholly and directly useful to mankind, and their strict preservation should be a duty of every State.

SOME Chinese contributions to meteorology are described by Co-Ching Chu in the *Geographical Review* (New York: American Geographical Society, February, 1918). Although several meteorological instruments had been invented and weather proverbs are numerous, systematic study of meteorological problems appears to have been introduced only with the Western sciences. The kite was known at a very early date, probably about four centuries before Christ, but was only employed in warfare and not for meteorological observations. Chang Hun, who invented the seismograph, lived from A.D. 78 to 139. He also calculated π to be the square-root of 10. Wind vanes are occasionally referred to in Chinese writings, as also rain gauges, but the earliest references to the latter are in Korean writings (A.D. 1442). Evidence shows that the Chinese had discovered the magnetic compass at least 700 years before its use by Columbus. Sun-spots were observed in China from 28 B.C. onwards, and are described as visible to the naked eye in A.D. 321. On the other hand, the thermometer and hygrometer were first introduced into China by Ferdinand Verbiest (1623–88), a disciple of Tycho Brahé, the instruments in question being an air thermometer and a hygrometer of gut, which Verbiest himself invented.

PROF. R. S. LULL discusses (*Amer. Journ. Sci.*, vol. xliv., p. 471, 1917) the alleged "sacral brain" of Dinosaurs, an enlargement of the spinal column that has been specially studied by him in Stegosaurus. In spite of Branca's contention, he feels that no unusual

function can be ascribed to such enlargements, other than "the normal one of transmission and reflex action in an unusual degree." The discussion involves interesting remarks on the mode of life of the large Dinosaurs.

AN interesting review of field observation and laboratory work on the problems of dynamic metamorphism in rock masses is given by Sir Jethro Teall in the Proceedings of the Geologists' Association (vol. xxix., p. 1, 1918). The famous Scourie dyke is again considered, and the flow of the Lizard rocks under pressure is imitated experimentally in blocks of heterogeneous clay.

AN important memoir by Messrs. A. S. Kennard and B. B. Woodward on "The Post-Pliocene Non-marine Mollusca of Ireland" appears in the Proceedings of the Geologists' Association (vol. xxviii., p. 107, 1917). The authors conclude that, "with the exception of two or three species which may have been accidentally introduced by man, all the species existed in Ireland in pre-Glacial times and survived the Glacial period." The Chara deposits often found beneath peat are held to indicate a warm epoch, when they were formed in shallow meres liable to desiccation in the hot summers. Under such conditions the plants become white and brittle, and break up to form a "marl." The raised beaches of the north-east belong to the same epoch. A damper time followed; but the cold epoch postulated in Prof. F. J. Lewis's series is not recorded by the mollusca. A just tribute is paid to the unflagging work of Mr. R. Welch, of Belfast.

THE *Boletin oficial de minas y metalurgia* publishes a report on the mineral production of Portugal (quoted in *Le Génie Civil* for April 27). The minerals exploited have been particularly uranium (1307 tons), wolfram, tin, copper, and iron. The total production of metals in Portugal in 1914 was only 455 tons, as against 845 tons the previous year.

Elektrotechnik und Maschinenbau for October 24, 1917, describes new types of platinum-iridium thermocouples for recording rapid changes of temperature. One type consists of wires 0·02 mm. in diameter, in the proportion of sixty-five parts platinum and thirty-five parts iridium. The maximum range of the combination considered is 1850° C.

IN the *Zeitschrift des Vereines deutscher Ingenieure* for December 8 last, Max Berlowitz discusses the improvements that have been made in the design of micromanometers. He also gives a detailed description of a recent instrument invented by Rosenmuller, which has the great advantage of a fixed zero. The author also describes a new method of standardising the micromanometer, and gives a table of simplified calculations for use with the instrument.

PROF. DOELTER, in *Die Zeit* (March 13), describes the phosphate deposits of the Ukraine. These deposits occur in the Silurian formation, chiefly in Podolia and Bessarabia, and also to a great extent on the banks of the Dniester and the Ladova, where it is obtained in lumps. The mineral is phosphorite, and contains considerable calcium phosphate, which yields 27½ per cent. of phosphoric acid. There are numerous phosphorite deposits in other districts.

A GERMAN patent has been granted (*Elektrotechnik und Maschinenbau*, April 25, 1917) for manufacturing electric condensers by covering a surface of metal with an elastic medium that adapts its shape to that of the metal. The tissue is then impregnated with a substance to render it dielectric, and a second sheet of metal forms the other plate. German Patent No. 291,923 (*Zeitschrift für Mechanik und Optik*, February 1, 1917) describes a condenser formed by a glass dielectric upon which a very fine film of lead is squirted.

MESSRS. BLACKIE AND SON, LTD., are publishing in two volumes, under the title of "Applied Optics: The Computation of Optical Systems," an edited translation, by J. W. French, of Steinheil and Voit's "Handbuch der angewandten Optik." Vol. i. is ready. Vol. ii., which is in preparation, will deal with the determination of refractive indices and dispersions and the computation of achromatic prisms, with the computation of doublet objectives; also with the discussion of the aberrations of different combinations. In addition, it will contain appendices on "The Determination of the Refractive and Dispersive Powers of Various Media" and on "The Trigonometrical Formulæ for the most General Case of the Refraction of Light by a System of General Surfaces."

OUR ASTRONOMICAL COLUMN.

NOVA MONOCEROTIS.—Additional particulars of the new star in Monoceros, which was discovered by Wolf on February 4 (NATURE, vol. ci., p. 52), are given in *Popular Astronomy* for April (vol. xxvi., p. 282). The position of the star for 1918·0, as determined by Prof. Barnard, is given as R.A. 7h. 22m. 46·93s., decl. −6° 30′ 34·7″. According to observations made at the Lick Observatory, the spectrum has reached the nebular stage, consisting of extremely broad bright bands of hydrogen, with the nebulium lines moderately strong and absorption near the centres of the green bands. Photographs taken at Harvard on February 21 show the bright hydrogen lines α to ζ, and bright lines also appeared at wave-lengths 4363, 4520, 4686, 5007, 5440, 5630, and 5750.

THE ATOMIC WEIGHT OF "NEBULIUM."—In a more complete investigation of the periods of vibration of a single-ring atom, taking account of the magnetic and associated mechanical forces on an electron due to its motion, Prof. J. W. Nicholson has made a more precise calculation of the atomic weight of "nebulium" (Monthly Notices, R.A.S., vol. lxxviii., p. 349). Adopting Wright's values for the two lines λ 5006·89 and λ 4363·37, it results that $m/M = 0{\cdot}000415$, where m is the mass of the electron and M that of the atom of nebulium. Since the mean of the best determinations of the corresponding ratio m/H for the hydrogen atom is 0·000545, it results that the atomic weight of nebulium is 1·31, the possible error being unity in the last figure. From observations of the limiting order of interference for the line λ 5007, Prof. Fabry had previously shown that the atomic weight was probably between those of hydrogen and helium.

HYDERABAD ASTROGRAPHIC CATALOGUE.—The work on the astrographic catalogue at the Nizamiah Observatory, Hyderabad, has been carried on with extraordinary vigour since the appointment of the present director, Mr. R. J. Pocock, in 1914. The seven zones from 17° to 23° south declination were originally assigned to the Santiago Observatory, but on account of the long delay in commencing operations the Hyderabad Observatory was afterwards invited to undertake the zones −17° to −20°. Little was done before Mr. Pocock took charge, but the telescope was got into working order and regular work on the catalogue commenced in December, 1914. The first volume of the catalogue has just been issued, comprising measures of rectangular co-ordinates and diameters of 63,436 star-images on plates with centres

in declination −17°. The form of the catalogue is generally similar to that adopted at Greenwich and Oxford, the measures for each plate being accompanied by an equation for the conversion of measured diameters to magnitudes, and the plate constants required for conversion to standard co-ordinates. The reduction of measured to standard co-ordinates, and thence to right ascension and declination, is fully explained in the introduction, and tables are provided to facilitate the computations. A supplementary catalogue gives the standard co-ordinates of the reference stars. All the plates reach at least to the 12th magnitude, and some include stars fainter than magnitude 13. The whole work reflects great credit on the director and his assistants.

THE CO-ORDINATION OF SCIENTIFIC PUBLICATION.

THE co-ordination of scientific publication formed the subject of a recent conference arranged by the Faraday Society under the chairmanship of Sir Robert Hadfield, when a number of interesting problems bearing on the desirability of a fuller co-operation amongst our scientific and technical societies were discussed. Both in the reading and publication of papers there is, at present, a considerable amount of overlapping and lack of co-ordination, with the result that much valuable work is either lost or overlooked owing to communications being made to societies which are not especially associated with the subject-matter of the investigations concerned, and much benefit would undoubtedly result from a federation of interests in this respect. Whilst there is a general consensus of opinion that it is essential to maintain the individuality of each society in regard to the reading and publication of papers, and that any attempt to pool communications for later distribution by a central organisation is undesirable, much effective co-operation could be secured between kindred societies by the arrangement of joint meetings and conferences with the object of promoting united work on problems of common interest. Borderland subjects merit special consideration from this point of view.

The publication of the proceedings of such meetings in the Transactions of the several societies concerned would be much facilitated by the adoption of a uniform size and type for the publications of societies dealing with allied subjects, so that each could include such papers in its journal or distribute them as self-contained reprints of a standard size. Similar uniformity is perhaps not practicable for all scientific and technical publications, but in so far as it can be adopted it would add much to the accessibility and the utility of the recorded work.

Organised collaboration is also desirable by means of which the members of scientific and technical societies should have opportunity of knowing what papers are being contributed to societies other than their own, apart from their later publication either in the journal of the society concerned or in the form of abstracts. The proposal, which, it is understood, is being considered by the Board of Scientific Societies, to publish a weekly journal of announcements would meet this want, and it is to be hoped that the Board will decide to issue such a publication as soon as possible. Meanwhile, individual societies could aid in this direction by publishing in their journals both the announcements of cognate societies and short summaries of papers read previous to publication, so that the subject-matter is brought to the notice of those interested at as early a date as possible. A method of mutual exchange to facilitate such co-operation could be easily arranged, and would in no way detract from, but rather add to, the interest in the later full publication of papers.

Apart from original contributions, the publications of most societies include abstracts of scientific and technical literature published both in our own and in foreign journals. In so far as such abstracts include subjects of common interest to members of kindred societies, there is at present a great deal of overlapping which could be advantageously eliminated by organised collaboration. We have, in the past, been far too reliant in many subjects on the foreign, and especially on the German, journals for our supply of the world's scientific and technical literature, and it is high time that we became independent and self-supporting in this respect. Effective co-operation should achieve this desirable end for each group of cognate subjects; and whilst the method of collaboration would depend to a considerable extent on the character of the subject, a common journal of abstracts for each group of societies would, in the majority of cases, prove the most advantageous plan. Although a scheme of this character would necessarily decrease the bulk of the publications of each society, the original contributions which mark their individuality would be given greater prominence, time wasted by the re-reading of the same abstract in several journals would be saved, and considerable economies in publication would be effected.

Much attention is being directed at present towards the unification and co-ordination of scientific effort. The co-ordination of scientific publication, which has made some progress in the directions indicated during recent years, should certainly continue to occupy a prominent place amongst these problems of reconstruction.

THE DIURNAL VARIATION OF TERRESTRIAL MAGNETISM.

PUBLICATION No. 102 of the Royal Meteorological Institute of the Netherlands consists of a doctor's dissertation in Dutch by Miss Annie van Vleuten "On the Diurnal Variation of Terrestrial Magnetism" and two short papers in English from vol. xxvi. (1917) of the Proceedings of the Science Section of Kon. Ak. v. Wet. of Amsterdam. The dissertation, which extends to 106 pages, contains numerous tables of diurnal variation data for the magnetic elements, and the corresponding Fourier coefficients for a number of stations, more especially for Pavlovsk, Sitka, Irkutsk, De Bilt, Cheltenham, U.S., Zi-ka-wei, Honolulu, Bombay, Buitenzorg, and Samoa, and for the group of years 1906–8. The Fourier coefficients, based on the data from these ten stations from the international quiet days, five a month, are used to furnish answers to the questions advanced in the two short papers in English: (1) Does the internal magnetic field to which the diurnal variation is partly ascribed depend on induced electric currents? (2) Do the forces causing the diurnal variation possess a potential? These are problems chiefly associated in England with the name of Prof. Schuster, to whose work there are many references, while abroad they have occupied, amongst others, Profs. Fritsche and Steiner. Schuster and Fritsche, using totally different observational data, separated the forces causing the diurnal variation into one set having a source external to the earth, and a second set having an internal source. Schuster suggested that the second set arise from currents induced in the earth by the former set. Steiner, employing Fritsche's results, decided against Schuster's hypothesis. Miss van Vleuten's material is at once more homogeneous than Fritsche's, and more representative than Schuster's. She concludes that.

while the terms of higher order accord pretty fairly on the whole with Schuster's hypothesis, this is not true of the principal terms of lower order. The natural inference is that the hypothesis is, at best, not a complete explanation of the phenomena. To the second question the answer obtained is that the forces causing the diurnal variation do *not* possess a potential; part, but only part, of the diurnal variation may be derived from a potential. Besides the main data mentioned above, data from a number of other stations are utilised, and there is, besides, a good deal of mathematical theory. While the publication makes most direct appeal to theorists, it contains much valuable information as to facts not otherwise readily accessible.

GALVANOMETRIC RECORDS OF EMOTIVITY.

IN the correspondence columns of the issue of the *Lancet* for February 23, Dr. A. D. Waller described some very interesting results which he had obtained by the study of the "emotive response" or "psycho-galvanic reflex" on various individuals. If, by means of electrodes applied to the dorsum and palm of the hand, a subject be connected in series with two Leclanché cells and a galvanometer, an emotive response is shown by the deflection of the latter, not only to physical stimuli such as burning, unexpected noise, smell (*e.g.* a poison gas), but also to psychical stimuli such as apprehension, questions, and thoughts, pleasant or unpleasant. The

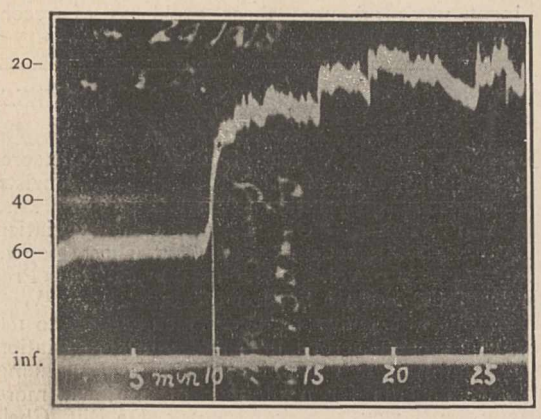


FIG. 1.—Galvanometric record of Miss G. De D. during the air raid of January 29, 1918. At the tenth minute of observation the noise of maroons, immediately followed by that of aeroplanes and guns, broke out, and the resistance, which was approximately 60,000 ohms during the first ten minutes before the disturbance, fell to approximately 20,000 ohms during the next fifteen minutes. (On the left hand is given the resistance in thousands of ohms.)

normal resistance between the back and the palm of the hand is between 10,000 and 40,000 ohms.

From many experiments made on different subjects, besides the big variation in actual resistance there is a marked difference in emotive response; also in the change of resistance which takes place during an experiment, and in the response of the subject to the same stimulus at different stages of the experiment. In some individuals a greater physiological change may be caused by an imaginary than by a real excitation. This is especially the case in imaginative subjects, such as members of the literary, artistic, and scientific professions. A very interesting record (Fig. 1) is given of the response of a subject taken during an air raid.

Comparative records are also given of two officers, one of high and the other of normal emotivity. It would be of extreme interest to know the nature of response in a series of subjects who have successfully withstood many nerve-trying ordeals—as, for example, the response of the experienced and successful fighting air-pilot. It is possible that this test would be of value in special cases in the selection of air-pilots, and also invaluable to the military authorities as an adjunct to the ordinary medical examination in classifying doubtful "nerve" cases, *e.g.* shell-shock, neurasthenia, and malingering.

ATMOSPHERIC POLLUTION.

AN examination of the third report of the Advisory Committee on Atmospheric Pollution, published as a supplement to the *Lancet* of March 23, shows that the total deposit for 1916–17 has increased in the (six) summer months over that of the previous year, which was greater than that of 1914–15, so that there has been a steady increase in most of the stations during the past three years. On the other hand, in the (six) winter months a diminution in 1916–17 is recorded. No very definite conclusions can be drawn from these results, as the stations have in some cases been changed; but in London, where the same stations have been in steady operation during this period, there is a distinct improvement in the winter months, and the same is true of Glasgow.

Among the towns exhibiting the highest deposits of atmospheric impurities St. Helens and Glasgow stand out most prominently, whilst Malvern and Exeter, as might be expected, exhibit the lowest figures.

A comparison of deposits during wet and dry weather indicates that, whereas insoluble matter is little affected by rainfall, soluble matter is brought down in much larger amount. The highest and lowest deposits, based on the average of eighteen stations, correspond, nevertheless, in no instance with the highest and lowest rainfall.

Some kind of automatic recorder for the rapid registration of atmospheric pollution, to replace the cumbersome and tedious method at present used, has always been a great desideratum. Dr. J. S. Owens describes in the present report a simple form of such an apparatus, whereby a known volume of air (2 litres) is drawn at a fixed rate through an aperture ($\frac{1}{8}$ in.) into which a piece of filter paper is inserted. The stain produced by the arrested dust particles gives a measure of the amount of suspended impurity, and by calibration with weighed quantities, which have been determined by Mr. J. G. Clark, the depth of deposit can be expressed quantitatively. The method appears to give trustworthy results, and each determination is complete in ten minutes. It does not, of course, touch the gaseous impurities, but as these run to a great extent parallel with the solid impurities, and as the latter are the more injurious, the results should give a fair record of the changes taking place in atmospheric pollution at different centres. As the method involves simple apparatus and but little attention, it is to be hoped that a larger number of observers will be induced to enrol themselves under the present committee. J. B. C.

LUBRICATING OILS.

IN a paper read by Drs. A. E. Dunstan and F. B. Thole before the Institution of Petroleum Technologists on April 16, the authors, in reviewing the work of previous observers, point out that little knowledge exists as to the chemical composition of lubricating oils and the relation between their chemical character and lubricating properties. These oils probably consist (though nothing very definite is known) of

saturated and unsaturated hydrocarbons of the naphthenic or polynuclear type, and, to a limited extent, of paraffins and aromatic hydrocarbons.

The authors have made careful determinations of viscosity by a modified form of Ostwald apparatus, and discuss lubricating value in terms of this property and chemical composition. The desideratum for a lubricant appears to be low viscosity and good lubricating power, as the lubricant is concerned in the transformation of solid into liquid friction. On the other hand, the mysterious property known as "body"—that is, the power of maintaining a film (or film strength) between shaft and bearings—is a vital factor. This property of body seems to depend on surface tension, and is not necessarily dependent on viscosity, but appears to be connected with molecular weight. The possible iso-colloid nature of heavy oils in explaining high viscosity is considered, and the view is put forward that if this is the true nature of such oils, the film strength may depend upon the relation of the two phases present in the oil.

The following are some of the authors' general conclusions:—Paraffinoid oils, though highly stable, have little lubricating value, and the smaller the hydrogen content, the greater the viscosity and durability; it is the polynuclear naphthenes, especially the unsaturated components, which confer viscosity and film strength; the higher fractions of petroleum contain such unsaturated members, which, when removed, exhibit lower density, lower viscosity, higher molecular weight, and, generally, lower lubricating value.

It appears, then, that the true lubricant is an unsaturated compound possessing the characteristic attributes of such compounds, and this applies not only to hydrocarbons, but also to fatty oils, such as rape, castor, and olive oil; in other words, unsaturation is a feature of chemical activity which, in addition to colour, taste, smell, and physiological properties, manifests itself in lubricating value. Moreover, the colloidal condition of a good lubricant may also have to be taken into consideration.

The whole subject of liquid lubricants is an important one, and in the above brief summary the authors have brought forward a contribution of a highly suggestive character, which emphasises very clearly the necessity for further comprehensive and detailed study.

STATISTICAL METHODS APPLIED TO PRACTICAL PROBLEMS.

WE have received a copy of the presidential address delivered before the Indian Science Congress at Lahore in January last by Sir G. T. Walker, Director-General of Observatories, India (Calcutta: Thacker, Spink, and Co.). The bulk of the address is devoted to illustrating the application to important practical problems of statistical methods. Illustrations are given of the use of coefficients of correlation in connection with crop prediction, and also to show the extent of co-variation between the fever rate, population, cost of rice, cultivated area, and rainfall, so far as this can be determined by a first-degree regression equation computed from the data of twenty-five years.

An interesting point is the apparently close association between an increase of population and an increase of fever. Sir G. T. Walker observes that this "is so directly opposed to widely accepted medical ideas that for some months I did not treat it seriously. But on my informing Major McKendrick, of Kasauli, of it he urged me not to reject it lightly, and directed my attention to some analysis of his which would suggest an explanation. I have therefore examined the corresponding relationship for all the ten provinces of India for which sufficient data are available, and have not found a single negative coefficient. The average value is +0·5. For those of you who are interested in sanitary matters I may briefly explain that the spread of malaria among men depends upon the meeting of healthy men with infected mosquitoes, and the spread among mosquitoes on the encounters between infected men and healthy mosquitoes; hence the relations are symmetrical from the mathematical, if not the æsthetic, point of view, and an increase in the number of men has essentially the same bad effect as an increase in the number of mosquitoes."

In view of the work which has been done upon the method of variate difference correlation during recent years, it would be of interest further to explore the association by the new method. Statisticians in this country will appreciate the concluding passage of Sir G. T. Walker's address:—"I hope that statistical methods may before long be recognised as essential for efficiency for the following reasons. First, a table of data covering, say, fifty years gives any intelligent man the same advantage as if he had carefully watched the conditions for fifty years and had a perfect memory; secondly, employing a draughtsman to plot these data will suggest relationships in a manner which would otherwise require profound study of the figures; and thirdly, employing a clerk to work out the correlation coefficients and regression equation will give him without effort trustworthy information about their relationships which will distinguish direct from indirect effects, and could be got in no other way."

METHODS OF GAS WARFARE.

THE issue of the Journal of the Washington Academy of Sciences for February 4 last includes a report of a lecture by Prof. S. J. M. Auld, of the British Military Mission, on "Methods of Gas Warfare," delivered before the Academy. Naturally in the lecture, which is here summarised, attention is confined to a description of what the Germans have been doing; nothing is said of the activities of the Entente Powers in this direction.

The first gas attack was made by the Germans in April, 1915, and the whole method of the war was changed. The attack was made, of course, against men who were entirely unprepared—absolutely unprotected. The Germans expected no immediate retaliation, as they had provided no protection for their own men. A clear and unobstructed gap in the lines was made, which was only closed by the Canadians, who rallied on the left and advanced, in part through the gas-cloud itself.

The method first used by the Germans is simple, but requires great preparation beforehand. A hole is dug in the bottom of the trench close underneath the parapet, and a gas cylinder is buried in the hole. It is then covered first with a quilt of moss containing potassium carbonate solution, and then with sandbags. When the attack is to be made the sand-bags are taken off the cylinder, and each cylinder is connected with a lead pipe which is bent over the top of the parapet. A sand-bag is laid on the nozzle to prevent the back "kick" of the outrushing gas from throwing the pipe back into the trench.

The attackers must know the direction and velocity of the wind with certainty. Favourable conditions are limited practically to wind velocities between twelve and four miles an hour. A wind of more than twelve miles an hour disperses the gas-cloud very rapidly. An upward current of air is the worst foe of gas. If the trench line is very irregular it is likely that gas will flow into a portion of one's own trenches. The

Germans use a 40° angle of safety; that means that on a given straight portion of the front the wind direction must lie between the two directions which make angles of 40° with the neighbouring sections of the front. The most suitable type of country is where the ground slopes gently away from where the gas is being discharged. If the country is flat like that about Ypres, and the wind direction is right, there is little difficulty about making an attack. German gas attacks are made by two regiments of pioneers, with highly technical officers, including engineers, meteorologists, and chemists. The first attack was made with chlorine. If a gas attack is to be made with gas-clouds, the number of gases available is limited. The gas must be easily compressible, easily made in large quantities, and should be considerably heavier than air. If to this is added the necessity of its being very toxic and of low chemical reactivity, the choice is practically reduced to two gases: chlorine and phosgene. Pure chlorine did not satisfy quite all the requirements, as it is very active chemically and therefore easily absorbed.

The first protection was primitive. It consisted largely of respirators made by women in England in response to an appeal by Lord Kitchener. Then came the helmet made of a flannel bag soaked in thiosulphate and carbonate, with a mica window in it. A modified form of this device with different chemicals is still used in the British Army as a reserve protection. The outcome of attempts to counteract the effects of phosgene was a helmet saturated with sodium phenate. The concentration of gases when used in a cloud is small, and 1 to 1000 by volume is relatively very strong. The helmet easily gave protection against phosgene at a normal concentration of 1 part in 10,000.

The element of surprise came in an attack by night. The meteorological conditions are much better at night than during the day. The best two hours out of the twenty-four, when steady and downward currents exist, are the hour between sunset and dark and the hour between dawn and sunrise. Gas attacks have therefore been frequently made just in the gloaming or early morning, between lights. This took away one of the easy methods of spotting gas, that of seeing it, and we had to depend upon the hissing noises made by the escaping gas, and upon the sense of smell.

Another element of surprise was the sending out of more than one cloud in an attack. After the first cloud the men would think it was all over, but ten minutes or half an hour later there would come another cloud on exactly the same front. Efforts were also made to effect surprise by silencing the gas. But silencers reduced the rate of escape so greatly that the loss of efficiency from low concentration more than made up for the gain in suddenness. Another method was to mix the gas up with smoke, or to alternate gas and smoke, so that it would be difficult to tell where the gas began and the smoke ended.

There was a long search for materials that would absorb phosgene. The substance now used very extensively is hexamethylenetetramine (urotropine), $(CH_2)_6N_4$, which reacts very rapidly with phosgene. Used in conjunction with sodium phenate, it will protect against phosgene at a concentration of 1 : 1000 for a considerable period. An excess of sodium hydroxide is used with the sodium phenate, and a valve is provided in the helmet for the escape of exhaled air.

A high concentration for a gas-cloud is 1 part in 1000, whereas concentrations of 2 or 3 per cent. can be met by respirators depending on chemical reactivity. One such respirator is a box of chemicals connected by a flexible tube with a face-piece fitting around the contours of the face, and provided with a mouthpiece and a nosepiece. As regards the chemicals used there is no secret, for the Germans have many of the same things. Active absorbent charcoal is one of the main reliances, and is a suggestion that we owe to the Russians. Wood charcoal was used in one of their devices and was effective, but most of the Russian soldiers had no protection at all. We wanted to protect against chlorine, acids and acid-forming gases, phosgene, etc., and at one time were fearful of meeting large quantities of hydrocyanic (prussic) acid (HCN). The three things that then seemed most important were:—(1) Chlorine and phosgene; (2) prussic acid; (3) lachrymators. Charcoal and alkaline permanganate will protect against nearly everything used, even up to concentrations of 10 per cent. for short periods.

As regards the future of the gas-cloud, it may be looked upon as almost finished. The case is different with gas shells. The gas shells are the most important of all methods of using gas on the Western front, and are still in course of development. The enemy started using them soon after the first cloud attack. He began with the celebrated "tear" shells. The original tear shells contained almost pure xylyl bromide or benzyl bromide, made by brominating the higher fractions of coal-tar distillates. The German did his bromination rather badly. It should be done carefully or much dibromide is produced, which is solid and inactive. Some of the shells contained as much as 20 per cent. dibromide, enough to make the liquid pasty and inactive.

When the Germans started using highly poisonous shells, the substance used was trichloromethyl-chloroformate, but not in great strength.

The use of gas out of a projectile has a number of advantages over its use in a gas-cloud. First, it is not so dependent on the wind. Secondly, the gunners have their ordinary job of shelling, and there is no such elaborate and unwelcome organisation to put into the front trenches as is necessary for the cloud. Thirdly, the targets are picked with all the accuracy of artillery fire. Fourthly, the gas shells succeed with targets that are not accessible to high explosives or to gas-clouds.

Among the effective materials used by the Germans for gas shells were mono- and tri-chloromethyl-chloroformate. Prussic acid never appeared; the Germans rate it lower than phosgene in toxicity, and reports concerning it were obviously meant merely to produce fear and distract the provisions for protection.

During the last months of 1917 the actual materials and the tactics used by the Germans have undergone a complete change.

One substance used for the method of simultaneously harassing and seriously injuring was dichlorodiethylsulphide (mustard gas). It has a distinctive smell, rather like garlic than mustard.

Up to the present time there has been no material brought out on either side that can be depended on to go through the other fellow's respirator. The casualties are due to surprise or to lack of training in the use of masks. The mask must be put on and adjusted within six seconds, which requires a considerable amount of preliminary training, if it is to be done under field conditions.

Among other surprises on the part of the Germans were phenylcarbylamine chloride, a lachrymator, and diphenylchloroarsine, or "sneezing gas." The latter is mixed in with high-explosive shells, or with other gas shells, or with shrapnel.

As regards the future of gas shells, it should be emphasised that the "gas shell" is not necessarily a gas shell at all, but a liquid or solid shell, and it opens up the whole sphere of organic chemistry to be drawn upon for materials. The material placed inside the shell is transformed into vapour or fine droplets by the explosion, and a proper adjustment between the bursting

charge and the poisonous substance is necessary. Both sides are busy trying to find something that the others have not used, and both are trying to find a "colourless, odourless, and invisible" gas that is highly poisonous. It is within the realm of possibilities that the war will be finished, literally, in the chemical laboratory.

The following compounds have been used by the Germans in gas-clouds or in shells:—

1. Allyl-*iso*-thiocyanate (allyl mustard oil), C_3H_5NCS (shell).
2. Benzyl bromide, $C_6H_5.CH_2Br$ (shell).
3. Bromo-acetone, $CH_2Br.CO.CH_3$ (hand grenades).
4. Bromated methylethyl-ketone (bromo-ketone), $CH_2Br.CO.C_2H_5$ or $CH_3.CO.CHBr.CH_3$ (shell). Di-bromo-ketone, $CH_3.CO.CHBr.CH_2Br$ (shell).
5. Bromine, Br_2 (hand grenades).
6. Chloro-acetone, $CH_2Cl.CO.CH_3$ (hand grenades).
7. Chlorine, Cl_2 (cloud).
8. Chloromethyl-chloroformate (palite), $ClCOO.CH_2.Cl$ (shell).
9. Nitrotrichloromethane (chloropicrin or nitro-chloroform), CCl_3NO_2 (shell).
10. Chlorosulphonic acid, $SO_3.H.Cl$ (hand grenades and "smoke pots").
11. Dichlorodiethylsulphide (mustard gas), $(CH_2Cl.CH_2)_2S$ (shell).
12. Dimethyl sulphate, $(CH_3)_2SO_4$ (hand grenades).
13. Diphenylchloro-arsine, $(C_6H_5)_2AsCl$ (shell).
14. Dichloromethyl ether, $(CH_2Cl)_2O$ (shell).
15. Methylchlorosulphonate, CH_3ClSO_3 (hand grenades).
16. Phenylcarbylamine chloride, $C_6H_5N.CCl_2$ (shell).
17. Phosgene (carbonyl chloride), $COCl_2$ (cloud and shell).
18. Sulphur trioxide, SO_3 (hand grenades and shell).
19. Trichloromethyl - chloroformate (diphosgene, superpalite), $ClCOO.CCl_3$ (shell).
20. Xylyl bromide (tolyl bromide), $CH_3.C_6H_4.CH_2Br$ (shell).

CRYSTALS OBTAINED FROM GLASS FURNACES.

MR. G. V. WILSON has studied the materials obtained from glass furnaces of the tank type making bottle glass, where, by a rupture of the tank, the glass has flowed out and has been allowed to crystallise slowly, and he described his results to the Society of Glass Technology on April 17. He finds that crystals of wollastonite form in great numbers, partly arranged in spherulitic groups of long diverging crystalline fibres, partly as separate rod-shaped crystals with well-defined faces. Tridymite occurs also in flat hexagonal plates, very thin, but showing the polarisation in sectors which is so characteristic of this mineral. He has also observed quartz as double hexagonal pyramids in places where veins of glass have eaten their way into the bricks which make the walls of the tank; and manganese augite, of purplish-brown colour, only in parts of the glass where an excess of manganese oxide has existed through imperfect mixing of the ingredients of the batch.

Fragments of limestone, probably in part magnesian, occurred in the glass, imperfectly dissolved and showing recrystallisation through contact alteration and admixture with silica and other elements of the glass. These have a granular crystalline structure except where veins of glass penetrate into them. The new minerals produced are wollastonite, augite (golden-yellow, in small prisms), melilite, and probably a silicate of lime ($3CaO,2SiO_2$).

The vault of the furnace consists of firebrick, and is covered with a fused glassy layer, from which stalactites hang down, and drops of molten matter must have been falling into the glass below. The zone of altered brick is about an inch thick, and two layers can be detected in it—an outer glassy stalactitic layer containing much corundum and a little sillimanite in a glassy matrix, and an inner white layer looking very like white porcelain to the naked eye. This inner layer is richly charged with sillimanite needles.

The external surface of glass pots also contains very well formed crystals of sillimanite, and sometimes also magnetite and corundum. The inner surface of old glass pots often shows much sillimanite embedded in clear glass, and, where the cooling has been slow, biotite and oligoclase also make their appearance.

Mr. Wilson regards as important the presence of volatile fluxes, such as soda, given off by the heated glass. These combine with the alumina and silica of the clay, forming glassy alkali-alumina-silicates which are comparatively fusible, and serve as a medium in which corundum, sillimanite, and other minerals are crystallised. The corrosion of the glass pots is due largely to the action of this alkali-alumina-silicate melt eating its way deeper and deeper into the clay.

THE CARNEGIE INSTITUTION OF WASHINGTON.

THE Year Book for 1917 of the Carnegie Institution of Washington has now reached us in its complete form. Attention has already been directed to the report of the president of the institution with which the Year Book, which was published previously separately, opens, and the opportunity provided by the receipt of the complete volume may be taken to refer to the financial records of the institution. During the year ending October 31, 1917, the total financial receipts of the institution reached 285,120*l.*; of this amount 220,100*l.* represented interest on endowment, 20,100*l.* interest on deposits in banks, and 36,000*l.* amounts derived from miscellaneous sources. The total of the yearly incomes of the institution since its foundation in 1902 amounts to 2,886,665*l.*

The income of 1917 was expended in the manner shown in the following table:—

	£
Investment in bonds	101,100
Large projects	139,160
Minor and special projects	19,500
Publications	12,600
Administration	9,800
Total	282,160

The departments of investigation to which the larger grants were made by the trustees of the institution are shown below:—

	£
Botanical research	8,686
Embryology	6,954
Experimental evolution	11,386
Geophysical laboratory	20,302
Historical research	7,090
Marine biology	3,980
Meridian astronomy	6,231
Nutrition laboratory	9,227
Publications	2,280
Solar observatory	35,509
Terrestrial magnetism	28,441
Total	140,086

The publication of twenty-five volumes was authorised during the year at a cost of 13,000*l.*

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—At the eighteenth annual meeting of the Court of Governors of the University in February last, a committee of twelve of its members was appointed to take into consideration the vacant Chancellorship. The committee has held three meetings, and after careful consideration will present a report to the special meeting of the Court, which has been convened for May 23, in which it will recommend that, subject to the approval of the Crown, the Rt. Hon. Lord Robert Cecil, K.C., M.P., be elected Chancellor of the University.

CAMBRIDGE.—Reports recommending changes of considerable consequence have recently been discussed by the Senate. The report of the previous examination syndicate, in which, among other proposals, the abolition of compulsory Greek and the imposition of compulsory science were recommended (NATURE, March 14, p. 37), formed the subject of an important debate, in which many prominent members of the University took part, and in which, naturally, the retention of compulsory Greek found strong advocates. In answer to the criticism, on which some stress was laid, that it was inconsistent to remove compulsory Greek and at the same time to impose compulsory science, it was pointed out by more than one speaker that science was rightly to be compared, not with Greek, but with language as a whole. Another question of considerable importance which has been discussed is a report of the council of the Senate on the length of terms. It is proposed that the Michaelmas and Lent terms should each consist of nine, and the Easter term of eight, complete weeks. This would add seventeen days in the year to the usual period of University residence. There is also a suggestion that the general degree examinations should be held so far as possible out of full term—that is to say, in the long vacation. In the discussion one of the points emphasised was that the vacations were by no means periods in which nothing was done. A large proportion of the original work which went on in the University had to be carried out in the vacations.

The question of degrees for women has again been raised by the issue of a flysheet, bearing a number of influential signatures, in which the proposal is made that as soon as the general state of affairs admits of full consideration being given to the matter, a syndicate should be appointed to report on the measures necessary for the admission of women to membership of the University. It is suggested that membership of the University should include membership of the Senate and eligibility to serve on boards and syndicates or hold any office in the University. A reply to this has been published by a number of prominent members of the University, asking members of the Senate to abstain from pledging themselves to these proposals at the present time, when so many of the younger members are absent on war service. It is further suggested as a solution which might find general acceptance that, so far as the absence of a degree is a disadvantage to women students at Cambridge, this could be obviated through the acquirement by an official body representing the women's colleges in Cambridge of power under charter in affiliation with the University to confer degrees on women students.

SIR R. ARMSTRONG-JONES has been elected Gresham professor of physic, Gresham College, London, in succession to the late Dr. F. M. Sandwith.

PROF. A. R. CUSHNY, F.R.S., has been appointed to succeed Sir T. R. Fraser as professor of materia medica and pharmacology in the University of Edinburgh.

BY the will of the late Mr. Charles Hawksley, a sum of 3000*l.* is bequeathed to the Institution of Civil Engineers for scholarships or prizes and legacies to persons in his employment.

So far back as 1838 it was urged that the city of Cork, which claimed to hold a position somewhat similar to that of Edinburgh in art and letters, was entitled to be the seat of a university for the South of Ireland. This claim has never been abandoned, although when from time to time it has been advanced—as, for example, on the establishment of the Queen's University in Ireland in 1850, of the Royal University in 1884, and of the National University in 1908—the answer given has always been that neither in number of students, in buildings and equipment, nor in the public support accorded by the province of Munster was the college strong enough to justify its transformation into a university. In all these respects a great change has come over the college during the past ten years. Its students now exceed five hundred in number; its buildings, especially its scientific laboratories, have been greatly extended; its staff has doubled, and a large and well-appointed hostel has been provided. The college now claims that it is as much entitled to the enjoyment of autonomy as the University of Belfast. A strongly supported movement is on foot to obtain a charter. A pamphlet issued by the governing body affords remarkable evidence of harmonious co-operation between all sections of the people of Munster, both Catholic and Protestant. This pamphlet is interesting as showing the extreme inconvenience of the federal system. Cork is 160 miles from Dublin, where the senate of the N.U.I. meets. Much time is wasted by the representatives of Cork in travelling thither, and when they reach the senate they find themselves outvoted by the representatives of Dublin. Nor does a member of a federation obtain the degree of control of its own affairs which is essentially desirable. Recently the senate decided that under its statutes the University alone has the right to say what new chairs shall be set up in the colleges, and this decision has been upheld by the Privy Council. The pamphlet also raises the very much larger question of centralisation *versus* the encouragement of local patriotism, adopting the view which is now generally taken that college and university should be synonymous terms, the United Kingdom being divided into provinces, each with its focus of university learning and education.

THE Education No. 2 Bill is at last in Committee of the whole House. It is the subject of an unusually large number of amendments, but the Minister of Education is giving evidence of no less tact and discretion in dealing with opponents whose purpose it is to wreck the Bill, or with extremists who, because of their zeal for education, submit amendments some of which under present conditions are impossible of achievement, than he has hitherto exhibited, with such striking sincerity of conviction, in advocating the general policy of the Bill, which has secured for it so large a measure of general support. In the course of two nights' debate the first three clauses of the Bill were considered, dealing respectively with the progressive and comprehensive organisation of education, the development of education in public elementary schools, and the establishment of continuation schools. Much concern was expressed by some Members as to the possibility of clause 1 being interpreted to mean that a decided bias might be given to definite vocational instruction, but strong assurances were given to the contrary, whilst at the same time it was made

clear that, so far as continued education was provided under the Bill, it was undesirable that attention should not be paid during the four years of compulsory attendance to the requirements of the vocation in which the young person was engaged and by which he was to live. With respect to free secondary education, strongly advocated by certain Members, Mr. Fisher pointed out that 67 per cent. of the children in State-aided secondary schools had already been in receipt of free instruction in the elementary schools, and that to abolish all fees in the secondary schools would mean a loss to the State of an annual revenue of 1,200,000*l.*, but he was prepared to submit a new sub-clause to clause 4 calling upon the local authorities in preparing schemes to provide means whereby no child because of poverty should be precluded from the benefits of higher education. In the organisation of advanced courses in public elementary schools, it was agreed to have regard not only to the older, but to the more intelligent children also who stay at such schools beyond the age of fourteen, and to add to clause 2 (*a*) (ii) of the Bill the words: "So much of the definition of the term 'elementary school' in section 3 of the Act of 1870 as requires that elementary education shall be the principal part of the education there given shall not apply to such courses of advanced instruction for older pupils." With these and other slight amendments clauses 1, 2, and 3 were added to the Bill. Clause 4, dealing with the consultation of authorities for the purposes of part iii. of the Education Act, 1902, was under consideration when the Committee adjourned. There are many formidable amendments yet to be considered, notably those relating to clause 10, on continued education, but the progress already made augurs well for the future course of the measure.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 2.—Sir J. J. Thomson, president, in the chair.—Dr. J. H. **Mummery**: Nerve end-cells in the dental pulp. The author has carried further his researches on the distribution of the nerves of the dental pulp. In a paper published in the Phil. Trans. for 1912, he demonstrated that the fibres from the nerve plexus in the pulp beneath the odontoblasts do not terminate at the inner margin of the dentine as described by Huber and others, but that, although they form an open plexus around the odontoblast cells, they are also distributed to the dentinal tubes and enter the dentine in company with the dentinal fibril, but make no connection with it. Recent preparations with improved methods have demonstrated that the fibres from the deep plexus in the pulp pass to definite nerve end-cells or peripheral nerve end-organs, which this method of staining has revealed at the inner margin of the odontoblasts.—H. **Onslow**: The nature of growths in colloidal silica solutions. The late Dr. Charlton Bastian claimed to have synthesised certain symmetrical bodies, resembling Torulæ and other minute organisms, from sterilised colloidal solutions which had been exposed for a long period to light. Further, he claimed that such organisms were capable of reproducing themselves. The author has repeated the experiments, using the special samples of sodium silicate reserved for and recommended by Dr. Bastian and following his directions in every detail. The greatest precautions were taken to avoid accidental contamination. The results obtained indicate that the method employed yields tubes which are absolutely sterile for all periods up to three years.

Physical Society, April 26.—Prof. C. H. Lees, president, in the chair.—J. **Guild**: Notes on the Pulfrich refractometer. The paper deals with points to be observed in the use and design of Pulfrich refractometers. A theoretical investigation of the various errors to which measurements are liable is included.—F. **Simeon**: The accuracy attainable with critical-angle refractometers. The three factors controlling the determination of a refractive index by means of a critical-angle refractometer are, so far as the prism system is concerned, (i) the angle of the prism, (ii) its refractive index, and (iii) the angle of emergence of the critical ray from the second prism face. Expressions are obtained for the variation of the required refractive index with each of these factors separately, and curves are given connecting these variations with the angle of emergence from the second prism face for various prism angles.—Prof. H. **Chatley**: Cohesion (fourth paper). The paper is the fourth of a series dealing with the subject of cohesion. The aim of the present paper is to consider the value of molecular force as indicated by Van der Waals's gas formula (particularly at the critical state where the liquid and gaseous states merge), and to relate the results to the previous inquiry.

Linnean Society, May 2.—Sir David Prain, president, in the chair.—G. M. **Thomson**: A new fresh-water shrimp (Caridina) from Fiji.—Dr. Marie **Stopes**: *Bennettites Scottii*, sp. nov., a European petrifaction with foliage. A new species of Bennettites is described, externally very like a Williamsonia "fruit" as regards both shape and size. It is, however, a young vegetative trunk, probably a "sproutling." The three main points of particular interest about it are:—(1) It is the smallest trunk of Bennettites yet known; (2) it is the first European specimen to include well-petrified young foliage; (3) it is well preserved, and elucidates some anatomical details of leaf-structure not completely known from the American specimens.—Dr. Marie **Stopes**: A survey of the biological aspect of the constitution of coal. The history of the complicated substance known as coal was narrated, from its earliest microscopical investigation in 1833 by H. T. M. Whitham, and shortly afterwards by William Hutton (1798–1860). Four special substances were particularised as building up coal, and some concluding remarks were devoted to the ecological aspect of coal in its formation in geological times.

Mathematical Society, May 9.—Prof. Hilton, vice-president, in the chair.—E. L. **Ince**: The continued fractions connected with the hypergeometric equation.—W. P. **Milne**: Determinantal systems of co-apolar triads on a cubic curve.—A. **Young**: The electromagnetic properties of coils.

PARIS.

Academy of Sciences, April 29.—M. Ed. Perrier in the chair.—J. **Boussinesq**: Calculation to the second approximation of the limiting thrust exerted on a vertical wall by a *terre-plein* with free horizontal surface.—C. **Richet**, P. **Brodin**, and Fr. **Saint-Girons**: The influence of intravenous injections of isotonic liquids on the dilution of the blood and on the number of red-blood corpuscles which may be lost in bleeding. From experiments on dogs, the classical theory is found not to be in complete accord with fact. The immediate cause of death by bleeding is a more complex problem than has hitherto been supposed.—E. **Ariès**: The saturated vapour pressures of triatomic liquids. The formula derived in earlier communications is applied to the examination of the experimental data for carbon dioxide, sulphur dioxide, and nitrous oxide. There are some divergences between the calculated and experimental values, the causes of which are discussed.—J. **Haag**: The application of the law of Gauss to syphilis. The application of the theory of probability to 120 cases of syphilis shows that the

period of incubation obeys very exactly the law of Gauss, the average duration being thirty-four days.—L. **Roy**: The problem of reflection and refraction by plane periodic waves.—F. B. **de Lenaizan**: The resistance of the electric spark.—P. L. **Mercanton**: The magnetic state of some prehistoric pottery. The articles examined were taken from Swiss lakes (Bienne, Zurich, Pfäffiken), and from magnetic observations on nine pieces the conclusion is drawn that at the time and place of manufacture the terrestrial magnetic inclination was nearly zero.—P. **Chevenard**: The determination of the velocities of cooling necessary for the realisation of tempering in carbon steels. The results for a series of steels with carbon graded from 0·2 per cent. to 0·8 per cent. are given in the form of curves.—C. **Matignon** and F. **Meyer**: The double sulphate of soda and ammonia. Thermochemical and solubility data.—P. **de Sousa**: The epirogenic movements during the Quaternary at Algarve, Portugal.—E. **Hernandez-Pacheco**: The Archæocyatidæ of the Sierra de Cordoba (Spain).—A. **Guébhard**: Remarks on the sedimentary crust.—E. **Saillard**: The balance of some constituent principles of the sugar-beet during the manufacture of sugar. The various products arising during the extraction of sugar from the sugar-beet have been analysed, and the data used to construct balance-sheets for the dry material, nitrogen, potash, soda, and phosphoric acid. The three last-named substances can be practically all recovered and returned to the soil, but about one-half of the nitrogen cannot be utilised.—L. **Devillers**: The determination of the indigestible residue *in vitro* produced by pancreatin acting upon wheat or the products of milling and baking. Figures are given for fourteen samples of wheat, flour, and bread.—F. **Guitel**: The first stages of the development of the adhesive apparatus of Lepadogaster.—A. **Nanta**: The initial alterations of the liver in great traumatisms.

BOOKS RECEIVED.

The Third and Fourth Generation: An Introduction to Heredity. By E. R. Downing. Pp. xi+164. (Chicago: University of Chicago Press; London: Cambridge University Press.) 1 dollar net.

Plant Products and Chemical Fertilizers. By S. H. Collins. Pp. xvi+236. (London: Baillière, Tindall, and Cox.) 7*s*. 6*d*. net.

The Alkali Industry. By J. R. Partington. Pp. xvi+304. (London: Baillière, Tindall, and Cox.) 7*s*. 6*d*. net.

University of Chicago. Publications of the Members of the University, 1902–1916. Pp. x+518. (Chicago: University of Chicago Press; London: Cambridge University Press.)

Bibliography of the Geology and Eruptive Phenomena of the More Important Volcanoes of Southern Italy. Compiled, with the assistance of Madame A. Johnston-Lavis, by Dr. H. J. Johnston-Lavis. Second edition. Pp. xxiv+374. (London: University of London Press, Ltd.)

Yorkshire Type Ammonites. Edited by S. S. Buckman. Part xv. (London: W. Wesley and Son.) 3*s*. 3*d*. net.

The *Athenaeum* Subject Index to Periodicals, 1916. Science and Technology, including Hygiene and Sport. Pp. 162. (London: The *Athenaeum*.) 10*s*. net.

A Handbook on Antiseptics. By Drs. H. D. Dakin and E. K. Dunham. Pp. ix+129. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd.) 7*s*. net.

The Botany of Iceland. Edited by Drs. L. K. Rosenvinge and E. Warming. Part ii. Pp. 347 to 675. (Copenhagen: J. Frimodt; London: J. Wheldon and Co.) 5*s*. 6*d*. net.

DIARY OF SOCIETIES.

THURSDAY, MAY 16.

ROYAL SOCIETY, at 4.30.—Note on Certain Coloured Interference Bands and the Colours of Tempered Steel: A. Mallock.—General Factors in Mental Measurements: J. C. M. Garnett.—The Absorption of X-Rays in Copper and Aluminium: C. M. Williams.—The Electrical Resolution and Broadening of Helium Lines: Dr. T. R. Merton.

ROYAL INSTITUTION, at 3.—The Prosecution and Punishment of Animals: Sir J. G. Frazer.

ROYAL SOCIETY OF ARTS, at 4.30.—The Freedom of the Sea: John Leyland.

INSTITUTION OF MINING AND METALLURGY, at 5.30.

FRIDAY, MAY 17.

ROYAL INSTITUTION, at 5.30.—The Story of a Grass: Dr. A. B. Rendle.

TUESDAY, MAY 21.

ROYAL INSTITUTION, at 3.—A Master of Method—Pitt-Rivers: Prof. A. Keith.

THURSDAY, MAY 23.

ROYAL INSTITUTION, at 3.—The Abode of Snow; Its Appearance, Inhabitants, and History: Sir Francis Younghusband.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—Some Transient Phenomena in Electrical Supply Systems: Prof. E. W. Marchant.

FRIDAY, MAY 24.

ROYAL INSTITUTION, at 5.30.—Internal Ballistics: Lt.-Col. A. G. Hadcock.

LINNEAN SOCIETY, at 3.—Anniversary Meeting.

SATURDAY, MAY 25.

ROYAL INSTITUTION, at 3.—Problems in Bird-Migration: Prof. C. J. Patten.

TUESDAY, MAY 28.

ZOOLOGICAL SOCIETY, at 5.30.—A Case of Hermaphroditism in a Lizard, *Lacerta viridis*: Noel Taylor.—Fresh-water Fish as Food: C. Tate Regan.

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