THURSDAY, JANUARY 10, 1918.

GERMAN COMMERCIALISM AND THE WAR.

My Four Years in Germany. By J. W. Gerard. Pp. xiv+320. (London: Hodder and Stoughton, 1917.) Price 7*s.* 6*d.* net.

IT has been an invariable characteristic of all the wars upon which Germany has embarked since the attack on Denmark in 1864 that the real motives of her rulers have been sedulously concealed from the mass of the people. She has in all cases sought to fix the cause upon her opponents and to throw upon them the obloquy of breaking the peace. This, of course, is an obvious trick, and no doubt has its advantages in the case of a nation which is not allowed to think for itself, and for whom opinion is manufactured through the agency of a controlled Press. But the rest of the world has never been deceived, and the true nature and motives of the quarrel have been understood and appreciated at their real merit. In every instance, as in the present case, Germany has been the actual aggressor, and in all her motive has simply been self-aggrandisement. Her action has been primarily directed by an autocracy which rests upon two powers—the one an aristocracy that regards war as a virtue and a necessity; the other capitalism, which speculates on war as a means to gain wealth and commercial influence. Each power is complementary to the other, and their combination is, of course, necessary to the successful prosecution of such a war as that upon which Germany has deliberately engaged. In time of peace the two powers have little or nothing in common; they are, indeed, antipathetic and distrustful of each other. In time of war they agree to work together for a common aim.

In Mr. Gerard's remarkable book there is an enlightening chapter which reveals, to some extent, how organised capital in Germany, aided by the State, is still seeking to dominate the world, in spite of the many setbacks caused by the unexpected prolongation of the war. It is always well to learn from your enemy if you can. But even if you do not choose to follow his example, it is at least desirable to know what he is up to, for, says prudence, to be forewarned is to be forearmed. The American ex-Ambassador's chapter is primarily addressed, of course, to the American public, and is more immediately applicable to American laws and conditions, but there is much in it that bears directly upon our own circumstances, both at the moment and when peace is restored. For it is absolutely certain that no matter what the purely military result of the war may be, capital in Germany is organising itself in such a manner that it means to start an economic war against the world with the view of preserving, and, if possible, strengthening, such monopolies as it has hitherto possessed. The most valuable of these monopolies depend upon the application of physical science to industry. Such is the character of her educational equipment that she thinks she is secure in the continued development of her means of turning science to practical account; and she has probably good grounds for her faith. It is rather to the economic side—the purely business aspect of the problem—that she is bending all her energies and the financial ability and astuteness of her commercial magnates.

Some time before the outbreak of war, and probably in view of it, the six great companies, each employing hundreds of chemists in research work, which practically control the dyestuff industry of Germany made an alliance not only for the distribution of their products, but also for the exchange of their ideas and trade secrets. They work together as one organisation, are exceedingly wealthy, and have hitherto been well served by agents all the world over. These concerns manufacture not only dyestuffs, but also a large proportion of the synthetic drugs which are so characteristic a feature of modern therapeutics, and in very many cases are manufactured from what otherwise would be useless by-products of the dyestuff industry. The blockade of Germany has, of course, prevented any considerable export of these dyes and drugs, and most of the countries at war with Germany have sought to develop their manufacture at home. The commercial submarines *Deutschland* and *Bremen* were to a great extent built with money provided by the dyestuff manufacturers, who shipped their products over to America before her entrance into the war in order to check, if possible, the development of the colour industry in the States, the German Department of the Interior meanwhile stipulating that Germany should receive in exchange cotton, of which she was in urgent need. This traffic has, of course, now wholly ceased. To meet the competition which it recognises to be inevitable, the great combine has very largely increased its capital and is prepared to spend enormous sums to undersell its rivals and force them out of business, and it rests with the several Governments to take such measures as will effectually protect these menaced industries. An enlightened public opinion, which will refuse to be hoodwinked by the propaganda and "peaceful penetration" of the Germans, may do much to counteract their insidious efforts. Dyes and drugs of the synthetic kind are largely affairs of fashion, and both appeal more to women than to men. Owing to the imperious dictates of fashion, which loves change, there is a constant demand for new colours or shades of colour for which there is no absolute necessity. If women would only be content with a more limited range of dyes, of which there are many possessing every essential attribute of a satisfactory dyestuff—at all events, until our own dyestuff industries are consolidated—half the battle would be won. As for the drugs, nine-tenths of them are worthless, and many of them are positively noxious. Many hundreds of them, the names of which are now forgotten, have been put upon the market by manufacturers solely in the attempt to exploit the by-products of the colour industry, and so long as fashionable practitioners can be induced to prescribe them and people induced to

drug themselves with them, novelties of the kind will continue to be supplied. But here, again, there is no necessity why one should succumb to the blandishments of the pushful "Kaufmann."

Combines or trusts of the kind we have indicated are looked askance at in this country and America as acting in restraint of competition. But in Germany, where they are known as "cartels," they are positively encouraged and upheld by the courts as a justifiable means of self-preservation. Under the post-war conditions which Germany intends to force upon us, this question needs very careful consideration, and it cannot be solved by economic formulæ which are supposed by doctrinaires to be as fixed and immutable as the law of gravitation.

One noteworthy outcome of the war in Germany has been the establishment by the State of a great institution known as the Central Einkauf Gesellschaft, whereby every importation of raw material into the country falls into the hands of this central buying corporation, which disposes of it under regulations to manufacturers. According to Mr. Gerard, this institution, which was created solely as a war measure, has come to stay. It is defended on the ground that it husbands the gold supply of Germany, prevents useless expenditure abroad, and benefits home industry. The Central Einkauf Gesellschaft will make its own purchases abroad, and as it will be a buyer on an enormous scale it will force the sellers to compete against each other in their anxiety to sell. In this way it is believed that the aggregate purchase will be effected at a lower rate than individual buyers would secure. The material will then be divided among the manufacturers at less eventual cost than if they had purchased it separately abroad. This is an example of socialised buying and selling which, if successful, is bound to have an enormous influence upon German commerce. Its very magnitude may, however, render it unworkable in practice. Should it prosper it will give a tremendous impetus to the cause of State Socialism.

Although there is much in Mr. Gerard's account of the manner in which Germany has grappled with the economic difficulties she has brought upon herself, which serves to illustrate her extraordinary powers of organisation and her well-drilled faculty of combination towards a common end, there are many instances of economic blunders on the part of departmental authorities, as, for example, Delbrück's treatment of the cyanide industry and the exportation of potash. In both these cases, and in others that might be mentioned, the anticipated result was altogether falsified by the event, and irreparable injury has probably been done to these industries in Germany. In the attempt to play off the United States against England, Germany was hoist with her own petard.

This fact is beginning to be perceived by the great mass of the commercial community in Germany and Austria-Hungary. Many industries are completely ruined already, and as the war continues to drag along others will share their fate. There are, however, some—powerful organisations like Krupp's and the great body of the Prussian Junkers and the landowners, who as growers of food are making money by the aid of the cheap labour of Russian and other prisoners—which will clamour for the continuance of the war so long as the dumb-driven common herd, who have no real leaders, are inarticulate, and have only a sham political representation, can be induced to tolerate their long-drawn-out agony. To Mr. Gerard it is a matter of surprise that the German manufacturers, who were enriching themselves so rapidly at the expense of the whole world by the aid of low wages and long hours, and with no laws against combination, should have allowed their military autocracy to drive them into war. They would probably have protested, with all the political power they possessed, had they foreseen that they would be up against four-fifths of the civilised world, and that, to use Dr. Helfferich's phrase, they would be doomed to drag about the leaden weight of the billions which this world calamity will have cost the country that really instigated it. No Pyrrhic victories can prevent the social and moral bankruptcy which will assuredly overtake Germany in the long run, and there are signs that this truth is being realised. Germany to-day suffers from the lack of a sane Liberalism, from the want of a strong party of moderate, clear-thinking men with sound political ideals and a larger measure of humanism than characterises the average Prussian. Politically she is torn asunder by two forces—a brutal and unscrupulous autocracy supported by a cunningly devised system of caste, and a Socialism the creed of which, in many of its moral aspects, is repugnant and hateful to all right-thinking men. Germany, like every other nation, has the Government she deserves, and she has brought her deserts upon her own head by her flagrant disregard of the nobler instincts of our common humanity.

T. E. THORPE.

THREE AMERICAN BOOKS FOR GARDENERS.

(1) *Greenhouses: Their Construction and Equipment.* By W. J. Wright. Pp. xvi+269. (New York: Orange Judd Company; London: Kegan Paul and Co., Ltd., 1917.) Price 1.60 dollars net.

(2) *Vegetable Forcing.* By Ralph L. Watts. Pp. xiv+431. (New York: Orange Judd Company, 1917.) Price 2 dollars net.

(3) *Modern Propagation of Tree Fruits.* By Prof. B. S. Brown. Pp. xi+174. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1916.) Price 6s. net.

(1) BY the skilful use of glass and artificial heat, gardeners have succeeded in the cultivation of tropical plants in temperate countries. Greenhouse gardening is comparatively modern, for although the Romans, before the time of Christ, knew how to force fruit and vegetables, they applied only hot manure for the purpose, and it was not until the early part of the eighteenth century that glass structures arti-

ficially heated were used for the cultivation of tender plants. Since then, however, the evolution of the greenhouse has been rapid. There are now glass structures, acres in extent, so cleverly made that the cultivation of plants in them is as successful as in the open with the most favourable weather conditions. The market gardeners of England have in the last fifty years made great progress in the art of glasshouse gardening, and in the United States, where the sun affords in winter more heat and light than it does here, huge structures are erected for the forcing of flowers and vegetables.

Mr. Wright, director of the New York State School of Agriculture and formerly a professor of horticulture, has collected in his book a large amount of helpful information concerning the location, adaptation, erection, and equipment of greenhouses to suit American weather conditions and requirements, which both builders and gardeners will be certain to appreciate.

The conditions in England are somewhat different; still, a great deal of Mr. Wright's teaching may be applied in the making of houses, frames, etc., in this country, and in methods of heating them. Our old greenhouses are too heavy and obstruct the light too much. A good plant-house must be strong, yet light, and it must cast very little shade. The angle of the roof, quality of glass, methods of ventilation, and the internal arrangements with respect to benches and floors are all questions of great importance, as Mr. Wright clearly shows in his well-illustrated chapters.

(2) Vegetable forcing as practised in the United States is the subject of an excellent treatise by Mr. Watts, Dean and Director of the School of Agriculture and Experiment Station at Pennsylvania State College. Forcing as practised in horticulture is the application of artificial heat to the growth of plants out of season. It is now very largely resorted to for the production of food vegetables in winter, enormous quantities of fresh, wholesome vegetables being grown in this and other countries where, without it, they would be difficult to obtain. It is also largely practised for the production of certain flowers, especially roses, carnations, daffodils, and violets. Where sunshine in winter is fairly constant successful forcing is easy, as, for instance, in the United States, where there is far more winter sunshine than in England. In greenhouses and frames specially constructed for the purpose perfect crops are produced in midwinter of such vegetables as cabbage, cauliflower, lettuce, radish, tomato, cucumber, rhubarb, asparagus, French bean, and mushroom. A knowledge of the treatment of soils, suitable manures, right temperatures and ventilation is necessary, and is best obtained by actual experience. Useful guidance can also be obtained from books, such as that by Mr. Watts, which sets forth the best methods of the American practitioners. They believe in soil sterilisation by means of steam or formalin. It is found that the soil continues to be productive year after year when it is annually sterilised, whereas without this it becomes "sick" and infested with fungi and other causes of disease in plants. Stable manure is preferred to all other fertilisers, but nitrate of soda is sometimes used as a growth stimulator. Greenhouse construction, heating, insect enemies and diseases, and marketing are carefully treated. The statement that plants are rendered susceptible to disease by high temperatures, excess of water, and over-manuring will be endorsed by practical cultivators in this country.

(3) The propagation of fruit trees by means of grafting, budding, layering, and cuttings is essentially the same in all countries. The methods vary, as does the skill with which the operations are performed. In America, where fruit-growing is done on a very large scale, labour-saving methods are practised. Orchards miles in area have to be planted and worked, for which men with spades and pruning-knives would be as inadequate as they would be for agriculture. The alert Americans have therefore sought the assistance of the machine-maker for their digging and planting operations, and even for binding in the operation of grafting.

Prof. Brown's book enables us to realise what a big industry fruit-growing has become in America. There are nurserymen there who each dispose of young trees by the million annually. "The growing of all the twenty to forty millions of American-grown apple seedlings that are used in this country every year is undertaken by less than a dozen firms." In addition, large quantities of young trees, both stocks and "maidens," are imported from Europe. At this rate America will soon be covered with fruit trees unless they are used up quickly, as roses are in that country. Some of our own fruit authorities advocate this intensive system on the ground that young trees properly managed give their best in the first few years, after which they should be scrapped. Apples, pears, plums, cherries, peaches, and a few other fruits are invariably grafted or budded on stocks known to influence growth and fruitfulness. Too little care, however, is exercised in the selection of stocks. Prof. Brown discusses the influence of scion on stock in regard to commercial fruit trees. His book is written for students, a number of what he calls "review questions" being set out at the end of each chapter, such as "What is meant by influence of stock over scion?" It contains numerous helpful illustrations.

W. W.

ANALYTICAL DYNAMICS.

A Treatise on the Analytical Dynamics of Particles and Rigid Bodies: with an introduction to the Problem of Three Bodies. By Prof. E. T. Whittaker. Second edition. Pp. xii+432. (Cambridge: At the University Press, 1917.) Price 15*s.* net.

THE first edition of this book was reviewed in NATURE of April 27, 1905. At that time what we now call aeroplanes only existed in

people's imagination and in reports of successes by the Wright brothers, and it was scarcely to be wondered at if applications to aerial navigation found no suitable place in a treatise on analytical dynamics. In the twelve years that have elapsed there has been plenty of time for pure and applied mathematicians to provide material that would not occupy merely a single chapter on "The Aeroplane" in a second edition of such a book as this, but might even form a predominating feature of the whole work. Yet on referring to the index we do not even find the word "aeroplane," while the references under "stability" and "resistance of the air" do not lead to any matter suggestive, even vaguely, of the existence of aerial navigation. It may well be a matter of surprise that such an omission should be possible at the present day.

We cannot lay the blame on Prof. Whittaker, because a book of this kind is necessarily largely an exposition and collation of the work of other writers. But it will be found on closer examination that, outside the problem of small oscillations about a state of steady motion, very little work has been done in advancing what is really out-and-out the most important development of theoretical dynamics, and for the most recent of the developments which have taken place physicists and engineers rather than mathematicians are mainly responsible, much of their work being the property of the Government at present.

It is, however, rather a pity that Prof. Whittaker has omitted to introduce the subject under the heading of "stability of steady motion," as this would, at least, afford his readers some stimulus to turn their studies in the right direction. Possibly the author considered it scarcely desirable to make any change until further developments had taken place, and in this second edition he has rather confined his attention to elaborating references to original work on old ground. It is not usual in reviews to repeat what has been said in a previous notice about a first edition. For this reason a detailed account of the actual contents would be scarcely necessary or desirable. The present work will be found of much use by such students of a future generation as are able to find time to extend their study of particle and rigid dynamics outside the requirements of aerial navigation, and it will also afford a valuable source of information for those who are in search of new material of a theoretical character which they can take over and apply to any particular class of investigation.

G. H. B.

OUR BOOKSHELF.

Orígenes y Tendencias de la Eugenia Moderna. By Joaquin Bonilla. Pp. 96. (Liverpool: *Daily Mail* (printers), 1916.) Price 3*s.* 6*d.* net.

THIS introduction to eugenics is intended primarily for Latin America. The author explains the aims of eugenics, and gives a sketch of the history of the idea of trying to control the agencies which improve or impair racial qualities in mankind. Simple expositions are given of Lamarckism, Darwinism, Mendelism, and Weismannism. There is a pleasant appreciation of the work of Sir Francis Galton, and the book pays due regard to experimenters and biometricians alike. The endeavours of the Eugenics Education Society are recognised, as well as the work of Prof. Karl Pearson's Eugenics Laboratory. So up-to-date is the book that mention is made of England's "Baby Week" and of the withdrawal of the veto on the representation of certain plays by Ibsen and Brieux. A chapter is devoted to eugenic activities in the United States.

The author has the wise and kindly intention of familiarising Spanish-speaking young people with the aims and methods of eugenics, and he seems to us to have written a clear and terse introduction to the subject. We should like to have seen some recognition of what is practicable in the way of ameliorating environment and function, and improving nurture generally. For the eugenic ideal does not, and cannot, stand alone. In a short book like this it should have been readily possible to avoid disfiguring verbal errors, such as Seleeby, Burcke, Havelock Elliott, and Weisner; but these are very small flies indeed in the carefully prepared ointment. We wish the book success.

The Human Body: An Account of its Structure and Activities and the Conditions of its Healthy Working. By Prof. H. Newell Martin. Tenth edition, thoroughly revised by Prof. E. G. Martin. Pp. xviii+649. (New York: H. Holt and Co., 1917.)

A BOOK which has reached a tenth edition needs but little recommendation. The late Prof. Newell Martin's work, like all that he did, is excellent. It is rather more bulky than the majority of books of an elementary nature; but, like these, it is a compendium of anatomy and physiology designed, not for the student of medicine, but for the general reader who desires to become acquainted with the mechanism of his own body and the reasons for the laws of health. It is naturally the physiological side which is mainly dwelt upon, only so much of structure being described as is necessary for the understanding of function. The present edition has been brought well up to date, and, like the only other book with which we may compare it, Huxley's "Elementary Physiology," has doubtless still before it a long and useful life.

A welcome feature of the book is the appendix, in which instructions for practical work are given in detail. Much of this will need a laboratory, but it is astonishing how much useful practical work can be performed without elaborate apparatus, and with the resources which are available to nearly every teacher.

LETTERS TO THE EDITOR.

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

The January Meteors of 1918.

I WATCHED the northern sky during most of the interval between 6h. and 10h. on January 3, and recorded eleven Quadrantids. The conditions were not good; there was a slight fog, through which the stars of Ursa, Draco, etc., shone dimly, and the air was frosty, the temperature being about 26°.

The Quadrantids observed were, in the majority of cases, near their radiant at $233° + 59\frac{1}{2}°$, and moved slowly. This position is near ι Draconis, and about 6° north of that usually determined in past years. I am at a loss to explain the cause of the discordance, the data of the present year being considered quite satisfactory. In the circumstances the results recently obtained by other observers will be awaited with special interest. W. F. DENNING.

44 Egerton Road, Bristol.

THIS evening, between 6 p.m. and 9 p.m., looking north, twenty-two meteors were observed at Sidmouth, South Devon. The most brilliant one appeared about 8.15 p.m. G.M.T., and was travelling in a south-easterly direction at a moderate speed. The meteor was of a reddish colour, and was followed by a long trail of white light. It was frosty and beautifully clear, excepting a slight haze for a short interval.

WINIFRED L. LOCKYER.

Salcombe Regis, Sidmouth, January 3.

NATIONAL MUSEUMS IN PERIL.

THE report that the Government proposed to requisition the British Museum as the headquarters of the new Air Board has resulted in a storm of protest from many men of light and leading throughout the country, and from corporate bodies concerned with the promotion of the intellectual welfare of the nation. The correspondence published in the *Times* and other journals represents only a small fraction of the budgets received, and it is evident that the Government will bring upon itself nothing but obloquy if it persists in the action contemplated. Since we referred last week to the projected dismantling of the galleries at Bloomsbury, it has been made known that the Office of Works has surveyed the Natural History Museum at South Kensington with the view of using the building for the purposes of other Government departments, and has reported in favour of doing so. The very existence of our two greatest national institutions is thus threatened, unless a united effort is made at once to convince the Cabinet of the unnecessary and ruinous proceeding to which certain administrative officials, with the usual indifference to scientific interests and inability to understand scientific values, desire to commit it.

The high-handed method adopted in the proposal to commandeer the two museums cannot be justified even by the provisions of the Defence of the Realm Act. Sir Arthur Evans states that the trustees of the British Museum were not consulted upon the matter, though they are responsible for the collections, not as Government nominees, but under an Act of Parliament. They were astounded upon receiving from the Air Board a requisition for the building to house the Board's establishment, and at once sent a strong protest to the Government against the scheme. Even an enemy invader could not adopt a more arrogant attitude towards the trustees than that shown by the representatives of the Government. The collections were regarded as so much furniture which could be packed up in a few days by workmen and conveyed in pantechnicons to convenient places of storage until after the war. As "A Londoner" writes in the *Times* of January 4 in an attempt to justify the official attitude: "It is pretty widely understood that the Air Board is willing and anxious to put its large resources in transport and labour at the service of the nation for the removal of the contents of the British Museum to places of safety which the Board has already inspected and approved."

This semi-official pronouncement reveals entire incapacity to appreciate the difficulty of the problem of dealing with the contents of the museum. The whole of the objects are considered as goods which may be removed in a few days and returned without detriment at a later period of reconstruction. Because a selected number of objects have been carefully transferred to places of security by museum officials during the past two years, as a precaution against air-raids, it is assumed that the whole may be dealt with summarily by energetic workmen under the supervision of experts. The absurdity of this view will be manifest to anyone acquainted with museum work. To make a selection of fragile objects and other national treasures, and to take measures to preserve them from damage, are very different matters from that of clearing space without reference to what it occupies. It is certain that if the indiscriminate and hurried dismantling of the museum is proceeded with, many of the objects taken away will never be worth bringing back, and it would be just as well to make a bonfire of them at once.

Only a small proportion of the contents of the museum could be removed in time for the space they occupy to be of any use to the Air Board. The library must remain, and the larger sculptures, including the more important pieces of the Elgin marbles, the Assyrian bas-reliefs, and the Egyptian statuary. The ethnographical collections cannot be disturbed without certain destruction of many objects. The glass, pottery, porcelain, and faience collections, the ancient and medieval gems, rings, and jewelry, the Greek vases, the Babylonian clay tablets, the Egyptian pottery and images, the terra-cottas, the bronzes—all these can be moved only with an infinitude of skilled handling and packing, and in a period of time which might well run into years rather than months. No, it must be clearly understood that if the museum is to be taken for the Air Board—

which needs offices quickly—the Board will have to be encamped in the middle of the collections, with all the increase of risk which such an encampment involves.

Our concern for the museum is not prompted by opposition to interference with the existence and work of the threatened institution, but by the desire to preserve national prestige and to prevent the ruin of possessions which can never be replaced. Only if reduced to the last extremity—and we are far from that condition—should a scheme be adopted which would give the enemy occasion to scoff at our willing sacrifice of the glorious heritage represented by the collections in the national museum.

"We profess to feel shame and anger," says Sir Henry H. Howorth, "and also terror for the future of our race, when we find the champions of German culture destroying Reims and Padua and Ypres. We call them Huns for their pains, and at the same time in another way, and for no urgent military purpose, ourselves put in jeopardy the noblest collections in the world of art and natural science, which neither money nor skill can replace, and which form the most valuable asset of the country if its mental and moral training are to count in this Armageddon of materialism."

The gravamen of the case against the proposed action is, indeed, that it shows a total lack of imagination and of perception of the value of intellectual studies on the part of responsible Ministers. They accept lightly, and without investigation, a proposal which, on the face of it, imperils the inestimable treasures of the British Museum. They do not consult the trustees as to the effect of their proposed action. They do not give heed to their own Minister of Education. They simply accept a scheme put forward by the First Commissioner of Works, who avowedly has not visited the museum to investigate its practicability, and whose expert advisers had on two previous occasions reported that the museum was not suitable for a public office. All this shows an indifference to things of the mind and a materialistic spirit which are of evil omen in statesmen whose business it is to maintain the ideals of the country at a high level, and thereby to hearten it to bear the strain of war. Who is to believe them in future when in their speeches they make play with Germany's crimes against civilisation, or exalt our ideals in comparison with German Kultur? They are lowering the pitch of England's endeavour, and the misfortune is that they do not realise that they are doing any harm in this action. If the members of the Government could be brought to face these facts, it is difficult to believe that they would continue to insist on a policy which is bad for the Air Board, bad for the museum, and a discredit to the country.

Though the spontaneous outbursts of indignation from all parts of the country may yet induce the Government to withhold the impious hand which the Office of Works laid upon the collections and buildings of the British Museum at Bloomsbury, the fate of the Natural History Departments at South Kensington also trembles in the balance. Yet the arguments drawn from unsuitability of structure and fragility of irreplaceable specimens are here no less strong, and they are reinforced by two others. The work in all the Natural History Departments bears directly on the material as well as on the intellectual life of the nation—indeed, on its very existence. Those who say that prosecution of the war must come first should be the first to insist on the continuance of the great help rendered by the museum to all branches of our fighting forces: we may refer them to an article in the *Times* for January 5. To stop this work for the convenience of the Registry of Friendly Societies would be a fine stroke for our enemies. Secondly, the objects in the Natural History Museum form the historical basis on which a great part of natural science rests; they are the standards to which present and future generations must continually refer. To destroy or damage them is to cut away the ladder on which we climb. The distinguished men responsible to the nation for the safety of its unique possessions—trustees, indeed, for the whole world now and to come—have already taken steps against possible attack by the enemy, while leaving the specimens available for accredited investigators. But they cannot prevent the certain destruction and widespread confusion that would result from a sudden clearance of more than half the building as though it were just a mammoth hotel. The removal from Bloomsbury took more than three years, yet, for all the care with which it was accomplished, it left damage which is not yet, and can never be entirely, repaired. When we think of the subsequent growth of the collections and the present depletion of an always insufficient staff, our imagination fails to grasp the threatened ruin. Generations could not restore it. For many a year the science of our country would be hampered.

In the early days of the war we had to fight for our national museum, and well was it that we won a partial victory. Since then the members of the staff unfit for military service have carried on, with what good results a few bald statistics will show. During the past year the Natural History Museum has been consulted by at least fourteen Government departments, as well as by numerous individuals engaged in war-work. The number of visitors, which in 1916 was more than 402,000, was increased in 1917 by 20,000; among these are soldiers receiving class-instruction in sanitary, veterinary, and other subjects. The annual number of acquisitions has decreased, because all purchases are stopped, but donations continue to flow in with a volume that seems to grow rather than diminish. Among these accessions have been thousands of specimens of the highest scientific importance. The dismantling of the museum would make the receipt of donations impossible, and the stream would be diverted elsewhere. In some cases it would never return.

"We are blamed," says the Government in

effect, "for commandeering hotels; we must leave places for our young officers to dine; do you expect us to oust another political club? We preach economy; do let us practise it for once. We can get the museum *rent-free.*" Rent-free, indeed! Is the cost of structural alterations, of packing, of removal, and of restoration not to be paid for? Does the scientific help for our food-producers, our industrialists, and our fighting or wounded men weigh as nothing in the balance? Are the gifts which you reject devoid even of pecuniary value? "What should ye do, then? Should ye suppress all this flowery crop of knowledge and new light sprung up and yet springing daily in this city? Should ye set an oligarchy of twenty engrossers over it, to bring a famine upon our minds again, when we shall know nothing but what is measured to us by their bushel?"[1] "Milton!" we cry with Wordsworth:

> Milton! thou should'st be living at this hour:
> England hath need of thee.

The following are a few of the resolutions which have been passed by important public bodies protesting against the proposed employment of the museums for purposes other than those for which they are intended:—

At a special meeting of the British Academy on January 3 it was resolved to represent to his Majesty's Government the irreparable injury that would be done to the interests of learning and humane studies by any serious damage to the priceless collections in the British Museum, and the slur which would be cast on the good name of the country by action which will be taken as implying indifference to those collections and to the civilisation they represent. To remove any considerable portion of the collections, except with the utmost care and the expenditure of many months of skilled labour, is impossible without the certainty of injury; and to house a large combatant department in the midst of the collections themselves involves a great increase in the risk of accident and fire, quite apart from the danger of air attack from hostile aircraft, which would obviously be much increased. The Academy earnestly appeals to his Majesty's Government not to sanction action which would discredit this country in the eyes of the civilised world.

The fellows of the Linnean Society of London in extraordinary general meeting assembled on January 7 placed upon record their profound astonishment and alarm at the reported intention to dismantle the British Museum, including the Natural History Museum, in order to use it for Government offices; their emphatic protest at a procedure which must endanger priceless and irreplaceable possessions acquired at great cost and infinite labour during the last two hundred years, constituting the most splendid museum in existence, and the recognised centre of systematic scientific research; their dismay at a resolution which must paralyse scientific activities that during the past three years have been devoted to work intimately connected with the prosecution of the war; and at the expenditure of a large sum in adapting unsuitable buildings, whilst other and more suitable accommodation might be provided at much less cost; and, finally, to emphasise the disgrace which must accrue to the nation in the eyes of the whole world by the evidence thus afforded of the inability of the Government to appreciate the essential value to the nation of scientific assistance, such as the British Museum has rendered and is capable of rendering.

The Entomological Society of London has resolved: This society, founded for the advancement and practical application of entomological science, knowing that this science, especially at the present moment, plays a most important part in many questions, often of extreme urgency, affecting the health of the nation and its forces at home and abroad, its food supplies, its timber, and the raw material of its manufactures, views with the gravest concern any action that would impede work essential to the national welfare. Towards the solution of these problems the collections at the museum have in the past largely contributed, and many of them are at present under investigation. The proposed action of his Majesty's Government in reference to the Natural History Museum would have a disastrous effect upon work which demands continued reference to its enormous collections. It is obvious that to be of any practical value these must always be readily available, and, moreover, their removal would not only be a very lengthy undertaking, but could not be carried out without irreparable damage. The Entomological Society of London feels bound, therefore, to enter the strongest possible protest against such proposed action, the full consequences of which can scarcely have been realised, and in the interests of the Empire urges that the suggested interference with these important collections should be abandoned.

At a meeting of the council of the Mineralogical Society of Great Britain and Ireland, held on January 7, it was resolved: That the First Commissioner of Works and the War Cabinet be most earnestly requested to reconsider the proposal to utilise a portion or the whole of the Natural History Museum for other than its present purpose. In particular, as regards the Mineral Department, the Mineralogical Society views with alarm any proposal to render inaccessible, both to the general public and students, and also to inquirers respecting economic questions, the national collection of minerals, which has been accumulated during the past century and a half, and is now the largest and most complete in the world. This collection contains, for reference and comparison, examples of all minerals (and ores) that have been put to economic uses, representing numerous localities that have not yet been worked commercially. Direct reference to those parts of the collection not exhibited to the general public would supply a large amount of information, not available elsewhere, even in published works, respecting mineral occurrences in all parts of the world. Such information has already been utilised by the Advisory Council on Scientific and Industrial Research, by the War Office, and by the Department for the Development of Mineral Resources attached to the Ministry of Munitions of War, and could also be of use to the proposed Imperial Mineral Resources Bureau. The proposal to render such information inaccessible would seriously hamper the work of all Government departments concerned with the development of the mineral resources of the Empire.

At a special meeting of the council of the Essex Field Club, held on January 7, it was unanimously resolved: That the council of the Essex Field Club learns with amazement that the Government contemplates occupying the British Museum, including the Natural History Museum, for departmental offices, and hereby expresses an indignant protest against such action, which is certain to result in irreparable injury

[1] Milton's "Areopagitica."

to the invaluable collections in the museums and in the cessation of much scientific work which is dependent upon such collections. That such action, in the opinion of this council, could not fail to bring discredit upon our nation in the eyes of all civilised peoples.

On January 7 it was resolved: That the Classical Association appeals to the Government against the proposed conversion of the buildings of the British Museum into a seat of combatant activity, both because of the inevitable injury that would be caused by removal to a multitude of objects of unique historical value, and because the change would legitimate and incite attacks from the air upon a library containing many thousands of irreplaceable books and MSS. which constitute a great part of the inheritance of the civilised world. Their safe-keeping is a trust for humanity imposed by history upon this country, and the association regards the present proposal as a declension from the high ideals with which the country and the Empire entered on the war.

Similar resolutions have been passed by the British Archæological Association, the annual Conference of Educational Associations, the Royal Society of Antiquaries of Ireland, the Royal Asiatic Society, the Royal Numismatic Society, the Cambridge Antiquarian Society, and many other representative bodies.

SANDS FOR GLASS MANUFACTURE.[1]

THE preface to this memoir refers to the great advantage which the glass industry of this country is deriving from the prescient policy of the Department of Optical Munitions and Glassware Supply of the Ministry of Munitions; and the memoir itself is an example of the department's efforts to place the industry in a sound position. A knowledge of the home resources of raw materials is of prime importance to the glass industry, and the exhaustive survey made by the author has enabled him to place on record for the first time valuable information as to the resources of suitable sands on which the glass manufacturer can rely. In pre-war days large quantities of excellent sand were imported from Belgium and France, and their cheapness was mainly due to their transport as ballast in coal-boats. Economic conditions may prevent the utilisation of many of the occurrences of sands and rocks to which the memoir refers, but much will depend on the provision of cheap transport by the adequate development of our canal systems. This is well shown by the sketch-map marking the locations of the chief resources of glass sands in relation to the glass-making areas.

A glass sand should be of uniform grain size, and the most desirable sands are those containing a high proportion of grains from 0·25 to 0·5 mm. in diameter. The presence of grains smaller than 0·1 mm. causes the formation of "seed," which is difficult to remove in the "fining" process. An even grade is also an important factor in securing homogeneity, and it is doubtful if stirring can completely eliminate heterogeneity caused by the use of badly graded, unevenly melting sands. An important conclusion to be drawn from the author's investigations is that although we have not in this country any deposit equal in quality, uniformity, and extent to that at Fontainebleau, we have ample supplies of sands suitable for all ordinary glass-making purposes. Carefully selected sands from the soft white quartzites of Muckish Mountain contain under 0·01 per cent. of iron oxide, and this source is of great importance, as, despite its inaccessibility, it is likely to provide a home supply of the small quantities of sand required for the manufacture of optical glass. Generally speaking, although crushed rocks are largely used in the American glass industry, they cannot for economic reasons be regarded as an immediate source of supply of glass sands in this country.

Sand-pit owners are now giving greater attention to the cleansing and grading of sand by washing, and the improvement which can be effected in the quality of a sand is indicated in the tables given on p. 64 of the memoir. It would have been of interest if quantitative information as to the yield of washed sand could have been added to these tables. The washers at present in use are satisfactory for comparatively coarse sands of the Leighton Buzzard type, but are much less efficient for finer-grained sands, such as those of Lynn and Aylesbury. Provided that a plentiful supply of water is available, there should be no great difficulty in designing an efficient washer for fine-grained sands, and co-operation between the glass manufacturer and the sand-pit owner is desirable if adequate washing plant is to be installed. Sands low in iron will be preferably graded by drying and sieving, instead of washing, so as to retain the alumina-rich coating which is adherent to the quartz grains. Alumina is valuable in a glass, as not only does it reduce the tendency of the molten glass to devitrify, but it also increases the toughness of the glass and enables the batch to be cheapened by increasing the proportions of sand and lime at the expense of the alkali. Felspar is being increasingly used as a source of alumina in a glass batch, and the author's survey of the resources of suitable rocks of low iron content is of value as an indication of the possibility of substituting the home for the imported material.

The uses of sand for its refractory properties are referred to only briefly, and the further memoir on our home resources of refractory sands will be awaited with interest.

Prof. Boswell has rendered a distinct service to the glass industry by this rapid completion of his survey.

[1] "A Supplementary Memoir on British Resources of Sands and Rocks used in Glass Manufacture, with Notes on certain Refractory Materials." By Prof. G. H. Boswell and others. Pp. 92. (London: Longmans and Co., 1917.) Price 3*s*. net.

ORGANISATION FOR INDUSTRIAL EXPANSION IN SOUTH AFRICA.

IN an article on "The Co-ordination of Research" which appeared in NATURE of December 6 mention was made incidentally of the issue of the *South African Journal of Industries*. Copies of the first number of this journal have now reached this country. Before alluding to the scope of the new journal it should be explained that the Scientific and Technical Committee appointed by the Department of Mines and Industries of the Union of South Africa has for its prin-

cipal functions the conduct of an economic survey of the natural resources of South Africa, the extension of provision for industrial research, co-ordination of industrial investigation, the elimination of overlapping in such work, and the provision of means for taking advantage of facilities for investigation not available in South Africa by co-operation with similar organisations in the United Kingdom and the other British dominions. The committee has so far made two chief recommendations, viz. (1) the appointment of various authorities in South Africa to report on the natural resources of the country, and (2) the publication of an industrial journal to give publicity to the reports and data collected under the committee's auspices. The first of these recommendations is being carried out, and the second has been given effect to in the issue of the *South African Journal of Industries*.

In common with most of the overseas British dominions South Africa, largely as a result of the war, is in the throes of new industrial developments with the view of providing the necessaries it formerly imported, but which it can no longer procure from the manufacturing countries in Europe. The first number of the journal is naturally largely occupied with articles surveying the present situation. Among these may be mentioned Mr. Warington Smyth's article on "The Beginnings of Organisation for Industrial Expansion"; that on the "Census of Manufacturing Industries, 1917," by Mr. C. W. Cousins, Acting Director of the Census; and Dr. Lehfeldt's report on "The Economics of Agricultural Production in South Africa." Among the new South African industries to which attention is directed is the manufacture of industrial alcohol, for use as a motor fuel, from the molasses produced on sugar estates in Natal. A report by the Imperial Institute on the results of examination of the fruits of *Ximenia americana* is printed, and Dr. Philips contributes a useful *résumé* of the information available regarding "buchu," a drug the production of which is a monopoly of South Africa.

The article in NATURE already mentioned directs attention to the difficulties of co-ordinating industrial research in the United Kingdom, and shows that there is no evidence that such co-ordination has yet been effected or is in process of being arranged. The appearance of the *South African Journal of Industries* is a reminder of the existence of the larger and still more difficult problem of devising means for the utilisation of the resources of the Empire within the Empire itself, and the solution of which is of first-rate importance to both British and Colonial industries.

NOTES.

AMONG the promotions in and appointments to the Most Excellent Order of the British Empire for services in connection with the war announced on Tuesday, we notice the following:—*Knights Commanders (K.B.E.)*: Mr. James Cantlie, member of Council and of Executive Committee, British Red Cross Society; Col. C. F. Close, Director-General of the Ordnance Survey of the United Kingdom; Dr. W. Morley Fletcher, secretary of the Medical Research Committee; Dr. J. Galloway, Chief Commissioner for Medical Services, Ministry of National Service; Dr. R. Robertson, superintending chemist, Research Department, Woolwich Arsenal; Prof. W. H. Thompson, scientific adviser to the Ministry of Food. *Commanders (C.B.E.)*: Prof. F. J. Cheshire, adviser on scientific side of Optical Munitions Branch, Ministry of Munitions; Dr. G. H. Fowler, Hydrographic Department, Admiralty; Prof. W. R. Hodgkinson, professor of chemistry and metallurgy, Ordnance College, Woolwich; Mr. R. G. K. Lempfert, Superintendent of the Forecast Division, Meteorological Office; Prof. W. J. Pope, professor of chemistry, University of Cambridge, member of panel of Board of Invention and Research, Admiralty; Prof. T. B. Wood, Drapers professor of agriculture in the University of Cambridge, adviser on meat production to the President of the Board of Agriculture, and chief executive officer, Army Cattle Purchase Scheme; Mr. G. Udny Yule, Director of Requirements, Ministry of Food. In addition, about two thousand names are included in lists of new officers and members of the Order (O.B.E. and M.B.E.).—Prof. James Ritchie, Irvine professor of bacteriology, University of Edinburgh, asks us to correct the mistake made in last week's issue of NATURE announcing that a baronetcy had been conferred upon him. The recipient of the distinction was not Prof. Ritchie, but Sir James W. Ritchie, son of a former Lord Mayor of London. We regret the error, but the Press announcement that it was Prof. Ritchie who had received the honour was perhaps a natural one for a scientific journal to accept.

Is the Carnegie Trust for the Universities of Scotland doing its duty in strengthening and developing scientific study and research? That is the question suggested by the report of a special committee published in the December number of the Journal of the British Science Guild. The question was first raised in an incisive manner by Prof. Soddy in an article communicated to *Science Progress* (January, 1917), and further inquiry seems to show that his contention is well founded. There may be some difference of opinion as to the exact interpretation of Clause A of the Trust Constitution; but there can be no doubt that the main object of the trust is to foster science, pure and applied, in all its branches, and to strengthen that side of university education which is of direct technical or commercial value. In the light of that general principle the following facts are well worthy of careful consideration:—(1) Only 14 per cent. of the available funds have been expended on scientific research; (2) by endowment out of Carnegie Funds of certain scientific departments, money formerly spent in their maintenance has been diverted into other channels, so that the university on its scientific side has not really been strengthened; (3) among the twenty-two members of the Board of Trustees, there have never been more, and have usually been fewer, than four who could be regarded as representing science, the majority being practically ignorant of the methods, and even the meaning, of research.

STEPS are being taken to incorporate the Selborne Society and to widen its objects, so that it may not in any way be hampered in its efforts to bring home to the public, especially through its lecturers, the great value of science to the community.

THE death is announced, on January 5, in his sixty-seventh year, of Mr. R. C. Woodcock, fellow of the Institute of Chemistry and of the Chemical Society, and author of a number of papers upon analytical chemistry.

THE death is announced, in his seventy-sixth year, of Dr. W. L. Purves, consulting aural surgeon, Guy's Hospital, consulting ophthalmic and aural surgeon, Hospital for Diseases of the Nervous System, and aural surgeon to the Royal Normal College and Academy of Music for the Blind.

AT the scientific meeting of the Royal Dublin Society held on December 19 last, Lord Rathdonnell, president, in the chair, the Boyle medal of the society was presented to Prof. J. A. McClelland, F.R.S., in recognition of his distinguished work in many branches of science, especially with those dealing with ionisation, and the more recently discovered forms of radiation associated pre-eminently with radio-activity.

THE death occurred on December 30, at the age of sixty-four years, of Sir William H. Lindley. To those who knew of the service Sir William rendered to the Royal Commission on Canals and Inland Navigation by the compilation of an exhaustive report on the waterways of France, Belgium, Germany, and Holland, published in vol. vi. of the Commission Bluebooks, the announcement of the knighthood, conferred upon him in 1911, came as no surprise. But to the general public his reputation was not so familiar, and this is scarcely surprising, seeing that the sphere of his professional activities lay almost entirely on the Continent, particularly in Germany and Austria-Hungary, where he succeeded to his father's position and influence. Sir William began his career in 1870, as resident engineer on the Budapest waterworks, and, three years later, took up the post of engineer to the city of Frankfort-on-Main, where, for more than twenty years, he administered the works of the municipality and port. During his lifetime he had associations with the towns of Elberfeld, Homburg, Mannheim, Wurzburg, Cracow, Prague, Warsaw, Bukharest, and Baku, in connection with various electricity, waterworks, and sewerage undertakings. But for certain adverse circumstances Petrograd would have been added to the list, for, as recently as 1912, he was appointed engineer-in-chief of a new municipal water-supply and drainage scheme for the Russian capital; the project, however, did not mature. His reputation among German engineers was deservedly high, and he discharged presidential functions on several Commissions. He had been a member of the Institution of Civil Engineers since 1878.

THE following minute, adopted by the board of trustees of the New York Memorial Hospital, is published in *Science*:—Dr. Richard Weil, Major in the Medical Reserve Corps, U.S.A., died while on active duty at Camp Wheeler, Macon, Ga., November 19, 1917. By his death the Memorial Hospital loses one of the most highly trained and successful workers of its medical staff, and American cancer research one of its recognised leaders. Since 1906 Dr. Weil had been an active member of the staff of the Huntington Fund, and throughout this period of eleven years he was constantly engaged in the problems of cancer research. His contributions in the field of the serology of cancer and in the general problems of immunity gained for him an international reputation. He was one of the founders of the American Association for Cancer Research, and largely through his efforts was founded the *Journal of Cancer Research*, of which he was editor-in-chief. At the reorganisation of the Memorial Hospital in 1913, Dr. Weil assumed the position of assistant director of cancer research and attending physician to the hospital, and in this capacity he laboured energetically to establish an efficient organisation of the routine and research work of the hospital. In 1915 he resigned the position of assistant director upon his appointment as professor of experimental medicine in Cornell University, but he continued without interruption his experimental work in cancer. Upon the declaration of war he was among the first to offer his services to the Government, and spent the summer at Fort Benjamin Harrison in the Medical Officers Training Corps. Quite recently he was detailed to take charge of a large military hospital at Camp Wheeler, Macon, Ga., and here in the performance of strenuous military service he fell a victim to pneumonia. During his brief but brilliant career he attained eminence as a devoted laboratory worker, a skilful experimenter, a broadly trained clinician, and a forceful writer, while his untimely death places his name among the first on his country's honour roll in the great war.

A REPORT containing the results of Dr. Benjamin Moore's researches on "The Causation and Prevention of Trinitrotoluene Poisoning" has just been issued by the Medical Research Committee (Special Report Series No. 11). It is shown that the only important avenue of entrance into the body is through the skin. The amount taken in as vapour or as dust is innocuous. The first noticeable indications of poisoning are those due to deficient oxygen supply, especially blueness of the skin and lips. This results from the action of the poison in decreasing the capacity of hæmoglobin to take up oxygen, a well-known effect on the respiratory process produced by nitro- and amino-benzene derivatives in general. Trinitrotoluene is said to convert hæmoglobin into its NO derivative, together with met-hæmoglobin. Various results follow from the deficiency of oxygen supply to the organs, but whether the degeneration of the liver and the consequent jaundice are secondary, as Dr. Moore holds, or whether the poison acts directly on the liver cells, is at present a matter of dispute. The same may be said for the anæmia. But the practical point is that the cyanosis is the sign to be looked for. Individuals differ in the property of their skins to absorb the poison, and it is recommended that all those showing susceptibility should be rigorously excluded from the work. A further preventive is covering the arms and hands with a casein varnish. Gloves are useless. The poison is reduced in the body, probably by the liver, to the hydroxylamino-derivative, and eliminated in the urine, conjugated with glucuronic acid. It is important, therefore, that the diet should include substances which afford a supply of this acid—namely, fresh vegetables and fruit.

Engineering, in its leading article for January 4, deals with standard aero-engine production, which in this country is in a state of chaos. More than forty different types of aero-engines are now being manufactured in Britain, and about as many firms are engaged in their manufacture. The labour absorbed in the extravagant multiplication of tools, jigs, gauges, drawings, and patterns, regrettable though it is, does not end the burden on the Air Service through this variety of designs. The effect, for instance, on the stocks of spares may easily be imagined; the engines are so different in construction that aerodromes at the front not only require separate spares for the several types that are used there, but also have to keep, for purposes of overhaul, separate gangs of mechanics versed in their individual peculiarities. The Production Department that now serves the Air Council in the Ministry of Munitions is well placed for obtaining improvement in the rate of manufacture, but the particulars that have been published of its constitution do not satisfy engineers that it is in a position to use its advantage. So far as is known, the department does not include men on its staff who would be accepted by engineers generally as able to speak with the necessary first-hand knowledge and authority on either the design of internal-combustion engines or the methods

of intensive manufacture. While the Production Department lacks specialised knowledge and authority, even the great abilities of the Director-General will be insufficient to produce the desired results. The duty of manufacturing engineers is to produce the engines, and while the machinery for controlling manufacture remains as it appears to be, it is preventing them from discharging that duty.

FROM the point of view of a statistician and avowedly in the spirit of an iconoclast, Mr. F. J. Brodie considers, in the December issue of *Symons's Meteorological Magazine*, the evidence in respect of the theory as to connection between gunfire and rainfall that can be gathered from the published figures in the weather reports of the Meteorological Office for the three years of the war ended September, 1917. From a series of maps showing the quarterly variation of rainfall with respect to the average for each of the twelve districts into which the British Isles are divided for meteorological purposes, the following conclusions are reached:—(*a*) That over a large portion of the United Kingdom an excess of rain was reported in nine quarters out of twelve; (*b*) that in seven out of the nine wet quarters the excess of rain was greatest in districts situated in the eastern or southern half of the country; further, that in two of the three dry quarters the only districts which failed to report any deficiency were again situated either in the eastern or in the southern section. For the whole period the excess was as much as 26 per cent. in England S.E., 20 in England E., 14 in the Midlands, 10 in England N.E., and 9 in England S.W.; while in Scotland N. and W. there were deficiencies of 5 and 10 per cent. respectively—a suggestive enough distribution. Unfortunately, the figures for northern France and Belgium are not available—the more so since M. Angot, writing in May, 1917, observed that no distribution of excessive rainfall having reference to a centre in the war area had been found in France. It is also worthy of remark that there was, prior to the outbreak of war, every reason for anticipating a continuance of the spell of wet years that had set in, in compensation for the long dry period that marked the nineties of last century and the opening decade of the present century (in London, 1903 was the only wet year between 1894 and 1909); furthermore, that one of the three dry quarters was that of July–September, 1916—the period of a great offensive in Flanders—and that the spring offensive of 1917 also was favoured with fine weather. So long is the arm of coincidence and so infinite are the resources of our climate that, in the absence of valid physical proof, it is doubtful whether, even in the event of similar conditions continuing for another three years (or the duration of the war), meteorologists would be convinced that the "frightfulness" of man can influence the course of the elements.

THE Société d'Anthropologie de Paris bravely continues its work in spite of the war. In part ii. of the *Bulletins et Mémoires* for 1916, which has just reached us, M. R. Anthony contributes a graceful obituary of one of its most illustrious foreign associates, Sir W. Turner. This is accompanied by a full catalogue, extending to nine pages octavo, of the works and papers on anatomy, physiology, and anthropology contributed by him.

MISS M. A. MURRAY supplements her paper in *Folklore* (vol. xxviii., No. 3, September, 1917) by an article in the Journal of the Manchester Egyptian and Oriental Society for 1916–17 on "The God of the Witches." She discusses the theory of an Eastern origin of the witchcraft observances, but the evidence is not quite satisfactory. Converts from Islam to the witch cult renounced their old religion, as did the converts from Christianity; Arab witches, like curs, used to ride about on sticks; the name of the great assemblies of the witches, Sabbath, suggests an Eastern origin, but cannot be connected with the sacred day of the Jews. "It seems certain then that in this religion, as in others, there was interchange between the East and the West. But having regard to the antiquity of the witch cult in Europe, it seems to me that the balance of evidence is in favour of its originating in the West, and being carried thence to the East."

IN the *South African Journal of Science* (vol. xiii., No. 11, July, 1917) the Rev. Noel Roberts describes a series of Bushman rock paintings discovered at the Zoutpansberg range, in the northern Transvaal, during the construction of the railway to Messina. The ochre used is believed to be derived from a deposit in the neighbourhood of the caves, and natives assert that the white paint was obtained from the milky kernel of the Stamvruchte (*Chrysophyllum magalismontanum*). Much controversy has arisen regarding the meaning and purpose of the paintings. Some believe that they represent historical incidents, or depict occurrences in hunting. Others trace a connection with the art of northern Africa. But Stow's conclusion that they are purely historical still holds the field. At the same time, as Sir James Frazer has advocated, there may be a magical object, and Mr. Roberts advances some arguments in support of this view. The excavation of the detritus of the caves containing the paintings should bring to light some objects which would help to fix the date and intention of these representations. Meanwhile, the article provides a series of photographs of considerable interest.

MR. C. W. MALLY describes, in the *South African Journal of Science* (vol. xiii., No. 11, July, 1917), a method of destroying that noxious pest, the Argentine ant. The plan is to surround the opening of the nest with a cordon of finely powdered corrosive sublimate about half an inch wide. Under some conditions the ants become excited before they actually touch the powder, the result being probably due to the fact that fine particles of the sublimate are floating in the air. When the drug has been sprinkled on the soil at any point, it remains sufficiently virulent to affect the ants for a long time; some spots thus treated after eight or nine months still react on the ants when they wander over them. Heavy rain disperses the sublimate, but light rain simply carries it into the soil, and then, as the moisture evaporates, there is a tendency for the corrosive sublimate to be re-deposited on the surface. This suggests that the foundations of buildings may be treated, either during or after construction, with a solution which will protect them from ant invasion.

MR. H. H. HAYDEN, Director of the Geological Survey of India, in his report on the earthquake which occurred at Dharmsala on May 10 last, states that the situation of the station, in an area of pronounced tectonic disturbance, renders the occurrence of periodical earth shocks probable. With this possibility in view there are, Mr. Hayden suggests, the alternatives to be considered: either to abandon Dharmsala altogether, or to adopt precautions which may render earthquakes in future, so far as possible, innocuous. The first course he does not recommend, and he believes that precautions such as have been adopted in other parts of the world may render the retention of Dharmsala as a station a matter of comparatively slight risk. He advocates the erection of a new type of building, the houses being either of wood or of reinforced concrete, and he thinks that it would not be difficult to select methods of construction which

would render Dharmsala safe against any earthquake that is likely to occur.

THE problem of mining thin coal-seams has recently been the subject of considerable discussion in Great Britain, and it is interesting to note that it has at the same time been attracting attention in Canada, as is shown by a recent publication of the Canadian Department of Mines, Bulletin No. 15, on the mining of thin coal-seams as applied to the eastern coalfields of Canada, written by Mr. J. F. Kellock Brown. The author discusses the technical aspects of the question, but lays most stress upon its economics. He points out that the present coal industry of eastern Canada is in a weak position, having reached its period of best productivity, but beset with outside competition and rising costs, and operated by over-capitalised concerns, the earning capacity of which is only 3 or 4 per cent. of their capital. He estimates that the coals now being worked may well be exhausted in about a century, and therefore proposes that the industry should be reorganised, worked by powerful corporations or combinations, and that legislation should compel the working of a certain proportion of coal from the thin seams along with that of the more easily wrought thicker seams. He considers that "when properly operated, and properly financed under reasonably favourable conditions, 12-in. seams of coal can be worked economically in eastern Canada to-day," though it is doubtful whether many colliery engineers in this country would fully concur in this conclusion. In any event, the bulletin is an important contribution to the great problem of the proper and effective utilisation of the mineral resources of the British Empire, and deserves careful study from this point of view, as well as for the technical considerations involved. Under the latter head numerous details of machine mining and underground conveyer systems are given, together with the actual operating costs in a few selected examples. The author appears to have reached the definite conclusion that in mining thin seams machine work—not only machine mining, but "the application of power to the whole operation of getting the coal, from the commencement of the undercutting to the placing of the coal into the mine cars"—is essential to success.

PART 3 of vol. vi. of the Science Reports of the University of Sendai, Japan, contains the sixth, seventh, eighth, and ninth reports of the Alloys Research Institute of Japan, which all have reference to the magnetic or other properties of iron and its alloys. The eighth report, by Prof. Honda, deals with the magnetisation of iron powders as the simplest form of the problem presented by the magnetisation of alloys. The powders used were of reduced iron mixed with fine sand to obtain small amounts of iron per c.c., and compressed to get densities approaching that of solid iron. Rods of 0·5 cm. diameter 15 cm. long were magnetised in a coil, providing fields up to 1000, and the magnetisation measured ballistically. The curve showing the relation between the specific magnetisation (the quotient of the intensity of magnetisation by the mass of iron per c.c. of the specimen) of the solid iron is of the usual type, the bend or shoulder occurring between fields 50 and 200, and the saturation value of the specific magnetisation being 210. For a powder containing three-fourths the iron per c.c. the curve shows no shoulder, though it is convex upwards. At a field of 1000 its specific magnetisation is only 140, and shows no sign of saturation. For smaller quantities of iron per c.c. the curves become nearly straight lines—that is, the specific magnetic susceptibility becomes constant for each mixture, but decreases as the mixture contains less iron.

THE latest list of Mr. F. Edwards, 83 High Street, Marylebone, W.1 (No. 380), contains 1066 items, and is devoted to biography. It is not very strong in science, but among the books offered for sale we notice the memoir of "Sir Samuel Baker," by T. Douglas Murray and A. Silva White; "Sir Joseph Banks's Journal during Capt. Cook's First Voyage," edited by Sir J. D. Hooker; "Life of Sir Joseph Banks," by E. Smith; the first edition of Washington Irving's "Christopher Columbus: History of his Life and Voyages"; "Charles Darwin: Life and Letters," edited by Sir F. Darwin; "Memoirs of the Life, Writings, and Discoveries of Sir Isaac Newton," by Sir D. Brewster, and several lives of men of science which have been published during the past few weeks. The catalogue will be sent upon written application.

MR. W. HEINEMANN will shortly publish vol. ii. of Dr. Montessori's "The Advanced Method." The work will deal with the Montessori material, and the use of it, for children up to the age of eleven years, and will be illustrated. It is announced in connection with the volume that an authorised Montessori Training Institute is to be established in this country, presided over by Dr. Montessori.

OUR ASTRONOMICAL COLUMN.

ENCKE'S COMET.—Encke's comet, which has been observed at every perihelion passage since 1819, has once more been detected, the discoverer being Prof. Schorr, at Bergedorf, Hamburg. The position on December 30 at 5h. 27m. G.M.T. was R.A. 22h. 59m. 4·93s., N. declination 3° 17′ 35″. The comet was of the 15th magnitude, but should brighten considerably in the next few weeks. The observed R.A. was smaller than the tabular by 4s., the declination smaller by 40″. These small residuals indicate that Mr. Viljev's calculated time of perihelion passage 1918 March 24·3 G.M.T. is not much in error, perhaps about 0·2d. too late. This adds certainty to Mr. Viljev's conclusion that the object observed in September and November, 1916, was not the comet. An ephemeris was given in NATURE of December 27.

THE NEAREST STAR KNOWN.—In Circular No. 40 of the Union Observatory, Mr. Innes gives the results of observations made for the determination of the parallax of the interesting faint star near α Centauri to which he first directed attention about two years ago. The observations extended from May 26, 1916, to August 23, 1917, and were made with a micrometer attached to the 9-in. equatorial at Johannesburg. The resulting value for the parallax is 0·88″, as compared with 0·755″ recently determined at the Cape Observatory by Mr. Voûte. The mean of the two values is 0·82″. The largest parallax previously known is that of α Centauri, which Kapteyn gives as 0·759″, and it would thus appear that the Innes star is the nearest known star to the solar system. The proper motion of the faint star is closely similar, in both magnitude and direction, to that of α Centauri, notwithstanding the separation of 2° 13′. Mr. Innes suggests *Proxima Centaurus* as a convenient name for this small star. The visual and photographic magnitudes of the star are 11 and 13 respectively.

THE INTERIOR OF A STAR.—An interesting popular account of his mathematical investigations relating to the physical conditions in the interior of a star is given under this title by Prof. A. S. Eddington in *Scientia* for January. Prof. Eddington considers that there is now overwhelming evidence in favour of the existence

of stars of increasing, as well as stars of decreasing, temperature, as has so long been advocated by Sir Norman Lockyer. Chiefly through the work of Hertzsprung and Russell, it has, in fact, been found that many well-known stars are in a highly diffuse state, and when such stars contract under the influence of their own gravitation, they must rise in temperature until they cease to approximate to perfectly gaseous conditions (density 0·2 to 0·4 compared with water). Prof. Eddington has made an important modification of Lane's theory by taking account of radiation-pressure, and he shows that as a star contracts the diminishing surface is compensated by increasing radiation, so that the total radiation remains nearly constant, until the density becomes too great for the theory to apply. Afterwards the star passes to the descending branch of the temperature curve, and the total radiation falls off very rapidly. Radiation-pressure has further been found to provide a reasonable explanation of the approximate uniformity of stellar masses.

THE VISCOSITY OF SLAG AT HIGH TEMPERATURES.

ALTHOUGH the data which have in recent years been accumulated on the behaviour of silicates at high temperatures possess a great interest and value from the points of view of the mineralogist and the geophysicist, a knowledge of the melting points and fields of stability of the silicates is not the most important factor for consideration in so far as application to the metallurgy of iron is concerned. In a study of the blast-furnace process what is of particular interest is the behaviour of the slag from the time it enters the zone of fusion until it is flushed from the slag-notch. In passing through this region where the smelting process occurs the most important *physical* property of the slag is its viscosity, while its most important *chemical* property is its desulphurising power.

It has long been known to furnacemen that molten blast-furnace slag is much more viscous than molten iron and most fused salts, and that the slag undergoes a gradual softening on heating rather than a sudden change to a mobile liquid. This particular characteristic was from the first rightly attributed to the silica content of the slag, and it appears to be due to the nature of the molecule, SiO_2, rather than to the element silicon itself. X-ray analysis in the hands of Prof. W. H. and Mr. W. L. Bragg has furnished an important confirmation of this hypothesis. Instead of finding, as is the case with the crystals of most chemical compounds, that the atoms are arranged separately at definite points of a space-lattice, they concluded that *three silica molecules* are associated with each point of the space-lattice. It is a matter of common knowledge that highly associated or polymerised liquids possess unusually high viscosity, and hence it seems plausible to argue that, since silica appears to be unusually complex in the solid state, this association or polymerisation tendency must be the fundamental cause of the extreme viscosity of silica itself and the high viscosity of the silicates in the liquid state. When a silicate gradually softens with rising temperature and passes entirely over into the liquid state it is probable that the increased fluidity is due to a weakening of the "residual-valence" attraction between the group-molecules, while the relatively high viscosity of the melt, as compared with that of molten metals and ordinary salts, is due to the preponderance of the group-molecules silica, alumina, and lime, and possibly in a particularly large degree to a highly polymerised condition of the silica group-molecule.

Considerations of this kind are set out in a valuable paper by Mr. A. L. Feild, assistant metallurgist at the United States Bureau of Mines, in a recent paper presented to the Faraday Society.[1] Mr. Feild points out that while it is theoretically possible to render any silicate mixture whatever sufficiently fluid to flow from the slag-notch of a blast-furnace it is necessary in practice that the slag should attain this necessary fluidity at a temperature which is not beyond the working limit of the blast-furnace lining, and does not demand an unusually high fuel consumption. It is obvious that if, for instance, a slag requires a minimum temperature of 1400° C. in order to attain a working fluidity, no iron will be produced in a furnace using this slag, regardless of the number of B.Th. units developed within the furnace, unless the temperature distribution is such that the slag acquires the necessary temperature at 1400° C. *Thus the fuel economy of the blast-furnace is to a great extent dependent upon the temperature-viscosity relations of the slag.* Apart from the question of mining cost and freightage, the value of an iron ore sufficiently rich in iron to be considered marketable largely depends on whether it can be made to yield economically a slag of desirable viscosity and desulphurising power.

Mr. Feild has worked out a method of determining the viscosities of slags up to 1600° C., this limit being imposed by the furnace refractories and not by inherent limitations of the apparatus. He has used a modification of the method originated by Margules in 1881, in which the liquid is confined between two concentric cylinders. The outer cylinder is rotated at a constant speed, and the torque exerted upon the inner cylinder measured. The method is applicable to liquids of a wide range of viscosity, and has been applied in this case to measurements on slags over a range of viscosity from 200 to 3000 (water at 20° C. = 1). Acheson graphite was used in the construction of all parts subjected to high temperatures, and the suspended system was damped so as to give it the stability and aperiodicity of the familiar damped D'Arsonval galvanometer. The outer cylinder was rotated about a vertical axis at a constant speed. The inner cylinder was suspended coaxially within the outer one by means of a steel or phosphor-bronze ribbon. Experimental data derived by this method are capable of an easy direct mathematical interpretation. A cylinder of radius b, rotating with a constant angular velocity ω, will exert upon an inner fixed concentric cylinder of radius a—the space between them being filled with the liquid—a couple Γ given by the relation

$$\Gamma = 4\pi\eta L \frac{a^2b^2}{b^2 - a^2}\omega,$$

where η is the coefficient of viscosity and L the common length of the two cylinders. With cylinders of fixed dimensions the viscosity is proportional to the torsion couple and inversely proportional to the speed of rotation in revolutions per second. Conversely the torsion couple is proportional to the speed of rotation and to the viscosity.

Viscosity values are given for eight commercial slags, two synthetic slags, and an artificial diopside. The temperature-viscosity curve approximates in form to that of the rectangular hyperbola, while the temperature-fluidity curve approaches a straight line in form. The average viscosity at 1500° C. of eight commercial slags was found to be 301 (water at 20° C. = 1). Refractory slags have been found to be not necessarily more viscous at high temperature than more fusible ones.

H. C. H. C.

[1] "The Viscosity of Blast-furnace Slag and its Relation to Iron Metallurgy, including a Description of a New Method of Measuring Slag Viscosity at High Temperatures." Proceedings, December, 1917.

THE LEARNING PROCESS IN A SNAIL.[1]

IN his well-known experiments (1904), the Russian physiologist Pávlov showed that salivary secretion in a dog, primarily induced by the odour or sight of food, could eventually be induced by a sound or colour which had been for a time synchronised with the primary stimulus. The dog, according to the experiments, was soon able to establish an organic association between the primary and the secondary stimulus. When Pavlov slightly changed the secondary stimulus there was a change in the dog's salivary reaction, and this was taken as evidence of the animal's power to discriminate between stimuli.

With noteworthy clear-headedness, Miss Elizabeth Lockwood Thompson has seen how to apply Pavlov's method to a water-snail, *Physa gyrina*, which glides about in ponds, with foot and mouth upwards, suspended from the surface-film. When a part of the body within a millimetre or two of the mouth is touched with a bit of food, a chewing motion of the mouth-parts is started. With the application of food to near the mouth there was synchronously associated a pressure with a clean glass rod at a fixed distance from the mouth. The next step in the ingenious experiment was to apply the associated or auxiliary stimulus alone in the absence of food, in order to determine from the presence or absence of reactions whether or not an association had been formed between the two sets of stimuli. Miss Thompson deserves to be congratulated, we think, on this extension of Pavlov's method, which he himself did not regard as applicable except to a limited number of mammals. It is now possible, along this line of investigation, to test a snail's power of "learning."

When food was applied to the mouth and at once withdrawn, response followed in 61 per cent. of the tests, the mouth being opened and closed on an average 3·93 times. By means of an apparatus a simultaneous application of pressure to the foot and food to the mouth was secured. In the first 60–110 trials of simultaneous stimuli no response followed; in the remaining trials, out of 250 in all, a response was always given. The snails were thus "trained." After forty-eight hours a response followed the pressure by itself, *i.e.* in the absence of any food-stimulus, but only for a limited period. Cessation of response to pressure after training is sudden and final. The limit of the effect of training (which simulates memory) is about ninety-six hours. An interesting waning of response (marked by a reduction in the number of mouth movements) was observed in some series of trials; it showed that the snails became adapted to a stimulus which was not followed by its wonted reward. The relation between length of training and training effect (as measured by response to pressure only) requires further investigation.

Miss Thompson also devoted many experiments to inquiring whether the snail could learn to solve a simple U-shaped or Y-shaped labyrinth with a picket fence of wires, one arm leading from near the foot of the tank to the air (the reward), the other not (the punishment). In some cases error was punished by an electric shock, and roughness of the path was used as a warning stimulus. The result was interesting. The snails showed no ability to learn that the one path was to be preferred to the other. But in 15 per cent. of a total of 930 trials in one series, the snails changed their course from the wrong to the right path after contact with a warning stimulus (in this case, slight irritation of the tentacles and the back of the head with a hair) before the shock (punishment) was received. There was formed a weak association between two stimuli, the hair and the shock, the former serving as a warning of the punishment to follow if the course be not changed. But the capacity to form associations, already proved by the method of using simultaneous stimuli, does not suffice for the solution of the simplest labyrinth. There was no evidence of "selective" ability.

Miss Thompson has made a very interesting contribution to the study of animal behaviour; the details of the experiments show the punctilious carefulness of her work.

[1] "An Analysis of the Learning Process in the Snail, *Physa gyrina*, Say." (Behaviour Monographs, vol. iii., No. 3, 1917, pp. 1–89+8 plates+12 tables.) (Cambridge, Mass.)

SCREW GAUGES.

THE production of a satisfactory screw gauge is a matter of considerable difficulty as regards both manufacture and testing, and the pamphlet on this subject just issued by the National Physical Laboratory[1] will be found to contain much useful information.

In the case of a plug screw gauge, it is essential that it should enter a standard check ring gauge, but this test is insufficient, since it may be complied with by a plug gauge having such a combination of errors as to enable it to enter the check and yet be useless for the purpose of gauging screws. "Not go" tests are also essential, and certain errors can be detected only by carrying out measurements on the gauge of either a mechanical or an optical character. The full (or major) diameter is measured by use of a micrometer in conjunction with a set of Hoffmann roller gauges. The core (or minor) diameter and the effective diameter are also measured by means of a micrometer, together with a pair of Vee-pieces and a pair of small cylinders respectively. The lathe in which the gauge is machined should be furnished with an attachment for holding the micrometer so that its axis intersects the axis of the gauge at right angles, and arranged so that the instrument can be readily removed. This permits of the gauge being measured as the work proceeds, without the necessity for removing it from the machine In instruments used for measuring these diameters in the inspection room, the micrometer should be held mechanically so as to comply with the same condition.

The machine described in the pamphlet for measuring the pitch of the screw appears to be both simple and effective. The actual measurement is made by means of a micrometer having a large dial reading to 0·0001 in. An ingenious arrangement, partly mechanical and partly optical, ensures that the axial movement of the micrometer point shall be exactly equal to the pitch of the screw under test. Both periodic and progressive errors in the pitch can be detected from the readings obtained in this machine.

As a general rule, optical measurements of screw gauges cannot be made to the same accuracy as mechanical measurements, but optical methods are of great service from the consideration that the whole of the screwed surface of a gauge can be examined in detail. Errors in angle, want of straightness of the threads, eccentricity between different diameters, and local bumps and hollows can be detected readily by optical means. Until recently, microscopes having cross wires in the eyepiece were alone employed for measurements, and a machine embodying this principle is made by the Cambridge Scientific Instrument Co., and is described in the pamphlet. Such methods have now been displaced to a great extent by a pro-

[1] "Notes on Screw Gauges." By the Staff of the Gauge-testing Department, National Physical Laboratory. Enlarged issue II. (Teddington: W. E. Parrott, The Causeway, 1917.) Price 2*s.* 6*d.*

jection machine, which throws on a screen a shadow-like image of the screw thread, magnified a definite number of times. This image is then superposed on a diagram of the correct thread form, drawn to the same magnification. Thus variations from the true form can be seen and measured with a scale. A simple projection apparatus and another having a large field of view are described, together with some convenient accessories.

With the exception of core diameter and pitch, the elements of a screw ring gauge cannot be measured readily. The method of taking plaster casts has been tried, but such casts cannot at present be relied upon to nearer than ±0·0005 to ±0·001 in. In general, screw ring gauges are not measured, but tested between limits by "go" and "not go" check plugs, made so as to test each diameter independently.

The pamphlet is written in a very practical manner, and sufficient information and drawings are given to enable anyone interested to set up the various appliances for himself. We are also glad to note that manufacturers who contemplate the installation of measuring instruments, or have experienced difficulties in measurement, are invited to visit the laboratory by appointment to discuss their particular problems with the members of the staff.

MARINE BIOLOGY.

THE twenty-fourth report (1916) of the Danish Biological Station contains two papers of much interest to marine biologists. Dr. C. G. J. Petersen gives a useful account of the development of the external characters in three of the common species of Gobius. The great difficulty there is in discriminating between the young stages of these fishes is well known to those who have handled general collections made in European waters, and Dr. Petersen's careful descriptions will be much appreciated. The second paper in the report is by Dr. H. Blegvad, on the food of fishes in Danish waters within the Skaw. The new feature in this work is that, in addition to an account of the kind of food upon which each species was found to be feeding, the weight of each kind of food found in the fish and the weight of the fish itself were recorded. In this way a more accurate idea of the relative importance of the different kinds of food can be obtained.

In the Marine Biological Report, No. iii., 1916, for the province of the Cape of Good Hope, Dr. J. D. F. Gilchrist, in the first paper, describes the eggs and larvæ of a number of Cape fishes. Unfortunately the figures which accompany this paper appear to have lost a great deal in the reproduction, and many of them can scarcely be considered adequate for recognising these very delicate forms, the identification of which often depends on a correct representation of their minute details. The remainder of the report contains an account of some observations on marine invertebrates, made on animals living in the tanks of the Marine Station at St. James, the description of four new South African fishes, which are well figured, and a continuation of Mr. W. Wardlaw Thompson's "Catalogue of Fishes of the Cape Province," with a very full bibliography of each species.

THE DEVELOPMENT OF BRITISH AGRICULTURE AND FISHERIES.[1]

THE advances recommended during the year amounted to 334,903*l*. Since the commencement of the war advances from the Development Fund have been mainly confined to schemes already established with the expectation of continued help from the fund, for which just sufficient advances have been recommended to secure continuity.

As regards new schemes, the Commissioners have continued to recommend expenditure upon the preparation, by way of preliminary surveys and reports, of projects of development for commencement after the war when the employment of labour upon a large scale may be desirable. They have also recommended expenditure on certain new schemes in order to meet war conditions, particularly in connecton with food supply and natural products. The two most important new advances recommended by them during the year, namely, 125,000*l*. for purchase of an estate for sugar-beet growing, and 50,000*l*. for improving the fish food supply by installing motors in fishing-boats in England and Wales, fall under this heading. These two advances amount to one-half of the whole sum recommended for the year. A largely increased supply of plants for afforestation purposes, and increased growings of flax for aeroplane cloth, are other instances where war conditions have called for extra expenditure from the Development Fund.

AGRICULTURE AND RURAL INDUSTRIES.

Agricultural Research and Education, etc.—For the continuance of the research scheme in England and Wales during 1917–18 the following grants from the Development Fund to the Board of Agriculture and Fisheries have been sanctioned:—

	£
Grants to colleges and institutions in aid of—	
(*a*) Scientific research and experiments ...	19,600
(*b*) The extension of advisory and local investigation work	8,000
(*c*) Special investigations and research, and scholarships	2,400
(*d*) Inquiries and experiments, etc., by or on behalf of the Board	600
Expenses of administration	880
	31,480
Less amount not payable from the Development Fund	1,750
	29,730
Research in animal pathology to be undertaken at the Board's veterinary laboratory, 1917–18	2,000
Research Institute in Plant Pathology at Kew	1,358

The proposed expenditure in respect of the grants for research institutes and advisory centres contemplates only the carrying on of existing work, and no new work of any importance was started last year with the exception of investigations bearing directly on the war, with which some of the workers are engaged, particularly at Cambridge University.

A grant to the Board of Agriculture and Fisheries of 16,445*l*. was made in aid of agricultural and dairy education during the year 1917–18.

A grant of 3700*l*. was sanctioned to enable the Board in consultation with the Commissioners to assist new emergency schemes of an educational or quasi-educational character. A grant of 1330*l*. was made to the Imperial College of Science and Technology for an investigation during 1917 into the effect of electrical discharge on the growth of crops.

The Commissioners have recommended an advance of 400*l*. to the North of Scotland College of Agriculture for the continuation during 1916–17 of research work which is being carried out under the supervision of a joint committee of the University of Aberdeen and of the college; an advance of 315*l*. to the University of Edinburgh for the continuation during the period

[1] Abstracted from the seventh report of the Development Commissioners on their proceedings during the year ended March 31, 1917.

November, 1915, to November, 1917, of research in animal breeding; and advances of 700*l.* and 395*l.* to the Board of Agriculture for Scotland for the purpose of aiding the University of St. Andrews and the three agricultural colleges of Scotland in carrying out during the academic years 1915–16 and 1916–17 schemes of special research in agricultural science. The Commissioners also recommended the renewal in respect of 1916–17 of the annual advance of 5000*l.* in aid of "extension" work at the three Scottish agricultural colleges—*i.e.* instruction to agriculturists in the colleges' provinces.

For the year 1917–18 a grant of 4000*l.* was made to the Department of Agriculture and Technical Instruction for Ireland in aid of its scheme of technical and advisory work in connection with agriculture, and a grant of 196*l.* in aid of the maintenance of property acquired for a new veterinary research laboratory.

Eggs and Poultry.—A grant to the Board of Agriculture and Fisheries of 3200*l.* was recommended for a scheme for augmenting the production of eggs and poultry during the season 1916–17 by the establishment of 300 centres in England and Wales for the distribution of trustworthy eggs for hatching, twenty stations for the distribution of day-old chicks, and the provision of five incubating stations; and a grant of 358*l.* to the Utility Poultry Club in aid of the continuance of the Burbage breeding experiments during the year to September 30, 1916.

Cultivation and Preparation of Flax, Hemp, and Tobacco.—Two grants to the British Flax and Hemp Growers' Society were recommended: one of 4575*l.* to meet the expenses of the society during the six months to September 30, 1916, and the other of 6275*l.* to meet the expenses of the society during the year to September 30, 1917. The object of the society is to ascertain whether flax can be grown in this country with profit to the growers. The society's scheme involves the cultivation of flax in selected districts, the establishment of experimental retteries, experiments on the growth of flax as a crop for seed independent of fibre, and experiments in the breeding and selection of better strains of flax. Owing to the war and the consequent rise in the price of flax, the acreage has been increased, and it is expected that the enhanced prices will cause a considerable reduction in the cost to the Development Fund of these experiments and at the same time stimulate the revival of the industry in this country. Shortly after the close of the year to which this report relates the Commissioners recommended a supplementary grant for a considerable extension of the society's work in 1917, undertaken partly in order to ensure a future supply of material for the production of aeroplane cloth and partly to increase the growth of linseed as a feeding stuff for stock.

A grant of 1200*l.* to the British Tobacco Growers' Society was recommended for the continuance of the work of the society during the year 1916–17. The society is conducting experiments in the cultivation and preparation for market of tobacco and nicotine products in order to ascertain whether tobacco can be grown in this country with profit to the grower. Confidence in the possibilities of the tobacco crop was so far established as to enable the society for the first time in 1915–16 to make contracts with growers to grow the tobacco at their own risk and at a fixed price, with the stipulation that only sound saleable leaves would be accepted. The arrangements proposed for 1916–17 are an advance in the experimental stage. The Commissioners considered the question of the suspension of the society's work until the end of the war, but the society claimed that the experiments had reached a stage at which their abandonment or suspension would involve a serious loss of the value of all past expenditure, and a largely decreased grant was applied for to carry on the work. The Commissioners came to the conclusion that a case had been made out for the limited operations proposed.

Encouragement of a Beet Sugar Industry.—The Commissioners are of opinion that a trial on a considerable scale of a sugar beet experiment should be made, and that the present time affords particular reasons for initiating such a trial. The Kelham Estate, Nottinghamshire, is exceptionally suitable for such an experiment, and the Commissioners recommended a loan of 125,000*l.* for its purchase with a view to the establishment of the beet sugar industry in this country.

Horse and Live Stock Breeding.—The following grants were recommended:—

35,100*l.* to the Board of Agriculture and Fisheries to meet the cost during the year 1917–18 of the scheme for the improvement of heavy horses, cattle, and swine, the extension of milk recording, and the employment of live stock officers at agricultural institutions in England and Wales; 10,250*l.* to the Board of Agriculture for Scotland in aid of the scheme for the improvement of heavy horses and cattle, and the extension of milk recording in Scotland during the year 1917–18; and 2000*l.* to the Department of Agriculture and Technical Instruction for Ireland in aid of the Department's scheme for the improvement of Irish draught horses during the year 1917–18.

Organisation of Co-operation among Agriculturists.—A grant to the Agricultural Organisation Society of England and Wales for its work during the year 1916–17 was recommended; also a grant to the Scottish Agricultural Organisation Society in aid of its work during 1916–17, consisting of an advance equal to the amount spent from the society's own funds during the year, but not exceeding 1000*l.*; and a grant of 532*l.* to the Irish Agricultural Organisation Society in aid of its work during the year 1916–17.

Forestry.

During the year the Commissioners reviewed their policy with regard to new forestry schemes to be financed from the Development Fund, especially in relation to the alternatives of purchase and long lease of land, and to their proposals for afforesting privately owned land on the basis of a division of the proceeds when they accrue. The experience of the war has shown that the nation must in prudence be prepared to incur substantial expenditure in increasing the home-grown supplies of timber. Much of the waste land of the country can be turned to account only by putting it under timber; and there are other areas of unimproved land which can be rescued from their present unproductive condition by composite schemes of afforestation and reclamation. A forest will afford seasonal employment for men occupying or employed on small farms, and will itself be economically worked by the labour so employed.

A grant of 4300*l.* to the Board of Agriculture and Fisheries was recommended for the continuation in the year 1917–18 of the scheme for research, forestry instruction and advisory work at four centres in England and Wales, minor forestry experiments and surveys. It was represented to the Commissioners by the Board of Agriculture that in view of the large amount of timber which was being cut down in this country, the difficulties in which nurserymen were involved owing to the shortage of labour, and the fact that seed and seedlings of enemy origin, largely purchased in normal times by nurserymen, were no longer available, it was desirable to raise a supply of forest tree seedlings in case there might be a shortage for replanting after the war A grant of 200*l.* was made

to the Commissioners of Woods towards the cost of the maintenance of the Forest of Dean Demonstration Area during 1916–17, on the condition that the land revenues of the Crown should continue as hitherto to bear the cost of general improvements and maintenance of Dean Forest and adjoining woodlands.

A grant of 1000*l.* for 1917–18 was recommended for the salaries and expenses of three forestry officers for advisory, survey, and research work, one at each of the three Scottish agricultural colleges.

During the year the Commissioners have reviewed the terms on which advances from the Development Fund have been made or promised for the purchase of land in Ireland and its afforestation. A provisional agreement was reached between the Commissioners and the Department of Agriculture, and in March last the revised terms were submitted for the approval of the Lords Commissioners of the Treasury.

Development and Improvement of Fisheries.

The development of sea fisheries and the increase of the fish food supply have been among the most important of the matters for which advances have been made during the year. The following advances for these purposes have been sanctioned, viz.: In January, 1917, an advance not exceeding 50,000*l.* to the Board of Agriculture and Fisheries for the provision of motor-power in fishing-vessels in England and Wales. The administration of this advance is in the hands of a small central executive committee appointed by the Board in consultation with the Development Commission. Not the least part of the Committee's work has been that of arranging for the necessary fuel, boxes, and other fishing supplies. During the time that this scheme has been in operation the results obtained have been satisfactory, and they promise to prove still more fruitful in the future. In January, 1917, an advance not exceeding 2000*l.* to the Cornwall Sea Fisheries Committee to enable fishermen at the Mount's Bay Ports and St. Ives to instal mechanical power in their boats. In March, 1917, authority was given for the unexpended balance of the grant of 2000*l.* to the Devon Sea Fisheries Committee for the purpose of experiments with motor-power in trawlers, etc., to be used in making loans to fishermen to enable them to instal motors in their boats. The unexpended balance in question was about 1900*l.*

An advance of 510*l.*, the available balance of the sum of 3000*l.* originally made applicable for the development of motor-boat fishing in Ireland, was sanctioned for the same purpose during the year 1917–18.

For the purposes of fishery research in 1917–18 a grant of 675*l.* was sanctioned, being 250*l.* less than the amount sanctioned for 1916–17. This sum was to be allocated by the Board of Agriculture and Fisheries, when the nature of the work had been definitely settled, between the following institutions: The Marine Biological Association, the Lancashire and Western Local Fisheries Committee, Liverpool University, University College of Wales, and the Armstrong College, Durham.

Finance of the Development Fund.

The total sum guaranteed to the fund is 2,900,000*l.*, which has all been paid over; in addition, interest on investments and other receipts up to March 31, 1917, amounted to 390,000*l.*, a total of 3,290,000*l.*

As will be seen from the table below, the total advances recommended to March 31, 1917, amounted to 2,602,277*l.* This sum cannot, however, be taken as the effective demand upon the fund: some of the recommended advances included in earlier schedules were not ultimately sanctioned by the Treasury, and in the case of several schemes for which assistance is sought annually the amounts sanctioned were not wholly spent within the year for which the grants were sanctioned.

The Commissioners estimate that the effective total of the advances sanctioned up to March 31, 1917, amount approximately to 2,085,000*l.*, leaving therefore a balance of 1,205,000*l.* then available to meet recurrent annual grants for existing schemes, new projects, and for an emergency programme of development works which is being prepared as suitable to be started at the end of the war.

Summary of Recommendations, 1916–17.

	Grant.	Loan.
	£	£
Agriculture and rural industries ...	139,348	125,000
Forestry	15,676	—
Reclamation and drainage of land ...	850	—
Harbours	844	—
Fisheries	51,185	2,000
	207,903	127,000
Total	334,903*l.*	

Sum Total of Advances Recommended up to March 31, 1917.

	Grant.	Loan.
	£	£
Agriculture and rural industries ...	1,492,172	128,500
Forestry	101,833	153,411
Reclamation and drainage of land	6,565	4,000
Rural transport	—	80,000
Harbours	214,539	171,410
Inland navigations	—	109,500
Fisheries	109,297	30,250
Sea defence works	—	800
	1,924,406	677,871
Total	2,602,277*l.*	

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

Under the auspices of the Council of the Library Association, the Athenæum Press has issued a Subject Index to Periodicals for 1916, the Historical, Political, and Economic Sciences, including the European war, geography, anthropology, and folklore. The catalogue is well arranged, and contains a wide survey of periodical literature. Owing to the high cost of printing and paper, the list of periodicals cited has been omitted, but in the present list 305 publications are indexed. The present catalogue can be regarded as only tentative, the Proceedings of some societies being in arrear, and most of those from the Continent unprocurable. But the idea is good, and in quieter times the catalogue will be more comprehensive.

At the annual meeting of the Headmasters' Association, Mr. A. P. M. Fleming (British Westinghouse Electric and Manufacturing Co.) gave an address on the increasing part which democracy would play in the near future in industry and public life. He said that industrial progress had been greatly accelerated in some directions, but that unity of aim and purpose among industrial workers was essential to continued advance. Industrial progress was incompatible with industrial unrest, and teachers should put industrial problems before their pupils in the right way, thus contributing to their right solution. Industrial harmony must be based on a sense of justice and of individual responsibilities as well as of individual rights.

A COURSE of nine lectures on "The Practical Applications of the Study of Weather" has been arranged and will be given at the Meteorological Office, by Sir Napier Shaw, on Fridays at 3 p.m., beginning on January 25. Each lecture will be followed by a conversation class for the discussion of practical details. The fortnightly meetings at the Meteorological Office for the discussion of contributions to current meteorology in colonial or foreign journals will be resumed at 5 p.m. on Monday, January 14, and will be continued on alternate Mondays until March 25. Students wishing to attend should communicate with Sir Napier Shaw at the Meteorological Office. The lectures are for advanced students and others interested in the subject. Admission is free, by ticket, to be obtained on application at the Meteorological Office, South Kensington, S.W.7.

THE University of London has arranged for the second term of the current session a series of public lectures in Imperial studies. A course of ten lectures on some biological problems of to-day will be given at University College, Gower Street, beginning on January 21, at 4 p.m., when Prof. W. M. Bayliss will lecture on the problem of food. Lectures will be given on future Mondays on other problems by distinguished authorities in biology. At King's College, Strand, and at King's College for Women, nine lectures on animal life and human progress will be given at 5.30 p.m. on the Wednesdays beginning January 30, when Prof. Arthur Dendy will take for his subject "Man's Account with the Lower Animals." In later weeks lectures on other matters of biological importance will be given by other well-known zoologists. Seven public lectures on "The Empire: its Commerce and Commercial Requirements," will be delivered at the London School of Economics, beginning at 5 p.m. on January 18, when Sir Alfred D. Hall, K.C.B., will speak on artificial manures.

THE Association of Science Teachers held its annual business and open meetings in connection with the Education Conference at University College, London, on January 3. At the business meeting a project was discussed for starting branches of the association in various parts of the country, and a committee was elected to draw up a scheme. A resolution was passed, and forwarded to the Headmistresses' Association, urging the necessity for allotting more time to science in girls' schools, and suggesting that physics be made the basic science. The growing tendency to limit the science in girls' schools to little more than botany was deprecated. At the open meeting, both the address from Prof. Davidge, of the Ordnance College, Woolwich, and the discussion in the afternoon opened by Prof. Womack, dealt with physics. Prof. Davidge described field telephones used on the battlefield, and exhibited a visible buzzer similar to one captured from the Germans, which solved the problem of the "ring-off" in the trench exchange. His audience was interested in what he had to say of the ignorance of science among men who came to him at the Ordnance College, an ignorance which suggested that the "fairy-tales of science" have not been making a wide appeal. Prof. Womack dealt with the teaching of physics in girls' schools. He advocated humanistic treatment; mechanics, which he considered specially important, should not be treated as a mathematical subject, but experimentally, with direct reference to the environment. In the discussion which followed, the views of Prof. Womack were supported by Miss Lees and other science teachers in girls' schools.

ONE serious omission in most recent schemes for educational reform is the absence of any proposal for ascertaining what educational facilities are at present in existence. Similarly, in Mr. Fisher's Bill the local authorities when preparing schemes of educational organisation are instructed to consult with other local education authorities, but no mention is made of autonomous institutions, such as private schools. Yet the various types of private schools and cognate institutions provide for a large number of boys and girls, and a recognition of this fact is important for many reasons. Lady Napier Shaw has therefore done good service by directing attention in the December number of the Journal of the British Science Guild to the need for a register of all existing schools. She gives the text of a draft Bill which has been considered by the Guild, intended to secure the formation and maintenance of a register of all colleges and schools in England and Wales, giving particulars of their constitution, staffs, pupils, accommodation, and provision for recreation. This draft Bill differs from Clause 24 in Mr. Fisher's Bill in that it provides that each education authority shall compile its own register, which is then to be forwarded to the Board of Education. Further, schools are to be induced to register by the denial to unregistered schools of the right to recover fees from pupils, and by the liability of such pupils to be proceeded against under the Compulsory Education Act. No one knows at present how many schools there are in England or how many of them are reasonably efficient, and some such measure as that proposed by Lady Shaw is urgently required. We ought to know the relevant facts before proceeding to take action.

OUR readers will remember that in the summer of 1915 the University College of Wales, Aberystwyth, became the possessor of the library and lifelong collections of the late F. W. Rudler, who was professor and dean of the college in the years 1876–80, and afterwards became curator of the Museum of Practical Geology, Jermyn Street, London. His library, consisting of about 2000 volumes and 4000 pamphlets, has been tabulated and cross-indexed, and his extensive collection of rocks, fossils, etc., carefully labelled. The mineralogical collection has been made available for teaching and demonstration purposes, while the archæological and other specimens have been added to the college museum. The additions thus made to the college collections, further assisted by the foundation of the "F. W. Rudler Geological Research Scholarship," have greatly increased the facilities for research work, particularly in the subject of geology. M. Jules Bernaerts, the eminent Belgian sculptor (of the Royal Academy of Brussels), has executed a life-size medallion of Prof. Rudler, which has been framed in oak and placed in the wall of the college quadrangle, and below it a brass tablet bearing the inscription:—"In memory of F. W. Rudler, I.S.O., F.G.S., 1840–1915. Professor in this College 1876–80, and Founder of the College Museum," has been affixed to a polished slab of Welsh marble specially cut for the purpose from the Narberth Quarries, Pembrokeshire. Prof. Rudler's numerous friends and all concerned in the welfare of the college will be pleased to know that the collections which he formed with so much ability have thus been made available for the furtherance of those studies in which he was so deeply interested, and to which he devoted the labours of a lifetime.

AT the annual meeting of the Geographical Association the president, Sir W. M. Ramsay, gave an address entitled "The Great Goddess Mother Earth," and as arising out of it various speakers from the Classical and Geographical Associations urged the closer co-operation of these mutually complementary lines of teaching and research. It is hoped that the classical geographers will be studied afresh, and that new in-

sight into the history of civilisation may be gained by combination of the points of view. The annual lecture was upon the crafts of Britain, past and future, and in it Mr. Henry Wilson, president of the Arts and Crafts Society, pleaded with geographers for spiritual maps, maps of the spread of forms of spiritual expression in handwork, maps of the spread of ideas and enthusiasms. In this way, the lecturer urged, we should work effectively towards a genuine revival of folk-life and of taste and creative power that would go with it. Mr. W. E. Whitehouse (University College, Aberystwyth) opened a discussion on map-reading as an element in both geographical and military education, and gave the results of his experience in training O.T.C. cadets and teachers. A session was devoted to papers sketching advanced courses for pupils in secondary schools (sixteen–eighteen), and the association's view was strongly expressed that an attempt must be made to diminish the separateness of the faculties of study. It would be highly desirable to have an "advanced course," including history on one hand and science on the other, and pivoting upon geography as essentially the regional study of human experience. The association is glad to be authoritatively assured that a course planned on these lines would receive sympathetic consideration from the Board of Education whatever the wording of the present regulations.

SOCIETIES AND ACADEMIES.

LONDON.

Faraday Society, December 12, 1917.—Mr. W. R. Bousfield, vice-president, in the chair.—Prof. A. W. **Porter**: The thermal properties of sulphuric acid and oleum. The object of this paper is to supply data at various temperatures for the heats of solution and dilution and evaporation, both of sulphuric acid and oleum. Pre-existing data apply only to atmospheric temperatures; but technical processes take place at various temperatures up to 200° C. or above. These additional data are obtained by indirect methods either from vapour pressures (of H_2O or SO_3) by means of Clapeyron's formula or from thermal capacities.—W. R. **Bousfield**: Isopiestic solutions. Solutions of KCl, LiCl, NaCl, and KNO_3 of equal vapour pressure are placed together in an exhausted vessel, so that interchange of aqueous vapour may take place. Hence is indicated an accurate method of determining the vapour pressure of an aqueous solution, by comparison with the equal vapour pressure of a solution of LiCl. The observations lead to the conclusion that for a pure salt without water of crystallisation there is, at a given temperature, a certain vapour pressure of water below which the dry salt surrounded by aqueous vapour will not take up water, and will, if it is not dry, become dried. This pressure may be called the *critical hydration pressure* of the salt at the given temperature.—Dr. J. W. **McBain**: Notes on the system of recording rate of chemical reaction. The usual equation representing rate of reaction may be written in the form kt=(remainder of expression). The author proposes so to choose the unit of time that k is always unity. A single number will then completely record the rate of reaction.—A. L. **Feild**: The viscosity of blast-furnace slag and its relation to iron metallurgy (see p. 373).—G. **Le Bas**: The refractivities of saturated and unsaturated compounds. The refractivities of unsaturated compounds, together with unsaturated systems containing conjugated unsaturated groups, have been considered. Benzene has been shown to be possessed of no anomaly. Cross-linking has been assumed in some cases. The effects of conjugation of ethenoid and carbonyl groups have been shown, whilst nitrates, nitrites, and nitro-compounds have been studied. The oximino-group especially has been taken into consideration. The cyclo-paraffins, substituted and unsubstituted, have been considered, together with a number of *p*-terpenes and derivatives. Anomalies have been connected with the side-chains or substituents and the appropriate numbers ascertained. The larger anomalies are connected with the trimethylene ring. Those for benzene derivatives have been ascertained. The unsubstituted hydrocarbons show no anomalies.—Dr. E. B. **Ludlam**: The effect of hydrogen chloride on the nitrogen-hydrogen equilibrium. The paper records an experimental attempt to simplify the difficult conditions of high temperature at high pressure under which the Haber synthesis takes place. It was thought that the presence of hydrochloric acid during the synthesis would displace the equilibrium in the direction of the formation of ammonia. The result of the experiments was negative.—Dr. H. B. **Maxted**: The influence of carbon monoxide on the velocity of catalytic hydrogenation. The inhibitive effect of small percentages of carbon monoxide on the velocity of hydrogenation of olive oil in presence of nickel has been studied quantitatively.

Geological Society, December 19, 1917.—Dr. Alfred Harker, president, in the chair.—B. **Smith**: The Chellaston gypsum-breccia considered in its relation to the gypsum-anhydrite deposits of Britain. (1) At Chellaston the gypsum was laid down as such, and has suffered no appreciable alteration or addition since the time of its original deposition and brecciation. There is no evidence that the rock was ever anhydrous. (2) By comparison with this deposit, and also by independent evidence, it seems probable that most of the important beds of gypsum in the country were laid down as gypsum, and have behaved throughout as stratified deposits. (3) When anhydrite is present, the evidence favours the view that it is original, and was deposited in a stratiform manner in sequence with gypsum. (4) Microscopic evidence shows that there has been, in some cases, an alteration of anhydrite into gypsum where the two minerals were in original juxtaposition; this alteration, however, is considered to have occurred at, or immediately after, the time of deposition, and to be confined to the existing plane of contact of the two minerals.

PARIS.

Academy of Sciences, December 17, 1917.—M. Ed. Perrier in the chair.—L. **Guignard**: The development of the structure of the ovule in the Apocynaceæ and the Asclepiadaceæ. After a summary of contradictory conclusions arrived at by previous workers on this subject, the author gives the summarised results of his researches on twenty species.—G. A. **Boulenger**: The conformation of the phalangettes in certain African frogs.—M. **Balland**: The alterations in war-bread: an investigation into the cause of war-bread going mouldy. The moisture ought to be from 10 to 12 per cent., but it generally amounts to more, 13 to 15 per cent., and in some of the mouldy bread up to 18 per cent. An alteration in the shape of the loaf is suggested as a provisional measure.—P. **Fatou**: Rational substitutions.—E. **Baticle**: The determination of the most advantageous dimensions of the principal elements of a hydraulic power installation.—M. **Mesnager**: A rigorous demonstration of the formulæ of beams and plates.—J. **Guillaume**: Observations of the sun made at the Lyons Observatory during the second quarter of 1917. Observations were made on eighty-six days, and the re-

sults are tabulated in three groups showing the number of spots, their distribution in latitude, and the distribution of the faculæ in latitude.—M. **Philippon**: The manufacture of silica bricks. A summary of the conclusions resulting from researches made at the Dunes factory during 1916 and 1917. Full details will be given in a later communication. The bricks now being made melt at about 1780° C., and have up to the present supported 200 melts in the Martin furnace.—Ph. **Glangeaud**: The geology of the neighbourhood of Bort (Corrèze).—Ph. **Flajolet**: Disturbances of the magnetic meridian at Lyons (Saint-Genis-Laval) during the second quarter of 1917.—P. **Guérin**: The stamen and the development of the pollen of the sages.—L. **Daniel**: Heredity of the abbreviation of development in the cultivated carrot and beet.—R. **Souèges**: The embryogeny of the Alismaceæ.—J. **Laborde**: The constitution of the fixed acidity of healthy and diseased wines.—E. **Kayser**: Contribution to the study of alcoholic ferments.—L. **Mencière**: Physiological properties and medico-surgical applications of guaiacol and benzoic acid. These two substances, associated with other substances of the aromatic series, have powerful antiseptic properties, and the advantage of not being toxic to the cell. Examples of their application in practice are given.—G. A. **Le Roy**: The photographic analysis of fresh and preserved eggs.

BOOKS RECEIVED.

French Scientific Reader. Edited, with Introduction, Notes, and Vocabulary, by Dr. F. Daniels. Pp. xvi+748. (New York and London: Oxford University Press.) 10*s.* 6*d.* net.

Tommy Smith at the Zoo. By E. Selous. Pp. vii+183+8 illustrations. (London: Methuen and Co., Ltd.) 1*s.* 9*d.* net.

How to Enlighten our Children. By Dr. M. Scharlieb. Pp. 202. (London: Williams and Norgate.) 3*s.* 6*d.* net.

A Course of Pure Geometry, containing a Complete Geometrical Treatment of the Properties of the Conic Sections. By Dr. E. H. Askwith. New edition. Pp. xi+284. (Cambridge: At the University Press.) 7*s.* 6*d.* net.

The Historical Register of the University of Cambridge. Edited by Dr. J. R. Tanner. Pp. xii+1186. (Cambridge: At the University Press.) 12*s.* 6*d.* net.

Cambridge Essays on Education. Edited by Dr. A. C. Benson. Pp. xix+232. (Cambridge: At the University Press.) 7*s.* 6*d.* net.

Elements of Constructive Philosophy. By Dr. J. S. Mackenzie. Pp. 487. (London: G. Allen and Unwin, Ltd.) 12*s.* 6*d.* net.

The Principles of Audosis and Clinical Methods for its Study. By A. W. Sellards. Pp. vi+117. (Cambridge, Mass.: Harvard University Press.) 4*s.* net.

The Fishing Village and other Writings. By W. Omer-Cooper. Pp. 184. (Bournemouth: H. G. Commin.)

DIARY OF SOCIETIES.

THURSDAY, JANUARY 10.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—Electrical Signalling and Control on Railways: C. M. Jacobs.

MATHEMATICAL ASSOCIATION (London Day Training College), at 11.—The Uses and Functions of a School Mathematical Library: Dr. W. P. Milne.—Nomography: Dr. S. Brodetsky.—Some Suggestions for a Presentment of Mathematics in Closer Touch with Reality: G. Goodwill.—At 2.30.—President's address: Mathematics and Individuality: Prof. T. P. Nunn.—*Discussion*: The Position of Mathematics in the New Scheme of the Board of Education for Secondary Schools: Openers: W. D. Eggar, P. Abbott, Miss J. Dow.

FRIDAY, JANUARY 11.

ROYAL GEOGRAPHICAL SOCIETY (Kensington Town Hall), at 3.30.—The Old Life in Egypt: Miss Mary Brodrick.

ROYAL ASTRONOMICAL SOCIETY, at 5.

MONDAY, JANUARY 14.

FARADAY SOCIETY, at 5.30.—*Discussion*: The Setting of Cements and Plasters.—The Mechanism of the Setting Process in Plaster and Cement: Dr. C. H. Desch.—Crystalloids *v.* Colloids in the Theory of Cements: Prof. H. Le Chatelier.—The Theory of Setting: Prof. F. G. Donnan.—The Constitution and Hydration of Portland Cement: A. A. Klein.—The Setting and Hardening of Portland Cement: George A. Rankin.—The Setting of Cement in its Relation to Engineering Structures: Bertram Blount.—Note on the Colloidal Theory of Setting: John Rhodin.—The Effect of the Addition of Suitable Slag on the Setting Properties of Portland Cement: E. H. Lewis and E. Deny.—Ancient and Modern Mortar: W. J. Dibdin.

TUESDAY, JANUARY 15.

ROYAL INSTITUTION, at 3.—Palestine and Mesopotamia: Prof. Flinders Petrie.

ILLUMINATING ENGINEERING SOCIETY, at 5.—Ten Years of Illuminating Engineering; its Lessons and Future Prospects: L. Gaster.

INSTITUTION OF PETROLEUM TECHNOLOGISTS, at 8.—The Petroleum Industry of Rumania: Capt. T. S. Masterson.

MINERALOGICAL SOCIETY, at 5.30.—Rock Diagrams: Dr. J. W. Evans.—The Use of the Gnomonic Projection in the Calculation of Crystals: Dr. G. F. Herbert Smith.

ROYAL STATISTICAL SOCIETY, at 5.15.—Urban Housing Problems: J. Calvert Shensley.

WEDNESDAY, JANUARY 16.

ROYAL METEOROLOGICAL SOCIETY, at 5.—Annual General Meeting.

ROYAL MICROSCOPICAL SOCIETY, at 8.—Presidential Address: The Royal Microscopical Society during the Great War—and After: E. Heron-Allen.

ENTOMOLOGICAL SOCIETY, at 8.—Annual Meeting.

THURSDAY, JANUARY 17.

LINNEAN SOCIETY, at 5.—(1) Restoration of the Head of Osteolepis; (2) Femur of Pterodactyl from the Stonesfield Slate: E. S. Goodrich.—Some Early Cape Botanists: J. Britten.—A Hybrid Stachys: C. E. Salmon.

INSTITUTION OF MINING AND METALLURGY, at 5.30.—The Incidence of Taxation upon Metalliferous Mining in the British Isles: H. Louis.—Molybdenum in Norway: E. R. Woakes.

FRIDAY, JANUARY 18.

ROYAL INSTITUTION, at 5.30.—Studies on Liquid Films: Sir James Dewar.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—Traction on Bad Roads or Land: L. A. Legros.—Utility of Motor Tractors for Tillage Purposes: A. Amos.

SATURDAY, JANUARY 19.

ROYAL INSTITUTION, at 3.—The Chemical Action of Light: Prof. W. J. Pope.

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