THURSDAY, JULY 4, 1918.

PHOTOGRAPHY: PRACTICAL AND THEORETICAL.

The Science and Practice of Photography: An Elementary Text-book on the Scientific Theory and a Laboratory Manual. By Dr. J. R. Roebuck. Pp. xiv+298. (New York and London: D. Appleton and Co., 1918.) Price 2 dollars net.

THIS is really two books, each with its own preface, though the paging is continuous. The second part consists of the laboratory instructions that the author issues to his students as they work through the prescribed course. These instructions are not modified to render them suitable for others than those for whom they were originally intended, and so we are told that "the staff reserves the right to impose fines" for breakages, that the work "confers two credits," and so on. This is a trivial matter, but when we are repeatedly told to consult the bulletin board, or to apply to the instructor, the difficulty is real; and, seeing that the bulletin board and the instructor are in Wisconsin, and we are in London, these sources of information are impossible for us. The course prescribed is an excellent series of twenty-four experiments in the making of negatives, printing by various processes, spectrum photography, photomicrography, enlarging, the use of autochrome plates, and, finally, getting the characteristic curve of a plate by means of the Chapman Jones plate tester.

The first part of the volume is of the nature of an ordinary text-book, though after a few pages of historical matter the author begins, perhaps advisedly in dealing with students who have already studied chemistry and physics, with the properties of gelatine dry plates as demonstrated by the work of Hurter and Driffield and some of those who have followed them. Then come chapters on colour sensitiveness, latent image theories, negative defects, positive processes, lenses, the photography of colour, and a chapter on "good pictures" that deals with pictorial matters. There is a constant feeling in reading some of these chapters that matters are mentioned rather than dealt with—perhaps intentionally so, seeing the circumstances in which the book was originally intended to be used. Still, we think that, having taken the trouble to give a diagram to illustrate the production of halation and two pages of text to the consideration of it, the author might have explained the production of the definite ring of light round a small illuminated area, which, indeed, is excellently shown in some actual examples given. We are told in the preface that the substance of the book has been in use for seven years, and has received innumerable additions and corrections. But there still remain some statements that need correction or qualification. Taking the first few pages: "Toward the end of the eighteenth century chlorine, bromine, and iodine had all been discovered and studied" should have "bromine and iodine" deleted, as these were not known until 1826 and 1812 respectively. In the next line, the statement that Davy and Wedgwood "coated plates," and with, among other salts of silver, "silver bromide and silver iodide," is obviously incorrect, as the results of these experiments were published in 1802. On the next page we read that Daguerreotypes were fixed "by boiling in strong sodium chloride solution" until "when the solvent action of sodium hyposulphite solution on the salts of silver was pointed out to him, he changed over to it"; and a few pages further on, that French chalk is "finely divided calcium carbonate": these are examples of the statements that call for more attention. We think it a pity, too, that the author should have adopted for his book the exact title of a text-book that has been before the public, both in this country and in America, in its various editions, for the last thirty years.

Still, in spite of its drawbacks, there is a refreshing originality about the volume. We appreciate to the full the author's advocacy of the importance of the study of photography from both the practical and scientific points of view. But when he says that "there is no reason why the methods of modern science, as well as its attitude, cannot be taught by a course in photography, as well as by a course in quantitative chemistry, or in the theory of electricity," he doubtless means what is true, but will probably be misunderstood. We want the chemistry, and the electricity, as well as the photography, and all the other branches of science, for though there is a measure of overlap at every division, there is no interchangeability between the various parts of the whole. C. J.

TEXT-BOOKS OF CHEMISTRY.

(1) *A Text-book of Inorganic Chemistry.* By Prof. A. F. Holleman. Issued in English in co-operation with H. C. Cooper. Fifth English edition, completely revised. Pp. viii+507. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1916.) Price 10*s.* 6*d.* net.

(2) *Principles of Quantitative Analysis: An Introductory Course.* By Dr. W. C. Blasdale. Second edition, revised and enlarged. Pp. xii+402. (London: Constable and Co., Ltd., 1917.) Price 10*s.* 6*d.* net.

(3) *The Chemistry of Linseed Oil.* By Dr. J. Newton Friend. Pp. vii+96. ("Chemical Monographs.") (London: Gurney and Jackson, 1917.) Price 2*s.* 6*d.* net.

(1) THE English edition of Prof. Hollemann's "Inorganic Chemistry" has become so widely adopted as a text-book, especially in the States, that any lengthy notice of the fifth edition seems almost superfluous. There are, however, one or two criticisms to which attention may be usefully directed. It seems undesirable in a text-book which is obviously intended for more advanced students to devote valuable space to elementary details at the expense of more im-

portant information. Whilst such elementary matters as the difference between chemical and physical changes, and the operations of filtration, distillation, etc., are minutely described and may well be omitted, we have failed to find any reference to Dalton's law of partial pressures, and such processes as the liquefaction of air, the production of nitric acid from ammonia, and of hydrogen from water-gas, which are at the present time of some importance, are either not mentioned or are very inadequately described—in short, the limited reference to industrial operations gives the book, rightly or wrongly, a pronounced academic bias.

The arrangement is not, perhaps, in all respects the best that could be devised. The electrochemical series, and, indeed, the whole process and theory of electrolysis, are so fundamental in explaining chemical reactions that one naturally expects some reference to them in the earlier portions of a text-book of this character.

Turning to the index, we find a reference is given to p. 428, where even the term "electrochemical series" does not occur; but on p. 436—that is, near the end of the book—the subject is described as of "great practical value," but is discussed only in its relation to electrolytic reactions.

On the other hand, some of the sections on physical chemistry are written in a terse and lucid fashion; these are wholly excellent and constitute the most valuable part of the book.

(2) This is an ideal little book on analysis. Its object, as the title indicates, is not so much the practice as the principles of analysis. Whilst the descriptions of detailed analyses are comparatively few and are selected as typical illustrations of a variety of methods, the general theory of these methods is carefully kept in view.

The first seventy-four pages are exclusively devoted to theory on such subjects as the nature of solution, on equilibrium, and on electrolysis. The practical part is divided into sections, each section illustrating a particular kind of analysis. Thus, the first has reference to processes involving the evolution of gas; the second, to precipitation methods; the third, to methods of extraction, and so forth. Several sections are given to volumetric analysis, and the last to physico-chemical methods.

The book is adequately illustrated with a few simple outline drawings of apparatus, and questions and problems are intercalated at intervals.

(3) This little volume on linseed oil, which forms one of a series of chemical monographs, contains in a small compass a compilation of the better-known chemical facts regarding linseed oil and an account of its evaluation for technical purposes, but has no reference to its industrial applications. It is provided with a very full bibliography of references which should prove useful to the chemist. As the author states in the preface, it is a subject which has not received the attention it merits, and opens a wide field, shared by many other vegetable oils, for more extended chemical investigation. J. B. C.

THE FUNCTION OF THE SPLEEN.

The Spleen and Anaemia: Experimental and Clinical Studies. By Prof. R. M. Pearce, with the assistance of Dr. E. B. Krumbhaar and Prof. C. H. Frazier. Pp. x+419. (Philadelphia and London: J. B. Lippincott Co., 1918.) Price 21*s.* net.

IN this pleasant volume on the results of removing the spleen Prof. Pearce has put together the various experimental studies carried out with a number of collaborators in the department of research medicine of the University of Pennsylvania during the past five or six years. Most of the data have been already published in periodicals, but it is convenient to have them in a revised and connected form and to read the author's general discussion of his results taken as a whole. Removal of the spleen in dogs leads to (1) an anæmia of moderate severity, lasting in all from two to six months; (2) an increased resistance of the red-blood corpuscles to destruction by hypotonic salt solution, saponin, and other hæmolytic agents; (3) a diminished susceptibility to hæmoglobinuria and jaundice induced by the injection of hæmolytic serum. The mere absence of spleen is never fatal, never, indeed, induces anything that could be called severe illness, and in six or twelve months the animals are normal again, except, perhaps, in respect of the resistance of their red corpuscles to laking. A number of paths have been pursued in search of some general explanation of these phenomena, and it must have been disappointing to find them mostly fruitless.

A good deal of the general discussion is necessarily barren because the authors have never inquired whether the anæmia is due to a deficiency of hæmoglobin or to a relative increase in the plasma, a point which is quite fundamental in considering the nature and effects of any anæmic process.

Most noteworthy are the observations that ligature of the splenic vein or its implantation into the inferior vena cava leads in some respects to much the same results as complete excision of the spleen, and that ultimately there is considerable hypertrophy of the bone marrow, not apparently to form blood-cells, but to act, as does the normal spleen, as a reservoir of iron. A long section, in which the well-known work of Dr. Sam Goldschmidt is incorporated, on metabolism in dogs and men before and after splenectomy leads to no definite aberration being found.

About a fifth of the whole book is occupied with a straightforward account of the "splenic anæmias" by Dr. E. B. Krumbhaar, in which the modern methods of clinical examination are given in detail. Evidence seems fairly conclusive that Banti's disease, Gaucher's disease, and acholuric jaundice are best treated by removing the spleen, and there must by now be a good number of people in the world who might be used to test the belief of antiquity that one could run faster if one had no spleen. Finally, there is a short chapter on

surgical technique by Prof. C. H. Frazier, a full bibliography, and a splendid index.

One point remains for criticism. The work presented is a typical example of that association of animal experimentation with practical medicine and surgery which has made such definite headway in recent years, especially in America. It is perhaps beside the point that in this particular case the contribution made by the experimentalist is rather meagre of practical indications. There can, however, be little doubt that the practice of restricting experimentation to one species of animal, generally, as in the present instance, the dog, is a dangerous technique if it is proposed to apply the results in detail to man. The truth of the matter seems to be that while the end which different animals will attain is the same (*i.e.* they will so far as may be restore themselves to the normal state or somehow or other get round their difficulties), the means and detailed mechanism of restoration and compensation will likely vary widely in various species; they are, of course, relatively immaterial to the individual concerned. A. E. B.

OUR BOOKSHELF.

Proceedings of the Aristotelian Society. New Series. Vol. xvii. Pp. 497. (London: Williams and Norgate, 1917.) Price 12*s.* 6*d.* net.

NOTWITHSTANDING the war, the Proceedings of the Aristotelian Society suffer no diminution in bulk. During the thirty-eighth session thirteen papers have been given, and two symposia have taken place. One of the latter, on the ethical principles of social reconstruction, deals directly with the war and some of its issues. In the other symposium the question is discussed whether the materials of sense—or "presented sensations," as G. E. Moore prefers to phrase it—are affections of the mind.

The Dean of St. Paul's writes suggestively of some phases of the philosophy of Plotinus. M. Ginsberg gives a critical account of Malebranche's theory of knowledge. C. Lloyd Morgan, discussing fact and truth, and distinguishing facts of appearance from facts of knowledge, points out that the former are facts *for* knowledge. The static nature of truth-structure and of fact is repudiated. C. E. M. Joad deals with the onslaughts of the pragmatists and the new idealists on the theory of monism. Relations are real, external, and experienced. The fundamental objections to monism are logical. Bernard Bosanquet discusses the function of the State in furthering the unity of mankind, but it may be questioned whether a "communal" mind actually exists. A. N. Whitehead emphasises the idea that logic is the organising principle by which observation is elaborated into science. C. D. Broad criticises Hume's handling of miracle, and concludes that miracles might, but do not, happen. W. A. Pickard-Cambridge writes of the relation of value to our consciousness. The various subjective criteria offered us are inadequate or erroneous. We have innate, direct, unique knowledge of value. G. Dawes Hicks attacks the problem of realism. Matter and mind are disparate entities. The *esse* of sensible objects is not merely *percipi*. There is no distinction between the mind and its states. The mind *is* its states. J. S. Mackenzie emphasises the dynamic value of the view that the universe is an intelligible whole. Miss L. S. Stebbing also contends that the conception of concrete unity is valid and stimulating.

H. Wildon Carr's presidential address inquires into the nature of recognition as a modified cognition, and also discusses racial or instinctive recognition. The volume is suggestive and stimulating, and we regret that space does not allow of more extended notice. W. L. S.

Aids to Rational Therapeutics with U.S.A. Pharmacopoeia Equivalents. By Dr. R. W. Leftwich. Pp. x+233. (London: Baillière, Tindall, and Cox, 1918.) Price 3*s.* 6*d.* net.

IN many books on the treatment of disease the plan adopted is to discuss each disease and to indicate its treatment. This leads to much needless repetition, for in many instances the same general treatment may be applied to many different diseases. If, for example, we take the case of the infectious fevers, almost the same line of treatment may be adopted for all, with here and there a slight modification or addition. The author of this book has acted upon this principle; he divides diseases into some forty groups, discussing the general treatment applicable to each group, and then adding any special method indicated for any particular case. Thus, selecting at random, we have such groups as the catarrhal, the anæmic, the abscess, the malarial, the rheumatic, the cardiac, the vitamine insufficience, etc. The grouping seems to have been particularly well done, and the information given in almost all cases is accurate and sufficient. Thus that rare disease, rat-bite fever, and its treatment with salvarsan are mentioned. Throughout, typical prescriptions are given, and, in addition, dietetic, electrical, and other forms of treatment are described as required. By adopting this plan the author has succeeded in compiling in a comparatively small space a complete system of treatment, and we believe that the book will be of considerable service to the young practitioner. In an appendix some useful hints are given on dealing with patients in private practice. R. T. H.

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 Profits of Research.

A NOTIFICATION issued by the Department of Scientific and Industrial Research, entitled "Notes on the Conditions under which Grants are made to Students-in-Training and to Individual Workers," states that the Department, with the object of encouraging research into fundamental problems of pure science, is prepared to make grants to workers in educational institutions and elsewhere. I think the

condition imposed in paragraph (14), which I quote, deserves a wider publicity.

"(14) It should be noted that grants to research workers will be subject to the following conditions [among others]:—

"The results of the investigation as obtained from time to time shall, in the first place, be communicated to the Committee of Council, who, after consultation with the bodies and persons who have co-operated in the conduct and maintenance of the research, shall determine in the national interest whether, and if so to what extent and under what conditions, the results shall be made available.'

"The Committee of Council reserve the right to determine, after consultation with the bodies and persons who have co-operated in the conduct and maintenance of the research, whether, and if so to what extent and in what proportions, the Committee of Council and those bodies and persons shall secure to themselves by patent, designs or otherwise, the ownership of the results of the research and any benefits and profits arising therefrom.

"It is not expected that results of direct technical value will often be obtained from research undertaken by a student in training, and the conditions stated above are not, therefore, attached to a grant to a student. But the professor and student will be asked, should results apparently of commercial value be produced, to consult the Department before taking any action to make the results public, or to communicate them to an industrial firm or other body for exploitation."

I sincerely trust that scientific investigators, whether professors or students, will read, mark, and inwardly digest paragraph (14), and think twice before they accept any grant from the Department of Scientific and Industrial Research. They have the right to know who is responsible for the imposition of this condition.

FREDERICK SODDY.

THE SUGAR INDUSTRY AFTER THE WAR.

UNDER the above title, Mr. T. H. P. Heriot, the lecturer on sugar manufacture at the Royal Technical College, Glasgow, has communicated a paper to the Royal Philosophical Society of Glasgow which has recently been published in its Proceedings. Since its appearance the subject has occupied the attention of the Royal Society of Arts, and the issue of the journal of the society for June 14 contains an interesting paper by Mr. George Martineau, which traverses much the same ground as that of Mr. Heriot and arrives independently at the same conclusions. The subject is so important at the present juncture, and our position with respect to it, in view of our prospective relations with our enemies, so serious, that no excuse is needed for referring to it. The general course of the development of the sugar industry is too well known to require any detailed description. Both authors deal with it in the introduction to their papers at just sufficient length to render the nature of their arguments and the conclusions to which they arrive intelligible and obvious to their readers.

Originally, all the sugar consumed in this country, and in Europe generally, was made from the sugar-cane, and most of it was imported from the West Indies. It was known, however, so far back as the middle of the eighteenth century, that the particular kind of sugar—sucrose—with which we are now concerned existed in other plants than the sugar-cane. In 1747 the chemist Marggraf pointed out that it was present in the beetroot, then being cultivated on an extensive scale in Silesia as a forage crop, and his pupil, Achard, a Frenchman who had settled in Germany, grew the root on his estate, and set up a small manufactory for extracting sugar from it. The success of this enterprise induced King Frederick William of Prussia, in 1801, to supply funds for the creation of beetroot-sugar factories. The industry may be said, therefore, to take its rise from the beginning of the nineteenth century.

The Continental disturbances of that time, combined with our maritime supremacy and the effectiveness of our blockade, especially of the French ports, gave a great impetus to the development of beetroot-sugar manufacture. Napoleon, with characteristic sagacity, quickly saw in the beetroot a method of countering our blockade, at least so far as regarded the import of sugar. By his orders tens of thousands of acres of French soil were planted with beetroot, and schools of instruction in the art of cultivating it and in the methods of sugar-making were founded by his direction. Before Waterloo ended his career the beetroot-sugar industry of the Continent had been firmly established both in France and in Germany, and to that extent the future welfare of our West Indian possessions was, as Napoleon clearly foresaw, seriously jeopardised.

The creation of the beetroot-sugar industry was due entirely, in the first instance, to the exertions of men of science who had no practical acquaintance with the art of sugar manufacture. Its development has been largely owing to their labours. They have studied the mode of growth of the root and the conditions under which the sugar is secreted, and they have thereby succeeded in greatly increasing the sugar content. By careful and intelligent investigation they have enormously improved the methods of sugar extraction and subsequent treatment. They have brought chemical knowledge and skill to bear on the improvement of the analysis of saccharine materials and on the elucidation of many problems of a chemical nature connected with the industry. There is probably no branch of technology that could be named in which science has been more successfully applied than in the creation and development of the beetroot-sugar industry. On the other hand, science, in times past, had little to do with the sugar-cane industry, and so long as the West Indian planters could count upon the enormous profits that they formerly enjoyed, they had little or no inducement to think of science in connection with it.

But it would be untrue to allege that the planters of these latter days have been wholly oblivious to the bearing of science upon their industry. They could not be altogether unmindful of what it had done for their rivals, nor without hope that it might be serviceable in their own case, and, as a matter of fact, various attempts

have been made by them to help themselves by the aid of science. But they suffered under one great disadvantage as compared with European producers. Whereas Continental Governments, and especially that of Germany, fostered the industry and afforded it financial support, favouring it in a variety of ways by legislative action, the West Indian planters were left, to a large extent, to shift for themselves. Few Colonial Ministers have had the wisdom and foresight of Mr. Joseph Chamberlain. In the face of a bounty-fed system, the West Indian planters naturally lost heart, and many sugar estates went out of cultivation; other planters, owing to lack of capital and consequent inability to provide themselves with modern machinery, were brought almost to the verge of ruin. Parliament, under the influence of a fiscal policy which had no real appreciation of Imperial needs, turned a deaf ear to their complaints. It was cold comfort to be told that they were the victims of economic and industrial progress, and of the changing conditions of social development. The masses were so enamoured of the idea of a free breakfast table that they continually returned to power the politicians who misled them with that specious cry.

In the meantime, Germany was steadily maturing her plans to secure world-wide power. Her manufacturers were paid a bounty by their Government to enable them to export sugar at a lower price than the cost of production in the hope of finally ruining the Colonial planter. In 1884 German beet-sugar was first "dumped" in this country. It was useless to point out the real meaning of this action and what the inevitable consequence would be. As Mr. Heriot says, "Great Britain looked only at the immediate advantage of cheap sugar, and cared nothing about the future."

We have now had a rude awakening. It is true that the Brussels Convention of 1901–2 abolished bounties on beet-sugar by international agreement. But by that time the mischief had been done, and we had become practically dependent on Continental sugar. Germany could well afford to sign the agreement. She had largely achieved her purpose. In the year before the outbreak of the war we imported nearly two million tons of sugar, of which less than 4 per cent. was British cane-sugar. Vested interests had meanwhile grown up in this country and had acquired a certain amount of political influence, which a democratic Government was powerless to withstand. What we have suffered from this condition of things scarcely needs to be stated. We have been compelled to transfer our custom, and still to assist, at a heavy cost to ourselves, in the production of sugar elsewhere than within the British Empire. The Colonial industry has, no doubt, slightly increased its production during the war, in spite of many difficulties, and we have rewarded its efforts by taxing it on excess profits.

The whole position in regard to the future of British sugar production needs to be reviewed. The Empire is certainly capable of making all, and more than all, the sugar it requires. Sugar is, and must continue to be, partly a tropical production and partly home-grown. The sugar-cane can only be grown in the tropics and with the aid of coloured labour. In 1915 the West India Committee ascertained that certain of our Colonies and Dependencies, which now collectively produce about 880,000 tons of cane-sugar annually, could produce 4,000,000 tons if all the land suitable for the growth of the sugar-cane were cultivated. And this estimate did not include India, Egypt, and the captured German colonies.

The sugar-beet succeeds best in temperate climates, where white labour is available. But Canada is, at present, the only portion of the Empire where the beet-sugar industry has been established, although it has been conclusively demonstrated that the sugar-beet will flourish in Great Britain, in Ireland, in South Africa, and in certain districts of Australia. Up to the present no very serious attempt has been made to introduce its cultivation into England. The Cantley scheme was a financial failure, as it depended on local farmers. Another attempt is now being made at Kelham, in Nottinghamshire, under other conditions, and the Government has advanced money for the purchase of 5600 acres of land, which seems almost insignificant when compared with the 70,000 acres which Napoleon, in 1811, ordered to be planted. But everything has a beginning and we must "wait and see."

It is abundantly clear that there is an ample sufficiency of land within the Empire to supply the world with sugar if the industry were properly organised, and reasonable steps taken to ensure the supply of labour and to attract capital. As regards the tropical production of sugar, more might be done to tap the immense reservoir of labour which exists in India. Home-grown sugar can, probably, only be produced at a higher cost, but the community would gain in other ways by the establishment of a large and important industry producing many valuable by-products, and requiring much machinery and agricultural implements.

To a large extent the problem is a question of tariffs, and its satisfactory solution can be settled only by boldly facing this issue. The country must make up its mind that the era of the cheap sugar of pre-war days is at an end. People who have found it no great hardship to pay 5½*d.* per lb. for their sugar can surely be induced to pay at least half that sum, exclusive of duty, if they and their successors are assured of a continuous supply produced within the Empire.

The British Empire Producers' Organisation, which was founded in 1915 to encourage the production of foodstuffs, raw materials, and manufactured articles within the Empire, and for the welfare of the Empire as a whole, has dealt with this matter of tariffs, and its proposals include the following:—

(1) That Empire sugar be granted preferential treatment to the extent of 50 per cent. of any tariff that may be in force. This means a reduction of the duty by ½*d.* per lb.

(2) That sugar produced by our Allies be granted preferential treatment to the extent of 12½ per cent. on the tariff in force. This corresponds with a reduction of the duty by ⅛*d.* per lb.

(3) That sugar produced by neutral countries should pay the full tariff without any reduction.

As regards home-grown sugar the Organisation recognises that some degree of protection will be absolutely necessary if capital is to be attracted to the new industry, and it suggests that "the difference between excise on home-grown beet-sugar and the duty on Empire-grown cane-sugar shall be 2*l.* 6*s.* 8*d.* per ton until the crop of home-grown sugar reaches 50,000 tons per annum, after which such advantage would cease."

These proposals will doubtless be fiercely opposed by all to whom the word "Protection" is anathema. But the events of the time, and the chastening influence of the conditions which have been forced upon us by the Central Powers in the effort by the most powerful of them to secure the domination of the world, have profoundly modified our views on many matters. The Government has now agreed to the principles of Imperial preference, and the policy of preferential treatment of our Allies has been embodied in the resolutions of the Paris Economic Conference.

In regard to tariffs the matter now resolves itself into a question of details, and if the nation is determined, as it no doubt is, that the disadvantage under which it has suffered shall never again arise, but that the machinations of our arch-enemy shall be effectually checkmated, once and for ever, there should be little or no difficulty in arriving at a satisfactory adjustment. T. E. THORPE.

THE MINERAL WEALTH OF GERMANY.

THE *Fortnightly Review* for June contains an interesting article by "Politicus" on "The Natural Wealth of Germany," in which particular stress is laid upon the immense value of the asset represented by that country's mineral possessions. These are tolerably accurately known, because in Germany the State owns the minerals and has therefore taken good care to have a complete and scientific inventory made of its mineral resources. The facts as to Germany's mineral riches are thus readily accessible, and ample statistical information is available on the subject. Taking the three undoubtedly most important of Germany's mineral products, namely, coal, iron-ore, and potash salts, the author of the article in question arrives at the startling conclusion that the value of these is close upon 240,000 millions sterling, out of which coal alone represents 89 per cent. A German poet has long ago warned the world that no prudent fighter underrates his foe, but it is perhaps almost as grave a blunder to overestimate his powers, and there is no difficulty in showing that this is what "Politicus" has done to an enormous extent.

It will be easiest to commence with coal, this being, as stated, by far the most important factor, whilst abundant statistics are available for discussing the question. "Politicus" takes the report submitted to the International Geological Congress in 1913, which gave the coal resources of Germany at about 400,000 million tons. He says simply that "at the very low average price of 10*s.* per ton at the pit's mouth" this coal is worth more than 200,000 millions sterling. He forgets, apparently, that this coal is not at the pit's mouth—it is deep within the bowels of the earth. The value of 10*s.* per ton at the pit's mouth may be readily accepted as a fair figure, but this is assuredly not the value of the coal in its unsevered condition. In a recent paper on the subject the writer of the present article showed that the value of coal at the pit's mouth in Great Britain amounted to about 10*s.* per ton in 1913, and that this price was made up of:—Royalty 5·35 per cent., wages 62·55 per cent., materials 16·45 per cent., administration 7 per cent., and interest and profit 8·65 per cent. It is surely obvious that it is only the first item which represents the value of the coal as it lies in the ground, and that out of the value of 10*s.* at the pit's mouth 9*s.* 6*d.* represents the cost of getting and raising it, so that its real value is only the balance of 6*d.* Certain American figures also quoted by the author of the article show that the royalty value of the coal—that is, the value of the coal as it lies in the seam—is less than 4 per cent. of its cost at the pit's mouth in the United States, so that the figure of 5 per cent. of the value at the surface here adopted may be considered to represent very closely the general value and can be applied to the German conditions without much risk of error. Hence, so far, the figure given by "Politicus" would appear to be twenty times too great, and his 200,000 millions would be reduced to 10,000 millions.

Even this latter figure is, however, a great overestimate, and that for a reason that "Politicus" has also overlooked. It has been seen that coal in the unsevered condition is worth 6*d.* per ton, but this 6*d.* is realisable only as and when the coal is won. A ton of coal that is to be won a century from now is worth to-day, not 6*d.*, but only 0·0456*d.*, or less than the twentieth part of a penny, allowing interest at 5 per cent. This quite obvious consideration, that a sum of money, receivable at a distant date, is worth to-day only the amount which, if allowed to accumulate at interest, would produce the sum in question, must profoundly influence the present value of coal to be won at a remote date, but it has been entirely omitted from the calculation. It is true that it is only possible to compute the present value of Germany's coal reserves by making a series of assumptions, yet by means of these we are able to determine, at any rate, the order of magnitude of the figures involved. In 1913, the coal production of Germany was about 150 million tons; if it be assumed that this increases by 50 million tons annually, the production in a century would be at the rate of 5150 million tons per year, and the total quantity worked during the century would be 265,000 million tons, or more than half the known coal resources of the country. No one can pos-

sibly predict what the coal production of any country will be a century hence, but, so far as anyone can see, this rate of increase of production is much greater than what the actual increase can reasonably be expected to be; it follows that the present value of the coal resources is greater on this hypothesis than it is in reality, even though the value of all the production after the first century be neglected. The value of the coal produced during the century at 6*d.* per ton, allowing money to earn interest at the rate of 5 per cent., is only about 550 millions sterling to-day, and though it is impossible to assert that the coal resources of Germany are really worth this amount, it is tolerably evident that they cannot be worth more. In other words, the estimate of "Politicus" is nearly 400 times too great.

Turning next to the iron-ores, the author puts the quantity at 4000 million tons, and he values these at 5*s.* per ton, apparently also at the mouth of the mine, and thus gets at a value of 1000 millions sterling. Fully 80 per cent. of Germany's iron-ore production comes from the minette ore-field of Lorraine and Luxemburg, and as this field is tolerably well known and much information has been published about it, it will suffice to confine the discussion to this field alone. "Politicus" has taken his figures from those published at the International Geological Congress in 1910, but these are now out of date, and more accurate data are to-day available. According to the most recent estimates by the leading German authority, the available minette ore in the Luxemburg-Lorraine ore-field amounts to about 2090 million tons. In 1913, the output was approximately twenty million tons, and it has been increasing at the rate of about two million tons per annum. Assuming a uniform rate of increase up to the exhaustion of the field, which, though technically impossible, is a convenient hypothesis for the purposes of calculation, and will assign to the ore-field a value in excess of the facts, the field would be worked out in about thirty-seven years, the output in the last of these years being calculated at ninety-two million tons. The estimate of value given by "Politicus" is certainly wrong; these ores cost at the mine about 2*s.* 6*d.* to 3*s.*, 3*s.* 6*d.* being considered a high figure. The value of the ore *in situ* must accordingly be low, though there are no data at hand for accurately determining this; a valuation based on English conditions would assign to it a value of 3*d.* to 4*d.* Taking the higher figure, and again capitalising at 5 per cent., the present value of this iron-ore field on the above assumptions comes to rather more than 12½ million pounds. If the discount on the value of the ore to be won in later years had not been taken into account, an erroneous value of close upon thirty-five million pounds would have been arrived at. Taking 3½ millions sterling as the value of the other iron-ores of Germany, a total of sixteen million pounds is arrived at, and the figure given by "Politicus" is thus sixty times too great; the error is less in this case than in that of coal, because the period of exhaustion has been assumed to be much shorter, and the present value, corresponding with the production at the end of the term, is correspondingly higher.

The third material discussed as a source of mineral wealth is the series of potassium salts derived from the vast deposits of which Germany owns the practical monopoly. Here there are no safe data available for determining the value. The writer in the *Fortnightly Review* assumes that the supplies amount to 50,000 million tons and that they are worth 10*s.* per ton; as before, he has confused value at the mouth of the mine with value *in situ*, and has made no allowance for discounting the sums realisable only at a distant date. It is therefore probable that his figures are several hundred—say, at least 200—times too high, and that 125 million pounds is a more probable estimate of the true present value than the figure given by him.

Thus a correct method of appraising mineral values shows that the figure of nearly 240,000 million pounds sterling, given by "Politicus" as the actual value of the three most important items of the mineral wealth of Germany, must be reduced to under 700 millions, so that the former figure is roughly 300 times too great. It need scarcely be repeated that the numbers here arrived at make no pretence to accuracy, but they do probably indicate the correct order of magnitude of the present value of these minerals, and, in any case, they serve to show the correct method of valuing minerals in their unsevered condition.

H. LOUIS.

ANTHRAX AND ITS PREVENTION.[1]

ANTHRAX is an acute, infective disease of man and animals and is caused by the anthrax bacillus, which becomes disseminated throughout the body so that every part is infectious. The many animal products used in commerce may thus be a grave source of danger if they emanate from animals which have succumbed to the disease. Although in this country anthrax is not to be regarded as a frequent cause of death, it is nevertheless of great importance on account of the increase which has taken place, and especially in virtue of the very large amount of material imported from countries where anthrax is rife. In order to prevent the disease in dangerous trades working with possibly infected animal material it would, at first sight, appear to be a simple thing to disinfect the infected material. In practice, however, this is found to be exceedingly difficult on account of the truly enormous powers of resistance of the spore of the anthrax bacillus, which is among the most remarkable of living things. A method to be efficient and practicable (1) must aim at the complete destruction of the infectivity of the material; (2) must not damage the material; (3) must be practicable on a large commercial scale; and (4) its cost must be reasonable.

[1] Report of the Departmental Committee Appointed to Inquire as to the Precautions for Preventing Danger of Infection by Anthrax in the Manipulation of Wool, Goat Hair, and Camel Hair. Vol. i., Report of the Disinfection Sub-committee. (London: Published by His Majesty's Stationery Office, 1918.) Price 1*s.* net.

Hitherto all methods have failed in one or other of these essentials. The report before us, however, contains a large body of accurate experimental evidence which goes to show that complete success can now be attained without risk to the workers and without damage to the material disinfected. The main feature of the process is a preliminary treatment in which material is submitted to the action of a warm solution of soap and water containing alkali, followed by squeezing through rollers. This causes softening and disintegration of any infected blood-clots, and the spores are laid bare for the subsequent destroying process, which is carried out by a warm solution of formic aldehyde. The material, after being again squeezed through rollers, is then dried and kept for a short time as an extra safeguard. According to the testimony of practical people the hair and wool are not injured by the process, and it is computed that ten million pounds of infected wool can be effectively disinfected for something less than 0·824 penny per pound weight.

The report is a brilliant instance of how preventive measures in medicine must be based on scientific inquiries, and it is not too much to expect that "wool-sorter's disease" may soon disappear from the list of the fatal maladies of man.

NOTES.

THE Bellahouston gold medal has been awarded by the University of Glasgow to Dr. R. T. Leiper, of the London School of Tropical Medicine, whose researches on Bilharzia disease in Egypt are well known.

THE David Syme research prize for 1918, consisting of a medal and 100*l.* for any scientific research in Australia during the last five years, has been awarded to Dr. T. Griffith Taylor for a thesis based on the correlation of Australian physiography, meteorology, and climatology, with special reference to the control of its settlement and industrial development.

MR. WILLIAM PERREN MAYCOCK, who died on June 29, was the author of many text-books and popular works on electrotechnics. Some of his works, as, for instance, his treatise on "Electric Lighting and Power Distribution," ran through many editions. Mr. Maycock took endless pains to present the subject clearly and correctly, and always welcomed criticism. He practised as a consulting engineer, and had been technical editor to the Westinghouse Companies' publishing department in Europe.

CANON RAWNSLEY, in a letter to the *Times* for June 28, stated that the War Office contemplated the draining of Wolmer Pond, near Liss, Hampshire, "in order to grow wheat on its sandy bottom." The pond is a natural feature of great interest, and it is closely associated with the natural history observation of Gilbert White of Selborne. We are glad to learn, therefore, in reply to an inquiry at the War Office, that it has been decided not to proceed with the draining of the pond. The Selborne Society has received the same intimation from the Secretary of State for War in reply to a petition submitted by the council of the society.

SIR J. J. THOMSON, Prof. W. H. Bragg, and Dr. W. Coolidge have been elected honorary members of the Röntgen Society. The following officers of the society have been elected for the ensuing year:—*President:* Dr. G. B. Batten. *Vice-Presidents:* Mr. J. Hall Edwards, Prof. A. W. Porter, and Dr. Dawson Turner. *Members of Council:* Mr. C. A. Clarke, Mr. N. S. Finzi, Mr. W. Hampson, Mr. C. Howard Head, Mr. C. R. C. Lyster, Dr. J. Metcalfe, Prof. J. W. Nicholson, Dr. G. H. Rodman, Mr. W. E. Schall, Mr. E. S. Worrall, Mr. E. P. Cumberbatch, and Dr. V. E. A. Pullen. *Honorary Treasurer:* Mr. Geoffrey Pearce. *Honorary Secretaries:* Dr. Robert Knox and Dr. Sidney Russ. *Editor of the Journal:* Mr. W. F. Higgins.

LORD HYLTON announced in the House of Lords on July 2 that it is proposed to recommend to the King that a Royal Commission should be appointed at an early date, consisting of members of both Houses of Parliament and other persons with special qualifications, to consider the question of the desirability or otherwise of making a change in our coinage system. The terms of reference will be to consider the proposal embodied in the Bill which was recently introduced by Lord Southwark in the House of Lords. The Commission, if it decides in favour of a change, may either adopt the proposals contained in the Bill or make any other proposals. It will be able to put forward its recommendations in the form of a draft Bill.

IN connection with the Food Economy (Plants) Exhibit at the Natural History Museum, South Kensington, an explanatory leaflet has been prepared giving an outline of the basal principles of nutrition and the characteristics of the common foodstuffs. The information is conveyed in simple terms now familiar to the general public, and should add greatly to the educational value of the exhibit. In a popular exposition of scientific knowledge on this subject it is impossible to avoid a certain degree of looseness of expression, which the physiologist or agricultural chemist might feel disposed to criticise. It is scarcely correct, for instance, to describe malt as "fermented barley." On the whole, however, the information is correct and in accordance with current scientific teaching, and in no case can it be described as actually misleading.

THE list of pensions granted during the year ended March 31, 1918, and payable under the provisions of the Civil List Act, includes the following names:—Mrs. Mann, in consideration of the valuable services of her late husband, Mr. R. F. Mann, to science and medicine in the development of radiography, in the course of which he received injuries which resulted in his death, 120*l.*; Mrs. Judd, in consideration of the services of her late husband, Prof. J. W. Judd, to geological science, 75*l.*; Mrs. Rippon, in consideration of the valuable services rendered by her late husband, Mr. R. F. H. Rippon, to natural history and science, 50*l.*; Miss Bertha Couch, in consideration of the scientific eminence of her late father, Dr. Jonathan Couch, naturalist, ichthyologist, and author, 40*l.*; Mrs. Vaughan, in consideration of the scientific eminence of her late husband, Dr. Arthur Vaughan, geologist, 40*l.*; Mrs. Coffey, in consideration of the value of the researches and writings of her late husband, Mr. George Coffey, curator of the Dublin Museum on Irish archæology, 30*l.*

A GROUP of botanists in the United States has arranged for the publication of a monthly journal of botanical abstracts, botany to be interpreted in its broadest sense. The prime purpose of *Botanical Abstracts* is to supply prompt citations and abstracts of all papers dealing with botanical subjects, wherever published, as soon as possible after they appear. The editor-in-chief is Dr. B. E. Livingston, Johns Hopkins

University, Baltimore, and there are fifteen associate editors in the United States for particular sections of botanical science. Sectional editors are being appointed for other countries, and Dr. Marie Stopes has accepted the British editorship in palæobotany for the new journal. Dr. Stopes will be glad if all British (including the Colonies and Dominions) authors of papers dealing with palæobotanical subjects will send her on publication the titles, volumes, and exact page and plate references of their publications, followed by reprints as soon as they are available. Work from January, 1918, is wanted at once. Address to Dr. Stopes at University College, London, W.C.1.

THE Norwegian North Polar Expedition under the leadership of Capt. Roald Amundsen was to leave Christiania last week, and is expected to be absent for about five years. According to the *Times*, the *Maud*, the vessel of the expedition, will call at Bergen and Tromsö, and will proceed thence to Novaya Zemlya. The Kara Sea will be crossed, and the *Maud* will call at Dickson Island, at the mouth of the River Yenesei, to take on board 225 gallons of oil. From the wireless station at Dickson Island the latest news of the expedition may be expected. Skirting the north coast of Asia, the *Maud* will turn northward on the east of the New Siberia Islands and enter the polar pack about September. In 1893 the *Fram* entered the pack west of the New Siberia Islands. Amundsen, by starting from further east, hopes to drift parallel to the *Fram* across the North Polar Basin, but further north. He does not expect to touch continental land during the drift of the *Maud*, although he believes in the existence of a considerable amount of land north-east of Alaska. There is little news so far of ice conditions in polar seas this year, but they were reported to be favourable in Spitsbergen waters in June, and it is hoped that the crossing of the Barents Sea will present no difficulties. July is an early month for navigation in the Kara Sea, and the *Maud* will doubtless encounter difficulties there, but Amundsen's early start is a wise choice, since August and September are good months for the navigation along the north coast of Asia.

WE learn from *Science* that President Wilson has issued a proclamation establishing three new national forests in the East United States—the White Mountain, in Maine and New Hampshire, the Shenandoah, in Virginia and West Virginia, and the Natural Bridge, in Virginia. Proclaiming the forests is the final step in carrying out the law for building up eastern national forests through the purchase of lands in the mountains. The Pisgah National Forest, in North Carolina, and the Alabama National Forest, in Alabama, are the only eastern areas which had received this status before the new proclamations were issued. The White Mountain National Forest is located in Grafton, Carroll, and Coos Counties, N.H., and Oxford County, Me. There is now a total of about 391,000 acres under Federal protection. This forest protects in part the watersheds of the Androscoggin, Saco, Connecticut, and Ammonoosuc rivers. The Shenandoah National Forest is situated in Rockingham, Augusta, Bath, and Highland Counties, Va., and Pendleton County, W. Va. Here there is a total of approximately 165,000 acres under Federal protection. The forest is for the most part on the watershed of the Shenandoah River, and it also protects a portion of the watersheds of the Potomac and the James. The Natural Bridge National Forest of 102,000 acres is situated in Rockingham, Nelson, Amherst, Botetourt, and Bedford Counties, Va. The forest, which protects a portion of the watershed of the James River, does not include the Natural Bridge, but this scenic feature is within three or four miles of the boundary.

WITH the double object of encouraging the Irish agriculturist to greater effort, and of making the facts better known in Great Britain, the Department of Agriculture and Technical Instruction for Ireland has issued a short leaflet giving a concise exposition of the part played by Ireland as a food supplier of Great Britain. For many years prior to the war the supply of food from Ireland to Great Britain steadily increased, until by 1913 it was exceeded only by that from the United States. Since the war the Irish supply has continued to increase, and, taking into account quantity, character, and proximity, must now be regarded as our most important supply. Comparison of the exports of foodstuffs from Ireland to Great Britain for the years 1912–13 and 1916–17 shows a decrease only in pig-products, dairy produce, and poultry, all items which have been detrimentally affected by the reduction of the import into Ireland of feeding-stuffs from abroad. The export of livestock to Great Britain has been more than maintained despite this reduction of imported feeding-stuffs and the breaking up of extensive areas of grass; while, in addition, Ireland has supplied very large quantities of potatoes, oats, hay, and straw to Great Britain and to the Army. Ireland produces 40 per cent. of the cattle and 30 per cent. of the pigs of the United Kingdom. She consumes only one-fourth of her own cattle. She is thus, in an increasing degree, Great Britain's nearest and greatest food base. An explanation is given of the meaning of certain Orders regulating exports from Ireland which have aroused adverse comment in Great Britain. It is maintained that these Orders were designed for the common interest of the United Kingdom, and were necessary to secure that the best possible use should be made of Irish resources.

WE regret to announce the death, after a long illness, of Prof. K. Toyama, professor of zoology in the University of Tokyo. Born in 1867, Prof. Toyama graduated from the College of Agriculture, Tokyo University, in 1892. After graduation he devoted himself to the study of the silkworm, the foundation of a most important Japanese industry. His earlier work dealt chiefly with the spermatogenesis and embryology of these insects, though he also published papers on their habits and the parasites attacking them. With the re-discovery of Mendel's work he commenced a series of experiments designed to elucidate the various characters distinctive of different breeds. During the progress of this research he spent several years working in the laboratory of the Royal Siamese Sericultural Department in Bangkok. The first instalment of his results appeared as a long and important paper in 1906—a paper which was the first of a series devoted to the unravelling of the genetic constitution of the various races of the silkworm. Later on he succeeded in clearing up the apparent inconsistencies in the hereditary behaviour of white and yellow colour in the silk which had puzzled other observers. He was able to prove the existence of two different kinds of white, one dominant and the other recessive to colour, a point of scientific interest as well as of considerable practical importance. One of his last pieces of work was the elucidation of certain peculiar phenomena in the transmission of egg-colours in the silk-moth, and he was able to show that these are comparable with those observed in connection with the seed characters of many plants. To zoologists, perhaps, his name is best known in association with some

remarkable gynandromorphs of the silkworm and moth which were bred and described by him, for, owing to their important bearing on the problem of sex-determination, they at once received recognition as classical cases.

AN interesting account of the luminous moss *Schistostega osmundacea*, Mohr, is given by Mr. G. T. Harris in the Journal of the Quekett Microscopical Club (vol. xiii., April, 1918). The luminosity is due to certain cells of the protonema, which, as pointed out by Noll in 1887, are so constructed that the light rays falling upon them are refracted through the transparent sap and concentrated upon the chlorophyll grains which are grouped at the base of the cell. Owing to the shape of the cell, the light rays are totally internally reflected from the basal walls and again emitted, which gives the luminous appearance. The moss appears to be widely distributed in the British Isles. It seems to prefer a habitat with a northerly aspect, and apparently thrives best in granitic areas. The light-cells are differentiated on the protonema, and are spread out in an irregular superficial layer over the underlying protonemal filaments, which are bipinnately branched. The fruit is somewhat rare, but when it occurs it may be abundant. The distribution of the plant is aided by the deciduous spore-capsules and by an abundance of gemmæ formed on the protonema, especially when barren conditions of the plant prevail.

RESEARCHES carried out by Dr. Lewis H. Weed in the anatomical laboratory of the Johns Hopkins University have thrown a flood of light on the origin and nature of the fluid system which surrounds the central nervous system of vertebrate animals. Dr. Weed was successful in replacing the cerebro-spinal fluid in living pig embryos by a ferrocyanide solution, and was thus able by the deposition of Prussian blue to discover a series of unknown stages in the elaboration of the space in which this fluid is contained. In the first month of development, up to the stage in which the pig embryo has attained a trunk-length of 14 mm., the cerebro-spinal fluid is confined to the central canal of the nervous system. At that stage of development the roof of the fourth ventricle of the brain becomes thin and membranous; chorioid villi for the secretion of the fluid become developed, and fluid begins to appear in the tissue spaces outside the roof of the fourth ventricle. That accumulation over the roof of the fourth ventricle represents the first stage in the development of the sub-arachnoid spaces. From the roof of the fourth ventricle the sub-arachnoid system gradually spreads out, and by the time the pig embryo has attained a trunk-length of 26 mm. the system has reached the limits of the extensive ramifications to be seen in the adult animal, in which the spaces surround both spinal cord and brain. It is thus clear that the sub-arachnoid spaces are not parts of the lymph system, but are extensions of a special system developed as extensions of the central canal of the nerve axis. The aqueous chamber of the eye and perilymphatic spaces of the inner ear are systems of a similar kind. Dr. Weed was successful in finding further and convincing evidence of the secretion of cerebro-spinal fluid by the chorioid plexuses and of its absorption into the great venous sinuses of the dura mater by a special mechanism, represented in the adult by the Pacchionian villi. Much still remains to be done before the exact uses of the cerebro-spinal fluid are determined. Dr. Weed's researches have been published in full by the Carnegie Institution of Washington (Contributions to Embryology, vol. v., No. 14, 1917).

IN Bulletin No. 28, entitled "The Soil Solution Obtained by the Oil-pressure Method," issued by the Michigan Agricultural Experiment Station, it is pointed out that the study of the liquid phase of the soil might yield much valuable information as regards soil fertility if a satisfactory method of obtaining a representative sample could be devised. An oil-pressure method is recommended, in which paraffin oil is forced through the soil enclosed in cylinders, thus displacing the soil solution. The physical and chemical properties of successive portions extracted from a given soil were found to vary very little, the greatest variation occurring in the nitrogen compounds, especially in the ammoniacal and nitrate nitrogen; the total nitrogen, however, did not change. From different soils the extracts differed; soil treatment and reaction cause considerable variation in potassium, calcium, magnesium, and especially nitrogen; phosphoric acid varies only slightly.

AT the present time the use of electric furnaces is spreading rapidly in this country. In view of their further possibilities, the need for researches on the production and application of high temperatures is urged by Mr. C. R. Darling in an article contributed to the Journal of the Society of Chemical Industry for May 31. To emphasise the point as regards electric furnace research, the writer notes what has already been achieved by its use in transforming certain common materials. Coke and lime give calcium carbide, which in turn yields acetylene and cyanamide. Coke and sand give carborundum, an abrasive now used throughout the world; and the fusion of bauxite gives another abrasive, alundum, which has practically superseded other materials for the grinding of steel. Amorphous carbon yields graphite, which is now invaluable in electrolytic processes, and has proved to be the best material for filling dry voltaic cells. These products have revolutionised many industries, but they represent only the beginning. Investigations are needed, for example, on the conditions under which tungsten could be melted on a reasonably large scale, and valuable results might be expected from a study of the possible alloys obtainable from tungsten, tantalum, and molybdenum. Research work of the character required is being carried out in America, but practically nothing has been done in this country, though a start is being made at Sheffield University by the erection of an electric furnace for experiments on steel. The practicability of producing high temperatures by the combustion of gases under pressure is also a matter for investigation; Sir Robert Hadfield has recently directed attention to some early experiments of Bessemer in this direction.

IN the Metropolitan Museum of Art, New York, is the tomb of Perneb, originally erected at Memphis about 2650 B.C. Mr. M. Toch has had an opportunity of analysing the pigments used on the tomb, and gives an interesting account of them in a paper quoted by the *Chemical News* of June 7. The pigments are red, yellow, blue, green, grey, and black. The usual idea that the red used by the Egyptians was red ochre appears to be erroneous; the red found in this instance proved to be hæmatite, which contains much more iron oxide than the ochres. All the yellows used on the tomb were composed of the native ochre, which is clay coloured with iron-rust. The Egyptian blues are beautiful colours, ranging from a light sky-blue to a dark ultramarine. A microscopical examination of the dark blue showed it to be of the nature of a powdered "smalt" glass or porcelain; this powder has been rubbed into the pigmented surface and allowed to set with Nile clay or mud, which, being slightly alka-

line, acts as a cement, and has both setting and binding properties. A greenish-blue pigment examined was composed of azurite, a hydrated carbonate of copper; whilst the green pigment was a mixture of malachite, azurite, and clay. The grey was limestone mixed with charcoal or carbon, and the black was a carbon black, composed of charred wood or burnt bones. It has been generally assumed that the Egyptians used white of egg as a binder for their pigments, but Mr. Toch could find no trace of any albuminous binder in the specimens submitted to him; they did, however, show evidence of the use of glue or gelatin. The pigment in two paint-pots, evidently thrown away by the workmen, was found to be hæmatite mixed with limestone and clay.

A REPORT of Prof. W. J. Pope's recent presidential address to the Chemical Society, which is comparable in importance with the late Prof. Meldola's address of eleven years ago, is printed in the April issue of the society's Journal. Prof. Pope commences his address —entitled "The Future of Pure and Applied Chemistry"—by pointing out that the last three years have dissipated for ever the fallacy that British chemists cannot excel in applied organic chemistry. In fact, Great Britain, which in 1914 had no resources for their manufacture, is now a larger producer of explosive, pharmaceutical, photographic, and other essential chemicals than Germany. The fact that science is unvocative has prevented the people from realising that the discoveries of Young, Davy, and Dalton at the beginning of the nineteenth century had more influence than the Napoleonic wars. The whole history of Europe for the last century was made within the laboratories of the Royal Institution. The greatest incentive to political change is the desire to increase the amenities of life, and research in pure science has for a hundred years been the greatest influence in this direction. Prof. Pope strongly urges that the various chemical societies should set up a joint council for the consideration of national questions in which chemical interests are concerned, and suggests for its consideration the correlation of the dye interests with the synthesis of pharmaceutical and photographic products, the development of natural colouring matters, and the study of patent law.

SOME interesting examples of the work accomplished by the Salvage Section of the Admiralty are given in *Engineering* for June 21. Since October, 1915, down to the present time about four hundred ships have been salved by this department. A large proportion of these ships, some of which are of high carrying capacity, has been repaired, refitted, and put in commission afresh. On account of the comparative shortage of shipping it is worth while at the present time to salve practically every sunken ship, whereas before the war many would have been left to their fate on account of the cost of the operation exceeding the value of the ship. One of the great aids to salvage operations is the submersible electric-driven motor-pump, some types of which can deliver 500 tons of water per hour to a height of 75 ft. to 80 ft. One of the examples quoted is that of a vessel carrying a cargo of foodstuffs to the combined value of more than 3,000,000*l*. After being torpedoed, she was taken in tow by the Section's tugboats, but sank before she could be left high up on the beach. Electrically driven submersible pumps were put down in the stokeholds and divers established communication between the flooded holds and the stokeholds. After making the parts thus involved watertight on the outside the pumps were started, and the vessel, being thus lightened, could be drawn higher up on the beach, when similar operations were effected in the lower submerged quarters. The vessel was ultimately floated off and repaired.

IN a recent issue of the *Zeitschrift für angewandte Chemie* is described a process (patented in Germany) for spraying metals on to any kind of surface, using metal melted in an electric arc and blown by means of gas-jets on to the surface to be covered. The metal to be sprayed forms one of the electrodes of the arc, and the gas-jets are directed so as to strike the sides of the metal electrodes without impinging on the arc and blowing it out. If the arc is produced between two electrodes, one being metallic, and a stream of non-oxidisable gas is directed on to the electrode, portions of the electrode that are melted will be carried away in the form of a fine spray, and may be deposited on any surface on which they impinge, thus forming a metallic skin on it. Suitable control apparatus is provided to allow for the wear of the electrodes.

WE have received a Classified List of Publications of the Carnegie Institution of Washington, dated December, 1917. It is stated that copies of each publication, except the Index Medicus, are sent gratuitously to each of the greater libraries of the world, while the remainder of the edition is to be sold at prices sufficient only to cover the cost of publication and postage. Among the volumes published by the institution in 1916 and 1917 we notice:—In astronomy, a revision of Ulugh Beg's Persian Catalogue of Stars by E. B. Knobel; in mathematics, a Sylow Factor Table of the first twelve thousand numbers by H. W. Stager; in chemistry, "The Interferometry of Reversed and Non-reversed Spectra," by Carl Barus; in terrestrial magnetism, "Ocean Magnetic Observations, 1905–16," by L. A. Bauer; in palæontology, "American Fossil Cycads," by G. R. Wieland, and "The Coal Measures Amphibia of North America," by Roy L. Moodie; in embryology, two new volumes of the "Contributions to Embryology," by various authors; in evolution, "Studies of Inheritance in Guinea-pigs and Rats," by W. E. Castle and S. G. Wright, "Gonadectomy in Relation to the Secondary Sexual Characters of some Domestic Birds," by H. D. Goodale, and "Sex-linked Inheritance in Drosophila," by T. H. Morgan and C. B. Bridges; in botany, "Plant Succession," by F. E. Clements; and in zoology, a new volume of papers from the Department of Marine Biology of the Carnegie Institution. It will be seen that the works recently published by the institution belong, as in former years, to many different branches of science. The complete list contains about 264 volumes published since 1903, with short descriptive notes on most of these publications.

MESSRS. BLACKIE AND SON, LTD., will shortly publish "Medicinal Herbs and Poisonous Plants," by Prof. David Ellis, of the Royal Technical College, Glasgow.

OUR ASTRONOMICAL COLUMN.

A NEW ASTEROID OF THE TROJAN GROUP.—A fifth member of this group has been discovered by Wolf. It has at present only the provisional designation CQ. The following elements are given in *Ast. Nach.*, No. 4945:—Epoch 1917, September 24·5, G.M.T., M 83° 18′ 55″, ω 329° 32′ 38″, Ω 300° 41′ 27″, i 8° 51′ 26″, ϕ 6° 46′ 53″, μ 294·427″, log a 0·720686. CQ and Patroclus are about 60° behind Jupiter in longitude, while Achilles, Hector, and Nestor are 60° in front of Jupiter. The value of μ for each of them oscillates about 5″ on each side of the value for Jupiter 299″, the period of an oscillation being

150 years. CQ had its minimum value of μ about 1911; it will reach the mean value in 1949 and the maximum value in 1986. Its phase in this libration appears to be nearly opposite to that of Patroclus, so that the two planets are on opposite sides of their librational ellipse.

A FAINT STAR WITH LARGE PROPER MOTION.—In the *Ast. Nach.*, No. 4944, Dr. Max Wolf announces the discovery that a 13th magnitude star, about 2° west of χ Leonis, has the exceptionally large proper motion of nearly 5″ per annum. The star appears on plates taken with the Bruce telescope at an interval of 17·055 years, and the following co-ordinates for 1875·0 have been determined from neighbouring comparison stars :—

	R.A.	Decl.
	h. m. s.	° ′ ″
1901·146	10 50 24·40	+7 45 21·8
1918·201	10 50 20·00	+7 44 36·7

These measures give the proper motion as 4·66″ in the direction 235·4°, in close agreement with 4·84″ in the direction 232° determined by the stereo-comparator. In the period covered by the observations the total motion of the star was 1·4′.

THE YOUNG MOON SEEN AS A CIRCLE.—Miss E. A. Stevenson has directed attention to the interesting appearance which the moon occasionally presents when about two days old (Journ. Brit. Ast. Assoc., vol. xxviii., p. 223). Besides the familiar earth-shine effect, the "dark" limb of the moon then appears as a ring of silver light, in continuation of the illuminated crescent. When observed by Miss Stevenson, the circle has always been complete, but never of uniform brilliance, and its whiteness was in striking contrast with the pink or ashy hue of the earth-shine. Mr. W. Goodacre points out that the ring is best seen when the earth-shine is most marked, and attributes the appearance to the greater brightness of the moon's surface near the eastern limb as compared with the adjacent regions. The presence or absence of a similar effect along the western limb just before new moon does not appear to have been noted.

PARALLAX OF THE BARNARD STAR.—A new determination of the parallax of this star has been made at the Dearborn Observatory (*Ast. Journ.*, No. 734). The value found is 0·557″ ± 0·016″, which is somewhat larger than the other photographic determinations.

A JAPANESE METEORITE.—Mr. Kuni Niinomi, writing from the South Manchurian Middle School at Mukden, China, sends us particulars of a meteoric stone which was observed to fall on January 25 last, at 2.28 p.m., in Central Japan, the locality being near the village of Tané, in the prefecture of Shiga, on the east side of Lake Biwa, province Omi. There was an explosion and something was heard to fall, and through a hole in the snow the stone was found at a depth of a foot in the ground. It is irregularly wedge-shaped, and covered with a black crust with the usual "thumb-markings." The greatest dimension is 86 mm., and the weight 311·16 grams, specific gravity 3·55. On the fractured surface the stone is grey, with brown spots and minute spangles of metal. In character the new stone is very similar to those of the shower which fell on July 24, 1909, near the town of Gifu, in province Mino (adjoining province Omi). The latter consist of olivine and bronzite, with very little nickel-iron, and were classed as a "white chondrite." These two falls are to be added to the list of sixteen falls of meteorites, mostly stones, recognised by K. Jimbō in 1906 in his "General Notes on Japanese Meteorites."

THE NEW STAR IN AQUILA.

THE following estimates of magnitude of Nova Aquilæ have been communicated by Mr. Harold Thomson, who independently detected the star on June 8 :—

Date	G.M.T.	Mag.	Date	G.M.T.	Mag.
June 8	11.45	0·74	June 19	11.15	2·10*
	13.30	0·74	20	11. 0	2·35*
9	9.50	−0·42	22	9.59	3·01*
	10.30	−0·26		10.47	2·87
	11. 0	−0·50		11.30	2·84
10	9.40	0·07*	23	10. 5	3·12
	12.10	−0·25		10.21	3·21
	12.45	+0·07	24	10. 0	3·1
11	10. 8	0·30	25	9.25	3·04
	10.50	0·55		11. 0	3·09
	11.45	0·43		11.20	3·10
14	13.30	1·04		12.15	3·24
15	9.38	1·55		12.35	2·99
	10.56	1·60	26	10.10	3·4
16	11.25	1·80*		11.20	3·3
18	11.10	1·90		12.30	3·4

The magnitudes marked with an asterisk were not considered very satisfactory on account of clouds or twilight. Making due allowance for these, the decline of the star does not appear to have been accompanied by any marked fluctuations.

Several early observations of the new star, made on June 8 and 9, are reported in the ephemeris circular of the *Ast. Nach.*, 1918, No. 548. The first information received by the Centralstelle was from Prof. L. Courvoisier, who had observed the star at Babelsberg on June 8 at 12h. 38m. G.M.T.; the magnitude at 13h. 30m. was given as 1·1, and the spectrum was stated to show bright and dark lines. Prof. Schorr states that a photograph taken with the reflector at Bergedorf on June 10 showed no trace of nebulosity in the vicinity of the nova. According to a telegram from Dr. Gautier, *via* Copenhagen, the new star was observed by Prof. Laskovski at Geneva on the evening of June 7, but no mention is made of its magnitude.

The spectrum of the new star has undergone considerable changes as compared with the observations previously reported in NATURE. On June 29, when the star had diminished in brightness to about magnitude 4, Prof. Fowler observed that while the bright hydrogen lines were still the predominant feature, they had become very broad, and each appeared to have a central dark line, as if reversed or doubled. In the case of H_α, there was no marked difference in the intensities of the two components, but the less refrangible component of H_β was distinctly the brighter. The total breadth of the bright H_β was estimated at not much less than 40 A. The band about λ 464 was broad and bright, but not so strong as H_β. Of the group of lines less refrangible than H_β, 492, 517, and 532 had considerably diminished in intensity, but 502 had not faded at the same rate, and was the brightest of the four. All these were very broad, and possibly double or reversed like H_β. The dark bands and the adjacent bright bands about 560 and D were still visible, and the bright D band was divided centrally by a dark line. There was also a broad, faint band about λ 600, and a narrower band about λ 631. The relative brightening of 502 may possibly indicate the incoming of the adjacent nebular line 5007.

Father Cortie informs us that further photographs of the spectrum were obtained at Stonyhurst on June 29 and 30. The chief features on these plates are the broad bright bands of hydrogen and the band about λ 464. Other bright bands are also present, but no

dark lines were apparent in the preliminary examination. The band at λ464 appears double, and is fringed by a band of lower intensity on its less refrangible side. On June 30 the nova was considered to be visually equal to β Scuti, which is of magnitude 4·5. The colour of the star was brick-red.

THE METEOROLOGICAL UNIT OF PRESSURE.

A MEMORANDUM recently circulated by Prof. C. F. Marvin, Chief of the U.S. Weather Bureau, raises the question of an appropriate unit of pressure, especially for meteorological usage. The measure of pressure by a barometric height, in millimetres or inches of mercury, even when reduced to standard temperature, is not an absolute statement at all, for its meaning depends on the local value of gravity. On the other hand, the C.G.S. measure of one megadyne per square centimetre, besides being absolute, happens to express quite closely the mean atmospheric pressure at about 100 metres above sea-level. The advantage that could be taken of this fact has long been obvious; it is referred to in early editions of Everett's "C.G.S. Units," and so long ago as 1888 the adoption of the unit of pressure as one dyne per square centimetre, under the name of a *barad*, was recommended by a committee of the British Association. But nothing very definite followed; and Prof. Marvin gives the history, which is not without its moral, of the way in which the natural appropriateness and utility of this unit re-noticed, reported upon, or brought into partial use upon inconsistent systems by Guillaume, Bjerknes, and various others, including international committees.

All this most people will be content to forget, if possible, but two or three simple cardinal points remain, and an appeal is made that we should assess them and settle down to uniformity of practice for the future. The first of these is: Can one unit be adopted for the whole range of physical, including meteorological, pressures, from high vacua to extreme compression, with the help only of the familiar C.G.S. prefixes of *mega-*, *milli-*, *micro-*, and convenient numerical factors? Secondly: What is this unit? Is it a dyne or a megadyne per square centimetre? Thirdly: How far, up to the present, has actual practice gone to fix and ratify the answers to these two questions? Finally: What is the name to be?

On these points meteorologists, at any rate, may be said to have made up their minds. The *bar*, of 10^6 dynes per square centimetre, is to be the unit. One millibar is approximately equal to the pressure of 0·75 mm. of mercury, and the mean atmospheric pressure is approximately 1000 mb. or 1 bar. One-tenth of a millibar is not far from the accuracy with which the barometer can be read. The range of the barometer is included within 100 mb. In increasing degree in recent years the unit has been brought into use in the publications of the British, French, and United States meteorological services. One may say that it would now be very difficult to dislodge the millibar from meteorological use. In supplement, Prof. Marvin has prepared a table that shows that it is entirely convenient for expressing the range of physical pressures from very high vacua at 0·01 microbar to pressures of a megabar, at, say, the bottom of the ocean; while the dyne per square centimetre, which the C.G.S. system first offers, entails a much more cumbrous set of factors.

If there are any substantial objections to the bar of one megadyne per square centimetre as the unit of pressure—and there do not appear to be any—the wide acceptance it has already won in use should go far to outweigh them. If physicists could resolve to adopt it, it would seem pretty sure of general and complete acceptance, and therefore offer one more piece of the difficult and contentious "No Man's Land" of conflicting units won over for the right side.

R. A. SAMPSON.

DEEP-SEA NEMERTINES.

DURING the forty years which have elapsed since the first two deep-sea nemertines were taken by the *Challenger* Expedition, a few examples have been collected by various other expeditions, but deep-sea nemertines have never been other than rare. Prof. Brinkmann, whose monograph on pelagic nemertines has recently been issued (Bergens Museums Skrifter, Bd. iii., No. 1, 1917, 194 pp., 16 plates), has, however, had a rich collection at his disposal, chiefly from the *Michael Sars* Expedition, so that he has been able to investigate the structure of most of the species described. He has also subjected the previously known species to careful revision, and concludes that five of them are so imperfectly described that they must be labelled as "uncertain." The rule that the single type specimen of a species should be kept intact is, in the opinion of the author, unsound, for the external features often give little help to the systematist, and therefore investigation by means of serial sections is indispensable.

The known pelagic nemertines, all of which belong to the order Hoplonemertini, are referred to eighteen genera and thirty-seven species. Bathynemertes is the most primitive genus, and in its external features resembles the bottom-living forms. Among the pelagic nemertines two types have been evolved:—(1) By an increase in the size of the gut diverticula, and therefore of the body surface—without a corresponding increase of tissue—some became specially adapted to a floating life, and in these a marked reduction of the musculature of the body-wall took place; (2) from the floating forms arose the swimmers, in which a tail-fin was formed, with strengthening of the parts of the musculature necessary for swimming. Two specimens of *Nectonemertes mirabilis* were observed swimming by means of undulations of the body and energetic strokes of the tail. These are the first recorded observations on the swimming of pelagic nemertines.

We have not space to give an adequate summary of the account of the structure of these animals, but reference may be made to the general reduction of sense-organs, to the presence of penes in Phallonemertes, to the reduction in the number of eggs to three or four in each ovary, or in the more modified genera to two, or even one, and to the presence of cephalic tentacles in Balænanemertes in both sexes, and in Nectonemertes in the male only, in which they probably act as claspers.

The author discusses the horizontal and vertical distribution of pelagic nemertines, some of which certainly, and the rest probably, are bathypelagic. Most of the species will probably be found to have a wide distribution, *e.g. Nectonemertes mirabilis* occurs in the tropical parts of the Atlantic and Pacific Oceans and in Davis Strait, the conditions as to temperature, etc., being uniform over a wide area in deep water. In spite of the enormous mass of water transported by the Gulf Stream into the North Sea, no example of any Atlantic species of pelagic nemertines has been taken in the North Sea. There is also a total absence of records from the Mediterranean, explicable by the fact that the pelagic nemertines in the Atlantic live in deep water, while the entrance to the Mediterranean at Gibraltar is comparatively shallow.

CATTLE-POISONING BY WATER DROP-WORT.

WE have received from Mr. C. B. Moffat, of Enniscorthy, a note written at the suggestion of Mr. R. J. Moss, registrar of the Royal Dublin Society, in which the question is asked, "Is *Oenanthe crocata* wholesome food?" The question is put owing to the fact that about a month ago Mr. Moffat had occasion to observe a herd of cows browsing on this plant, and had been able to satisfy himself that no injurious effects resulted. As he justly remarks, the records of death from eating this plant leave no doubt as to its usually poisonous character. He cites a case, investigated by Mr. Moss in 1917, in which roots of this plant were found among the stomachic contents of four cows found dead on land that had been flooded. He is, therefore, led to inquire whether the poison is confined to the roots or if at particular seasons or in particular localities the green parts of the water dropwort are innocuous. Cornevin ("Plantes Vénéneuses") has stated that this plant, on which animals readily browse, leads to cases of poisoning every year; that all parts of the plant are toxic, the root being particularly so; and that drying does not destroy the noxious principle. Holmes (*Pharm. Journ.*, 1902, p. 431) refers to *Oenanthe crocata* as perhaps the most dangerous and virulently poisonous of our native plants. Long ("Plants Poisonous to Live Stock," p. 37) has more recently cited a formidable number of specific English instances confirming the judgment of Cornevin and Holmes. Nevertheless, notwithstanding the silence of these distinguished authorities on the point, the question raised by Mr. Moffat is not new. So long ago as 1845 an authority so eminent as the late Sir Robert Christison ("Poisons," p. 860) explained that while this plant has usually been held to be one of the most virulent of European vegetables, and seems well entitled to this character in general, yet climate or some other more obscure cause renders it inert in some situations. As Christison pointed out, the plant has been the subject of an uninterrupted series of observations since 1570, when Lobel directed attention to its poisonous properties. These observations show that in France, Germany, Holland, Spain, and various parts of England so far north as Liverpool it is actively poisonous at all seasons of the year. Yet the careful experiments undertaken by Christison, while proving the virulence of the plant as grown near Woolwich and near Liverpool, showed that the same species as grown near Edinburgh is devoid of toxic properties. It is singular that little more is known now than Christison knew, and it is to be hoped that those competent to deal with the matter may be induced to undertake the research which is required to settle the questions raised by Mr. Moffat's confirmation from County Wexford of Sir Robert Christison's experience of three-quarters of a century ago as regards Midlothian.

AERONAUTICAL INVENTIONS.

THE Air Ministry wishes it to be known that the Air Inventions Committee, which was formed about nine months ago, has now received and examined upwards of 5000 inventions and suggestions relating to the Air Service. It is regretted that, owing to war conditions, a detailed account of the investigations cannot be published, but the experience of the Committee indicates that it may be possible to publish certain information which will facilitate the work both of the inventors and of the Committee.

The following statement has been drawn up with this object in view, but it is realised that it is incomplete for the reason just given. It is appreciated also that inventors are placed at great disadvantages in present circumstances, for, unless immediately connected either with the Air Services or with aircraft manufacture, it is almost impossible that they should be acquainted with the most recent developments; so rapid has been the rate of progress that it is difficult, even for those in close contact with the Royal Air Force, to keep abreast of all the latest improvements. Again, it is practically useless for inventors at the present time to submit inventions which would necessarily take a long time to develop, the requirements of war and the conditions of labour and material making it impossible for the Committee to support proposals of this nature.

Generally speaking, and so far as the period of the war is concerned, no very startling change in the present type of aircraft is anticipated, although improvements in parts and also in details are always possible, and may produce very important results.

The stage of development in construction which has now been reached is such that major improvements can be expected only from those possessing the requisite scientific and mechanical knowledge, skill, and experience. Thus radical changes in the shape of the wings of aeroplanes, the body, and the propellers are possible only after long and patient research carried out in aeronautical laboratories.

Again, many inventors have forwarded proposals for helicopters and aircraft of this nature, which, if an efficient design can be produced, would possess certain advantages (but probably not so great as was once imagined); others have suggested flapping wings and rotatory planes. Such schemes do not give any promise of being developed for use during this war, and in any case would require some years of experiment before they could be regarded as practical proposals.

As regards minor improvements, inventors should bear in mind that many details, such as turnbuckles, clips, etc., are now standardised, and a change would be justified only by some very marked superiority.

Safety devices for preventing crashing of the machine and the pilot form a numerous class. The chief of these is the parachute, either applied by a harness to the pilot or directly attached to the machine. Those who have seen a passenger dropped by a parachute from an aeroplane for exhibition purposes often fail to realise the conditions under which a parachute may have to be used as a safety appliance. Then the machine may be out of control, dropping at a velocity of 150 to 200 miles per hour, or spinning downwards in flames. Many other safety devices, such as automatic stabilisers, wind-brakes, etc., have been proposed at various times. The additional weight entailed by the use of any of the suggested safety appliances must remain a very serious factor for so long as war conditions prevail.

The engine is the heart of the aeroplane, and on its trustworthiness depends the safety of the pilot. Persons acquainted only with motor-car engine practice sometimes do not realise the exacting conditions under which an aeroplane engine must work. The engine must be capable of running for the whole of the time of flight at its maximum power. The lubrication and ignition must be perfect, and the engine must not become overheated. The rating applied to aeroplane engines is the weight per horse-power, and engines are now being produced which show surprising results in this respect. Inventions which differ radically from present-day practice (such as the internal-combustion turbine) have small possibilities of being adopted, for successive design and reconstruction, entailing probably several years' work, are necessary before satisfactory results can be hoped for.

In view of the shortages of materials and labour at the present time, no new type can be embarked on unless it is demonstrably superior to existing types and possessed of definite and immediate advantages over them.

A subject which is intimately connected with the power plant is its noise. This constitutes one of the disadvantages of an aeroplane. For night-flying a method by which it would be possible to hear from one aeroplane the approach of another would be of great advantage. The engine can be silenced without serious disadvantages, but the noise of the propeller and the hum of the wires are so great that silencing the engine is not sufficient.

Many proposals for the projection of bombs and grenades of flame and of poisonous gases have been received. The trailing bomb or grapnel for attacking enemy aircraft and submarines is a favourite suggestion from inventors. This device was tested before the war and at various times since, but has been abandoned in favour of more effective methods.

Many hundreds of inventions and suggestions for inclinometers and instruments for straight flying and accurate bomb-dropping have been investigated. Efficient and well-designed instruments for these purposes have been available for some time past, but it is quite possible that improved forms may be produced, though it is scarcely likely that this can be done by anyone who does not possess the necessary scientific and mechanical knowledge required for an investigation of this nature. Some inventors entirely disregard the action of centrifugal force upon pendulum and spirit-level devices.

A large number of gyroscopic instruments have been proposed which show insufficient knowledge of the correct application and limitations of a gyroscope.

Anti-aircraft devices of various kinds are constantly suggested, but now contain very little new matter for consideration, as such proposals have received the careful attention of the authorities for a long time past, and have been the subject of much trial and experiment.

The Committee fully appreciates the genuinely patriotic motives which inspire most of the communications which they have received, and it is with the object of encouraging the submission of useful and well-considered proposals that this statement is issued. Inventors should, however, bear in mind that the somewhat obvious proposals which might have been useful in an earlier stage of the war are now no longer serviceable.

FOOD CONSERVATION BY REDUCTION OF RATIONS.[1]

IT is perhaps remarkable that, with all the current discussion regarding food conservation, so little emphasis has been laid upon the possibility of conserving food by reducing the diet. When one recalls the agitation of enthusiasts for reduced diets during the past thirty years, and recognises the fact that all special pet theories can at this psychological moment obtain a better hearing than at any previous time, it is surprising that the advocates of reduced diet have made so little progress, and, indeed, have apparently ceased their propaganda.

The popular conception that we eat too much is usually quantitatively expressed by the statement that we eat "twice as much as we ought." The nutrition laboratory has for years been endeavouring to discover if there exist any special groups of individuals who live regularly upon a diet that would be commensurately low. For this purpose it was assumed that the minimum or basal metabolism must be taken as the index of food requirement. Differences in muscular activity are so great that no two individuals can be compared save on an absolutely quiescent, resting basis. After the metabolism of two hundred or more individuals had been carefully measured, it was seen that, although we were dealing with people of varying ages and dietetic habits, and of supposedly very low metabolism, no such individuals were easily recognised in our measurements. It would thus appear offhand that if there are no individuals other than pathological which present abnormally low basal metabolism, and if the law of conservation of energy in the human body obtains, as we know it does, then there is no *a priori* reason for expecting that a reduced diet can be permanently adhered to. A reduction in diet will simply mean that body reserves will be drawn upon until death from starvation occurs.

Through the kind offices of Profs. J. H. McCurdy and Elmer Berry, of the International Y.M.C.A. College at Springfield, Massachusetts, both unusually interested in metabolism problems, arrangements were made to select twelve men out of a group of volunteers from the student body. The men entered heartily into the spirit of the whole research, and readily consented to all the strict requirements of the test.

The general plan was to curtail the diet sufficiently to reduce the weight approximately 10 per cent. This could have been done by a complete withdrawal of food for about fourteen or fifteen days. It was recognised that these men were, first, college students with obligations for educational advancement, and, secondly, volunteers for scientific research. A complete fast for fourteen days would, in all probability, have caused most of them considerable discomfort, if not distress. The alternative was to curtail the dietetic intake so that the weight-loss would take place, not in fourteen days, but in four to six weeks. This was done by serving the men approximately one-half to two-thirds of the caloric requirements prior to the dietetic control, making absolutely no change in the kinds of foods eaten. The young men were cautioned not to lessen their mental or physical activities. Obviously if the activity of a group of men were lessened, as, for example, by putting them to bed, to use an extreme illustration, their dietetic requirements would be very much less. Suffice it to say that these men carried out all the requirements of collegiate activity, both physical and intellectual, throughout the entire period. As soon as the reduction in weight had reached 10 per cent. or thereabouts, the calories in the intake were increased to such an extent as to hold the weight at a constant level. The number of calories required to hold this weight constant over a considerable period of time could be taken as a fair representation of the actual caloric requirement for this group of men.

To ensure a suitable base-line, therefore, a second group of twelve men from the large number of volunteers originally presenting themselves was selected to act as a control squad. These men were in every particular studied with the same degree of care as squad No. 1, except that there was no dietetic control.

While body-weight can be taken as an approximate index of the metabolic level, further checks were absolutely necessary to rule out the inevitable differences in muscular activity that would be found with groups of individuals, even when they were subsisting under the same collegiate conditions. The gaseous metabolism was therefore measured practically every morning for each one of the first squad. These measurements were made by collecting the expired air and analysing it. From the amounts of oxygen con-

[1] Abridged from an address on "Physiological Effects of a Prolonged Reduction in Diet on Twenty-four Men," given to the American Philosophical Society on April 20 by Prof. Francis G. Benedict. (From the Nutrition Laboratory of the Carnegie Institution of Washington, Boston, Massachusetts.)

sumed and carbon dioxide produced, the basal heat output could be computed by indirect calorimetry, thus furnishing the second index of metabolic level. The pulse-rate was recorded simultaneously every morning. Every other Saturday night the entire group of men was taken to Boston and placed inside a large respiration chamber, where the men could sleep comfortably. The carbon dioxide excretion of the twelve men was thus determined simultaneously during deep sleep. This furnished a third criterion for judging the metabolic level.

The control squad showed no seasonal variation, and their basal metabolism, as measured in the large respiration chamber in Boston, was found to be absolutely identical with that of the first group of twelve men prior to the restriction in diet. To check the important findings with the first squad during the early period of the investigation, the second squad was later placed upon a very restricted diet for a period of three weeks, the diet given being less than one-half of their normal requirements.

For both squads, when on diet, the food for each day was carefully weighed, sampled, and analysed for the individual men. It is thus possible for us to measure the complete intake of protein and calories.

The most important scientific findings may be summed up as follows:—

(1) A gradual reduction in weight to a point 12 per cent. below the initial weight took place during a period of from three to ten weeks, with low calories and a moderate amount of protein in the food intake. The normal demand of the men prior to the dietetic alteration ranged from 3200 to 3600 net calories. One squad of twelve men subsisted for three weeks on 1400 net calories without special disturbance.

(2) After the loss in weight of 12 per cent. had been reached, the net calories required to maintain this weight averaged about 2300, or approximately one-third less than the original amount required.

(3) At the end of the reduction in weight the actual heat output during the hours of sleep, as computed by indirect calorimetry, was approximately one-fourth less than normal, thus giving a rough confirmation of the lowered number of calories found by actual measurement of the food intake. That there was no seasonal variation in metabolism was shown by the constancy in the metabolic level of the control squad.

(4) The heat output by indirect calorimetry per kilogram of body-weight and per square metre of body-surface was essentially 18 per cent. lower than at the beginning of the study.

(5) Throughout the period of loss in weight, and for some time afterwards, there was a marked loss of nitrogen to the body. In round numbers these men each lost approximately 150 grams of nitrogen. There is an intimate relationship between this "surplus nitrogen and the metabolic level. Removing the "surplus nitrogen," we believe, distinctly lowers the stimulus to cellular activity.

(6) The nitrogen output per day at the maintenance diet of 2300 net calories was about 9 grams. The control group of twelve men, living substantially the same life and eating in the same dining-room, but with unrestricted diet, showed a nitrogen output of 16 to 17 grams per day.

(7) The pulse-rate was astonishingly lowered. Many of the men showed morning pulse-rates as low as 33, and daily counts of 32, 31, and 30 were obtained; at least one subject gave six definite counts on one morning of 29.

(8) The blood-pressure, both systolic and diastolic, was distinctly lowered.

(9) The skin temperature, as measured on the surface of the hands and forehead, was with some subjects considerably lower than normal. With most of the men normal temperatures prevailed.

(10) The rectal temperature was practically normal.

My colleague, Dr. Walter R. Miles, found as a result of numerous tests of the neuro-muscular processes that there was no material change as a result of the reduced diet. There was a very slight falling-off in the strength tests with the hand dynamometer.

As one of the best indices of muscular performance, my associate, Dr. H. Monmouth Smith, measured the energy required by each man to walk one mile in about twenty minutes. With a reduced diet the requirement was found to be lower with all the men than with a normal diet, this being due, in part, to the fact that the reduced weight meant a lower weight to transport. In other words, these men walked a mile with noticeably less energy consumption than a man not subsisting on a reduced diet.

The subjective impressions were almost uniform that the muscles in the thigh were distinctly weakened. The men complained of difficulty in walking upstairs, but our personal observations go a long way towards refuting this, for all the men seemed able to go upstairs two steps at a jump on several occasions. On February 1, 1918, at Springfield, after four months on diet, eleven of the diet squad were pitted against eleven men from the college body in an arm-holding contest for endurance. The arms were held extended, palms down, at the level of the shoulder. The number of men falling out was practically the same in both squads; as a matter of fact, seven in the diet squad and eight in the uncontrolled squad held their arms out for one full hour.

The most noticeable discomfort experienced by the subjects was a feeling of cold, which it is only fair to say might be due in large part to the severity of the past winter. In general, notwithstanding the very great reduction in the metabolism, which we believe was due to the removal from the body of the stimulus to cellular activity of approximately 150 grams of "surplus nitrogen," the whole period of lowered food intake had no untoward effect upon the physical or mental activities, and the men were able to continue successfully their college duties.

When the second squad was put upon a restricted diet the picture exhibited by the first squad was strikingly duplicated in all details, although as the loss in weight was obviously not so great with the second squad (6 per cent. as compared with 12 per cent.) the phenomena were quantitatively somewhat less emphasised.

At the conclusion of the entire research the men presented an appearance not unlike the average college student; it would have been difficult to pick them out from the rest of the college body on the campus. On close inspection the members of the diet squad would perhaps have appeared somewhat emaciated, particularly in the face, but they were performing their duties as college students, both physically and intellectually, with no obvious reduction in stamina.

The great objection to making practical deductions from laboratory experiments is usually that such researches are carried out on the lower animals, or if men are studied, but one, or at the most two, are used. With a group of twenty-four men, such as was studied in this research, one is justified, if ever, in drawing deductions or making recommendations. We cannot then be charged with faddism or irrational propaganda if we are led to make certain definite recommendations—recommendations that admittedly we would never make in peace times, and that admittedly may have serious faults. These recommendations are primarily a war measure.

I find myself in a novel situation as a public advocate of far-reaching dietetic alterations. Recalling my

earlier objections to Prof. Chittenden's inferences from his experiments, I realise that, although abstract science and propaganda are more or less incompatible, in time of stress old beliefs may well be challenged, earlier concepts discarded, and conservatism permitted to exercise a less restraining influence; hence a public avowal of change in point of view and an admission of the errors of earlier judgment are not only desirable, but also absolutely necessary. While still maintaining that the published records of Prof. Chittenden's experiments left the desirability of a propaganda for lower protein and energy open to serious fundamental criticism, I am now convinced that his data on protein intake justified many of his public statements and recommendations. His conjectures regarding calorie needs seem in no small part substantiated by the results of this new research.

Although some of our men were under twenty-one years of age, the data obtained in our experiments have no bearing on the period of growth; the diet of the growing child should in no circumstances be reduced. Neither are the results applicable to the conditions of severe muscular work, as, for example, in the Army. They may, however, legitimately suggest practices for patriotic civilians not performing severe muscular work; that these standards represent the optimum needs for peace times requires further evidence for substantiation. It is quite clear that a civilian body of men could readily withstand a siege on half-rations without difficulty for several months, and, since danger seems remote, that reduced rations for all adult civilians may be justifiable as a war measure for a relatively long period of months. Prof. Chittenden's conclusions from his experiments that a low protein diet is practicable seem fully substantiated; this expensive source of food material may thus be materially lowered. The calories may also, without doubt, be lowered. Indeed, it may become a serious question as to whether a patriot should be permitted in times of stress to carry excess body-weight, for the expense of carrying it around calls for calories that other people need. The excess weight is *prima facie* evidence that he is living at the highest metabolic level, higher than he needs by approximately 25 per cent., and there is no doubt that the excess weight contributes to shorten life.

It is quite clear that variation in diet is absolutely essential. If a person craves a certain article of food he may eat it, but he should stick religiously to the "half portion."

Of special significance is the importance of not eating between meals and of omitting the eating of extras. It has surprised us to find how large a proportion of the total diet is made up of these extras. Capt. Gephart, in his study of the food intake of St. Paul's School, Concord, New Hampshire, found that out of a total daily intake of 5000 calories per boy, 647 calories were derived from extras in the form of sweet chocolate, candy, coffee-buns, etc. With our control squad at Springfield, when on normal diet, approximately 4000 calories were consumed daily by each individual. Of this amount about 400 calories were obtained from extras not served at the table.

I cannot feel that an alteration in the Army diet is justifiable at present. It is bad policy "to swap horses in the middle of the stream." The fighting unit may well be exempted from innovations, but let the civilian population give this whole project a thorough, honest test, recognising that while there may be, in certain cases, an element of hazard, and in many cases an element of discomfort, the possibilities for danger in accomplishing a weight reduction of 10 per cent. are negligible. The calories thereby saved are by no means negligible, but with the sum-total of our population would feed an enormous Army.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

LORD DURHAM has been elected Chancellor of Durham University in succession to the late Duke of Northumberland.

THE residue of the estate of the late Mr. T. P. Sims, of Swansea, has been left to the Swansea Technical School for the foundation of three two-year scholarships in the subjects respectively of chemistry, metallurgy, and modern languages for commercial purposes.

THE Board of Agriculture and Fisheries has awarded the Fream memorial prize for 1918 to Mr. Leonard C. Robinson, a student of the Harper Adams Agricultural College, Newport, Salop, who took the highest marks at this year's examination for the National diploma in agriculture.

WE have received a copy of the calendar of the Kyushu Imperial University. The University was established at Fukuoka by Imperial ordinance in December, 1910, the first article of which lays it down that "Imperial universities shall have for their objects the teaching of such arts and sciences as are required for the purpose of the State and the prosecution of original research in said arts and sciences." Among other interesting developments recorded in the calendar may be mentioned the establishment in 1914 of a marine biological station in connection with the institute of anatomy in the University. The regulations show that real efforts are being made to encourage research in the University; a certain number of students, who are possessed of high academic attainments and good character and wish to devote themselves to scientific research, are selected and appointed to research scholarships, exempting them from investigation fees, and providing a monthly allowance to enable them to pursue their study and research.

THERE was a discussion in Committee of the House of Commons on July 2 upon clause 22 of the Education Bill, which provides for the abolition of fees in all public elementary schools. Mr. Fisher, President of the Board of Education, replying to the arguments put forward in favour of the continued recognition of fee-paying elementary schools now existing, pointed out that the Bill retains fees in secondary schools and abolishes them in elementary schools, and provides for free education in continuation schools. In other words, it applies the principle that where education is compulsory it is to be given without charge to the parents, but where the parent has an option whether or not to send his child to a particular type of school there he should be at liberty to pay fees. It is the opinion of the inspectors of the Board that the existence of fee-paying schools militates against the proper organisation of higher-grade education in an area. The case for fee-paying schools is the provision of exceptional opportunities, but if the opportunities are no longer exceptional, the special case for those schools is greatly weakened. The clause was eventually agreed to without amendment, as were also the remaining clauses of the Bill.

Science for May 10 publishes a report of the Mellon Institute in the University of Pittsburgh, in which Prof. Kennedy Duncan's scheme for industrial research fellowships is in operation. Particulars of this scheme were published by the Board of Education some time ago in a pamphlet written by Mr. T. Ll. Humberstone. The progress made by the institute is indicated by the increase in the number of fellows from twenty-four in 1911–12 to sixty-four in 1917–18, the amounts contributed by the subsidising firms having increased in the same period from 39,700 dollars to

172,000 dollars. The subjects of research, a list of which is given in *Science*, indicate a wide range both in inorganic and organic chemistry. Dr. Raymond F. Bacon, who succeeded the late Prof. Duncan as director, has been commissioned in the American Army in command of the Chemical Service Section. A considerable number of the research fellows are working on war problems assigned to the institute by the National Research Committee, and others have entered military service. The shortage of research men of the type demanded by the fellowship system has forced the institute to hold in abeyance a number of desirable research problems. "It required the cataclysm of the great war,' the report observes, "to bring men to realise fully the part which applied science is playing, and, more particularly, will play, in the life of nations"; and the Mellon Institute is proud that it has been a pioneer in this field, and set an example to other institutions. The report is signed by Dr. E. R. Weidlein, the acting director.

THE Education (Scotland) Bill was read a second time in the House of Commons on June 26. The Bill is divided into two parts—administrative and educational. The educational area will be the county. The authority will be what is commonly known as an *ad hoc* authority, or an authority specially elected for the purposes of education. The members of the authority will be all directly elected. As the simple majority vote does not afford reasonable protection to existing minorities, or give them the opportunity of making their voices heard in the councils of the community, it has been decided to introduce the principle of proportional representation. The main object of the Bill is the better education of the whole of the people of Scotland, irrespective of social class, age, sex, or place of residence. The effect of the two main proposals of the measure is that when the Act comes into full operation the education of practically every young person will be continued, in one form or another, until he or she reaches the age of eighteen. There is also ample provision to prevent the exploitation of child-labour by parents or employers. It is not proposed at first to raise the age for compulsory attendance at continuation schools beyond sixteen. But power is taken in the Bill to raise the age further by instalments to seventeen and eighteen as circumstances permit. It is proposed to make a special grant in aid towards the local expenditure of those authorities who in the discharge of a national duty find themselves obliged to impose upon their constituents a burden higher than that which is the average in the country.

THE Library Association (Caxton Hall, Westminster) has issued a "Class List of Current Serial Digests and Indexes of the Literature of Science, Technology, and Commerce," published as Appendix A to the final report of the Library Association Technical and Commercial Libraries Committee. The list is intended to show the minimum bibliographical equipment of a library professing to specialise in certain departments of knowledge, and is issued for the guidance of librarians. For example, we are told that a library that specialises in chemistry should include the abstracts published by the American Chemical Society and by the Chemical Society of London. Similar information is given with regard to some fifty other subjects in pure and applied science, manufactures, law, and economics. In making their recommendations as to the choice of publications containing abstracts of the literature of the different subjects considered, the compilers of this list have ignored German serial digests except when no suitable substitute in another language could be found. It is not explained why this course is taken, but probably it is thought that libraries should not be encouraged to buy German books at the present time, even if they are able to do so. At all events, the list will direct special attention to English and American bibliographies and abstracts, which may be used instead of the German publications, to which, perhaps, in the past undue preference has been given. In recommending this list to all who are interested in the formation and maintenance of libraries, we would lay stress on the statement that it represents a minimum equipment of periodical works of reference. There are, of course, many similar works, not included in the list, that a good library should possess.

IN the *Revue Scientifique* for April 20–27 M. Paul Otlet has an article on "Transformations opérées dans l'appareil bibliographique des sciences—Répertoire, Classification, Office de Documentation." By the term "répertoire" or "repertory" he means a card catalogue or a loose-leaf catalogue in which new matter can be quickly inserted in its proper place without disturbing any other part of the catalogue. M. Otlet urges that all catalogues of books and papers should be arranged in this way. As to the details of classification, M. Otlet is, as is well known, a strong advocate of the decimal system. As this system is by no means generally understood, we may quote an example given in this article. The number 31 stands for *statistics*, 331.2 for *salaries*, (44) for *France*, "17" for the *seventeenth century*. The full expression 31 : 331.2 (44) "17" means: "Statistics of salaries in France in the seventeenth century." But these four numbers may be rearranged on the index-card in all possible permutations. For example, (44) 31 : 331.2 "17" would be translated: "France: statistics of salaries in the seventeenth century"; while "17" (44) 31 : 331.2 would mean: "The seventeenth century in France, statistics of salaries." It is to be observed that the colon, brackets, and quotation marks are integral parts of the decimal system as used by M. Otlet. In the third section of M. Otlet's article it is explained that an office of documentation is a library in which all books, and even parts of books, have been indexed on cards in accordance with the decimal system of classification. It is claimed that anyone possessing the key to the classification will then be able in a few minutes to obtain a list of all the books in the library bearing on a particular subject in which he may be interested.

SOCIETIES AND ACADEMIES.

LONDON.

Zoological Society, June 11.—Mr. A. Ezra, vice-president, in the chair.—Lt.-Col. S. Monckton **Copeman**: Observations on a colony of burrowing bees (*Andrena fulva*).—Dr. A. Smith **Woodward**: Two new Elasmobranch fishes from the Upper Jurassic lithographic stone of Bavaria.—Morley **Roberts**: The function of pathological states in evolution.

Mineralogical Society, June 18.—Mr. W. Barlow, president, in the chair.—W. A. **Richardson**: The origin of septarian nodules. Septarian structure consists not of a simple combination of radial and concentric circles, but of irregular polygons closely simulating mud-cracking. By experiments with clay balls and films, and comparison with timber cracks, it was shown that radial cracks widening inwards are produced by internal circumferential contraction, radial cracks widening outwards by internal expansion, concentric cracks by contraction towards the centre, and

polygonal cracks by either free or chemical desiccation. Moreover, analysis shows that septarian nodules are more aluminous towards the centre than the outside, and are therefore capable of contraction. The evidence disproved the expansion theories, and showed that contraction on numerous centres in a colloidal medium caused the cracking, and desiccation by chemical agents the contraction. The central portions are not merely enclosed clay, but clay that has undergone considerable chemical modification, and the original colloidal nature of the medium is so changed that closing of the cracks by absorption when placed in water cannot occur. Finally, the occurrence of the nodules suggests their origination by rhythmic precipitation according to the laws of Liesegang from solutions of bicarbonates diffusing through a colloidal medium.—Dr. C. T. **Prior**: The composition of the nickeliferous iron of the meteorites of Powder Mill Creek, Lodran, and Holbrook. A simple and expeditious method of determining the amount and chemical composition of the nickeliferous iron of a meteorite was described. The method depends upon the use of dimethyl glyoxime for the separation of nickel. Its application to the meteorites Powder Mill Creek, Lodran, and Holbrook gave percentages respectively of about 42, 30, and 6½ of nickeliferous iron, in which the corresponding ratios of iron to nickel were about 13, 11½, and 5.

Royal Meteorological Society, June 19.—Sir Napier Shaw, president, in the chair.—Dr. S. **Chapman**: The lunar atmospheric tide at Greenwich, 1854–1917. The tidal forces due to the moon affect the aerial as well as the fluid ocean, and the lunar atmospheric tide is manifested by the periodic variation in the height of the barometer having two maxima and two minima (high and low tide) in the course of a lunar day. This variation is much smaller than the solar semidiurnal barometric variation, which is not a simple solar tidal effect; the minute lunar variation, however, can be detected with ease in the records of tropical observatories, where the irregular fluctuations of pressure are small. Attempts to determine it in the records of European observatories have been made, but hitherto without success. By treating hourly observations of "quiet" days only, on which the barometric range did not exceed 0·1 in., and by abstracting the solar variation, the lunar atmospheric tide at Greenwich has now been ascertained. Its total amplitude is less than 0·001 in., the harmonic formula being $0{\cdot}00036 \sin(2t+114°)$ in., where t represents lunar time measured, at the rate of 360° per lunar day, from the epoch of upper transit. A comparison with the variation at Batavia (lat. 6° S.), viz. $0{\cdot}00256 \sin(2t+65°)$ in., suggests that the amplitude varies as the fourth power of the cosine of latitude, and that the phase also varies with latitude.—Miller **Christy**: The audibility of the gunfire on the Continent at Chignal St. James, near Chelmsford, during 1917. In this paper the author continues his series of observations of the sound of gunfire commenced in 1915, and published by the society in 1916. Mr. Christy considers that the most interesting point in connection with his observations is the fact that there is apparently (1) a regular and well-defined season or period during which the gunfire is usually audible with ease, and that this is followed by (2) a longer season or period during which the gunfire is seldom or never heard. The following are the earliest and latest dates of the sound of the gunfire on the Continent as heard at Chignal St. James during the three years 1915–17:—1915: From about May 1 to about August 31=17 weeks 3 days. 1916: From about May 1 to about August 15=15 weeks 1 day. 1917: From about April 22 to about September 6=19 weeks 4 days.—F. J. W. **Whipple**: Seasonal variation in the audibility of gunfire. Mr. Miller Christy's observations indicate that in Essex Continental gunfire is heard only during the summer months. On the other hand, evidence collected by W. Brand, and published in the *Meteorologische Zeitschrift* in February, 1917, indicates that in Germany at places 100 km. or more from the firing-line such sounds are heard only during the winter. Thus it appears that in summer the outer zone of audibility lies to the west of the source of sound, in winter to the east. No theory hitherto put forward in explanation of the existence of the outer zone of audibility is in accord with this generalisation.

Royal Microscopical Society, June 19.—Mr. J. E. Barnard, president, in the chair.—Prof. Benjamin **Moore**: Studies of activity of light in inorganic and organic systems. The chief points dealt with were (1) the natural modes of production of reduced organic compounds with uptake of energy, (2) the synthesis of formaldehyde from carbon dioxide and water by the action of light, (3) condensation of formaldehyde in light to form reducing substances such as sugars, (4) reduction of nitrates by sunlight, accompanied by energy absorption, (5) growths of organisms in nitrate and nitrite-free media in presence and absence of air, showing that nitrites in air are essential, and that nitrogen fixation in soil is probably due to nitrite fixation from the atmosphere.—Dr. E. **Penard**: A new type of Infusorian, *Arachnidiopsis paradoxa*. The organism described, egg-shaped and about 1/500 in. in length, has neither cilia nor setæ, but its locomotive organs consist of two flexible tentacula, which beat the water with great rapidity. The forms described under the genus Arachnidium by Saville Kent were possibly of the same type.

Linnean Society, June 20.—Sir David Prain, president, in the chair.—Prof. H. **Coutière**: Les espèces d'Alpheidæ rapportées de l'océan indien par M. J. Stanley Gardiner.—Sir N. **Yermoloff**: A series of intermediate forms of the Diatom genera Navicula and Cymbella. An examination of the series suggests the hypothesis that the large, simple, and homogeneous ancestral form *Navicula monmouthiana* was a primordial species adapted to the more uniform conditions of life on the planet during the pre-Glacial epochs, and that the Cymbellæ which afterwards evolved from it are smaller, more complex heterogeneous forms, gradually derived from *Navicula monmouthiana* under the influence of quite different and more varied conditions of life and climate, which established themselves on the earth after the Glacial epochs, at least under the latitudes between 40° and 60° N. A similar trend of changes from larger and less varied forms to smaller heterogeneous ones has affected the whole of organic life after the Glacial extensions towards the south.—E. J. **Collins**: Sex-segregation in the Bryophyta. Three cultures of *Funaria hygrometrica* were made in Marchals's nutrient fluid as follows:—A, protonemata grown from the antheridia of a male "flower"; B, protonemata grown from the perigonial leaves of the same male "flower"; C, spores from a ripened capsule. Submitted to the same cultural conditions, A and B produced a sward of plants with large discoid male "flowers" *only*, no sporogonia being produced at any time; C produced plants bearing male and female organs, resulting in a dense crop of sporogonia. It appears possible that vegetative development from structures borne on male and female branches respectively may, if a sex-segregation has actually occurred somatically, lead to the production of distinct male and female plants.

DUBLIN.

Royal Irish Academy, June 10.—Prof. G. H. Carpenter, vice-president, in the chair.—T. A. **Stephenson**: Certain Actiniaria collected in Irish waters during the years 1899–1914. The paper dealt with part of the collections of sea-anemones made by the scientific staff of the Irish Fisheries Branch. Twenty-one species are enumerated, mostly from deep water off the west coast of Ireland. Of these seven have not previously been described, viz. *Actinostola atrostoma, Cymbactis gossei, Actinernus aurelia, Chondractis coccinea, C. pulchra, C. duplicata,* and *Carlgrenia desiderata*. The last species is the type of a very interesting new genus, related to Halcurias, McMurrich.

PARIS.

Academy of Sciences, June 17.—M. Léon Guignard in the chair.—J. **Boussinesq**: Uniformity of flow in hour-glasses. The amount passed appears to be independent of the height of the sand.—G. Neumann was elected a correspondant for the section of rural economy in succession to the late M. Heckel, and A. Lameere a correspondant for the section of anatomy and zoology in succession to the late Prof. Yung.—H. **Villat**: Certain singular Fredholm equations of the first species.—P. E. B. **Jourdain**: Demonstration of a theorem of ensembles.—E. **Cahen**: The series of Dirichlet.—M. **Poincet**: Theoretical and experimental study of steam turbines.—C. **Flammarion**: Observations of the new star in Aquila.—M. **Luizet**: First observations of the new star. The nova was seen on June 8 at 8.41 G.M.T. Measures of magnitude are given to June 14.—R. **Griveau**: The heat of formation of the anhydrous calcium borates.—A. **Mailhe**: The direct transformation of the secondary and tertiary amines into nitriles. In a preceding communication it has been shown that it is possible to transform di-isoamylamine and tri-isoamylamine into isoamyl nitrile by passing the vapours over finely divided nickel at 350° to 380° C. The generality of the method is now proved by the preparation of the corresponding nitriles from dicaproylamine, tricaproylamine, diamylamine, triamylamine, bibutylamine, tributylamine, dipropylamine, and tripropylamine. The general reaction is

$$(C_nH_{2n+1})_2NH = 2H_2 + C_nH_{2n} + C_nH_{2n-1}N.$$

—J. **Martinet**: The isatines which contain a quinoline nucleus.—M. **François**: A method for the estimation of the halogens, sulphur, and nitrogen in presence of mercury. The mercury is removed as metal by the action of zinc, and the above-mentioned elements are then determined in the usual manner.—L. **Gentil**: The existence of large "nappes de recouvrement" in the province of Cadiz, Spain.—H. **Coupin**: The harmful action of magnesium carbonate on plants. The harmful action of magnesium carbonate was proved for eight species of plants.—F. **Maignon**: Comparative study of the toxicity and nutritive power of food proteins employed in a pure state. Experiments on white rats with diets of either white of egg, fibrin, casein, or meat-powder. For the three last foods the cause of death was exhaustion of the reserves, and not chronic intoxication. The toxic action of albumen has been described in an earlier paper.

BOOKS RECEIVED.

The Action of Muscles, including Muscle Rest and Muscle Re-education. By Dr. W. C. Mackenzie. Pp. xvi+267. (London: H. K. Lewis and Co., Ltd.)

Peru-Bolivia Boundary Commission, 1911–13. Reports of the British Officers of the Peruvian Commission, Diplomatic Memoranda, and Maps of the Boundary Zone. Edited for the Government of Peru by the Royal Geographical Society of London. Pp. xi+242. (London: Cambridge University Press-Printers.)

British Museum (Natural History). A Map showing the known Distribution in England and Wales of the Anopheline Mosquitoes, with Explanatory Text and Notes. By W. D. Lang. Pp. 63. (London: British Museum (Natural History), and others.) 2*s*. 6*d*.

The Statesman's Year-Book, 1918. Edited by Sir J. Scott Keltie, assisted by Dr. M. Epstein. Pp. xlviii+1488. (London: Macmillan and Co., Ltd.) 18*s*. net.

Memoir of John Michell, M.A., B.D., F.R.S. By Sir A. Geikie. Pp. 108. (Cambridge: At the University Press.)

DIARY OF SOCIETIES.

FRIDAY, JULY 5.

ARISTOTELIAN SOCIETY, at 9.—Space—Time: Prof. S. Alexander.

SATURDAY, JULY 6.

ARISTOTELIAN SOCIETY, at 10 a.m.—*Symposium*: Are Physical, Biological, and Psychological Categories Irreducible? Dr. J. S. Haldane, Prof. D'Arcy W. Thompson, Dr. P. Chalmers Mitchell, and Prof. L. T. Hobhouse.—At 2.30.—*Symposium*: Why is the "Unconscious" Unconscious? Dr. E. Jones, Dr. W. H. R. Rivers, and Dr. M. Nicoll.

SUNDAY, JULY 7.

ARISTOTELIAN SOCIETY, at 2.30.—*Symposium*: Do Finite Individuals Possess a Substantive or an Adjectival Mode of Being? Dr. B. Bosanquet, Prof. A. S. Pringle-Pattison, Prof. G. F. Stout, and Lord Haldane.

MONDAY, JULY 8.

ARISTOTELIAN SOCIETY, at 2.30.—Special Problems.—At 8.—The Philosophy of Proclus: Prof. A. E. Taylor.

CONTENTS.

Editorial and Publishing Offices:
MACMILLAN AND CO., LTD.,
ST. MARTIN'S STREET, LONDON, W.C.2.

Advertisements and business letters to be addressed to the Publishers.

Editorial Communications to the Editor.

Telegraphic Address: PHUSIS, LONDON.
Telephone Number: GERRARD 8830.